Alkhateeb, Mohammed

Address		**Email** mohkha88@gmail.com (update 2019/02/04)	
46 Quai de la Loire Paris, Ile-de-France 75019 France		**Home Phone** **Office Phone**	
Current Institution		**Department**	
Location	Paris, Ile-de-France 75001, France		
Highest Degree	MS	**Institution** Aix-Marseille University	**Date** 2018/07
Thesis Advisor	Sara Collins and Gunnar Bali		
Thesis Title	A Determination of the Charm Quark Mass Using Lattice QCD		
Research Interests	**Primary** Particle Physics		
Secondary			
Current Research Interests: *Theoretical particle physics and particle physics phenomenology are at the center of my research interests. I worked on the following: - In neutrino physics: i worked on a project under the supervision of Prof. Nidal Chamoun in which we checked whether or not some textures of the neutrino mass matrix can accommodate experimental constraints. we worked on the symmetry realization of those textures too. Lattice QCD: the subject of my master thesis was "a determination of the charm quark mass using lattice QCD"*			
Discipline(s)	Particle and Astroparticle Phenomenology; Physics; Theoretical Physics; High Energy Physics		
Position(s) applied	PHD		
1. Nidal Chamoun, Professor at HIAST Syria - Damascus, nidal_chamoun@yahoo.com (2019/02/04)			file (PDF, PDF, 2019/02/08)
2. Laurent Lellouch, CNRS research director - CPT Marseille, lellouch@cpt.univ-mrs.fr (2019/02/04)			file (PDF, PDF, 2019/02/12)
3. Sara Collins, Permanent research staff - University of Regensburg, sara.collins@ur.de (2019/02/04)			file (PDF, PDF, 2019/02/13)
Received Materials	**PHD**	**Cover Letter:** file (PDF, PDF 2019/02/04) **Curriculum Vitae:** file (PDF, PDF 2019/02/04) **Research Statement:** file (same, PDF 2019/02/04) **Copies of grades transcripts:** file (PDF, PDF 2019/02/04)	

Mohammed Alkhateeb Email: mohkha88@gmail.com

Statement of Research Interests

(Applicantion for a PhD Study in Theoretical Particle Physics)

I am Mohammed Alkhateeb, a graduate student, holding a master's degree from the university of Aix-Marseille, the programme of Theoretical & Mathematical Physics, Particle Physics & Astroparticles (P3TMA), where my study was supported by the A*MIDEX scholarship. In this letter I am applying for the announced PhD positions at the Collaborative Research Center "Particle Physics Phenomenology after the Higgs discovery".

The following is a description of the attended courses and the projects carried out during my master's study:

- Last Semester, I was an intern in the university of Regensburg, where I carried out a research project on the determination of the charm quark mass using lattice QCD. In this project I computed the renormlized PCAC mass using $N_f = 2 + 1$ lattice QCD. This internship was part of my study in the P3TMA programme. My grade for the internship was 14.83/20 and I graduated from the P3TMA programme with a general average 12.74/20. My internship was supervised by Dr. Sara Collins and Prof. Gunnar Bali.

- During my second year of the master's degree, following the P3TMA programme, I studied the courses of particle physics, relativistic quantum field theory, general relativity, physical cosmology, statistical and mathematical methods for physics and other courses. I also carried out a computing project on lattice QCD and Monte Carlo simulation in which I studied the quantized $SU(2)$ gauge theory. This project was supervised by Mr. Laurent Lellouch.

- In my first year of the master degree, following the programme of Theoretical Physics and Applications (TPA) in the university of Cergy-Pontoise, I studied the courses of quantum mechanics, introduction to symmetries in physics, Monte Carlo methods in physics, computational Physics, condensed matter, statistical physics and differential geometry and focused on mean field theory and renormalizaiton group which were included in the syllabus of the master programme. I also carried out a computing project on the Mote Carlo methods in statistical physics aiming at investigating the phase transition phenomenon in a two-dimensional Ising system, besides other computing projects on the numerical solution of ordinary, partial, and non-linear differential equations in which I used Fortran and Matlab. My general average for this year was 14/20.

- During my master's study at Damascus university I followed the courses of condensed matter, particle physics, advanced quantum theories, advanced topics in theoretical physics and computational physics. I passed the exams of the first year of this master programme with a general average 80.14/100. Following that year, I started working on a research project under the supervision of Dr. Nidal Cahmoun. 'Flavour problem' in the Neutrino sector was the theme of this work. In particular, we tested whether or not some specific textures of the "Neutrino mass matrix" can accommodate experimental constraints. We hope later to generalize this work into the Lepton sector, trying to understand the charged lepton mass hierarchies and whether they are related or not to the neutrinos' ones. This should be later implemented in a whole set up including the quark sector as well, so that to examine the 'flavor problem' in particle physics. Last year, we updated this work with the recent experimental results of 2017. Our final results are expected to be published in the next few weeks. This project was heavily dependent on numerical simulation and analytical calculations which I performed using Matlab and Maple.

Working independently has central importance to my self-valuing. My productivity and motivation are highly boosted when working on projects requiring independent initiatives and efforts. The research I am working on with Dr. Chamoun, the projects of computational physics and the seminar projects assigned to me during my master's study and most importantly the research project I worked on during my internship in the university of Regensburg were appropriate opportunities to experience that.

Studying at two French universities and accomplishing an internship in Germany allowed me to expand significantly my skills for teamwork and increased my flexibility for adaptation to different academic and cultural environments.

With this background in Particle Physics, and with the experience acquired through the research projects I carried out during my master studies, I believe I am the appropriate candidate to join your group as an early stage researcher.

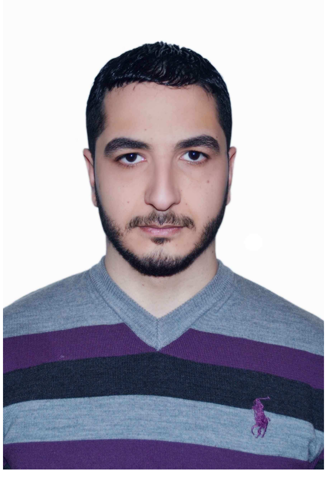
The projects I would like to participate in are:

- A1b: Higgs boson physics with higher order QCD corrections within the Higgs Effective Theory.
- A3a: Extended Higgs sectors at the LHC
- B3a: Dark sectors at the LHC
- C2a: Hadronic Matrix Elements and Exclusive Semileptonic Decays

In the end, I would like to thank you in advance for considering my application and I am looking forward for your favorable reply.

Mohammed Alkhateeb

Curriculum Vitae



CIVIL STATUS

- Date of Birth: 06/Jan/1989
- Nationality: Syrian
- Single

CONTACT INFORMATION

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Address :
Chez Hossino
5 Avenue de Laumière
75019 Paris

LANGUAGES

- English : Fluent
- French : Average
- Arabic : Mother Tongue

INFORMATICS

- C++
- Fortran
- Python
- Matlab
- Mathematica
- Maple
- Mathcad

FIELDS OF INTEREST

- Theoretical physics
- Particle Physics
- Modelling and Simulation
- Data Science
- Programming

EDUCATION

2017-2018 **Master 2 P3TMA, Aix-Marseille University**
Followed Courses:
General Relativity, Statistical and Mathematical Methods for Physics, Computing Project, Relativistic Quantum Field theory, Experimental Project, Neutrino Physics, Experimental Tests of the Standard Model.
General graduation average : 12.74/20.

2016-2017 **M1 Theoretical Physics and Applications, Cergy-Pontoise University**
Followed courses :
Quantum Mechanics, Condensed Matter, Statistical Mechanics, Programming, Computational Physics, Differential Equations, Group Theory, Differential Geometry.
General graduation average : 14/20.

2013-2014 **Master of Physics (Theoretical Orientation), Damascus University**
Followed Courses :
Advanced Quantum Mechanics, Modelling and Simulation, Programming, Advanced Topics in Theoretical Physics, Advanced topics in Experimental Physics.
Gereral graduation average : 80/100

2007-2013 **License of Physics, Damascus University**
Gereral graduation average : 76.07/100

Professional Experience

April – July 2018 **Internship, University of Regensburg,**
Carried out a research project on the determination of the charm quark mass using lattice QCD. Programming langage used in this project is C++.
Supervision :
Prof. Gunnar Bali
gunnar.bali@physik.uni-r.de
Dr. Sara Collins
sara.collins@physik.uni-regensburg.de
My grade in this internship was 14.8/20.

2014-2016 **Research Project, Damascus University**, carried out a research project on "Neutrino Physics" related to specific textures of the neutrino mass matrix and their ability to accommodate experimental oscillation data.
Programming language used in this project is Matlab.
supervision :
Prof. Nidal Cahmoun
nidal_chamoun@yahoo.com
The results of the project are expected to be published in two papers this year 2018.

2014-2015 **Supervisor at Applied Physics Laboratory, Damscus University**, supervising the conduction of the experiments in the course of Applied Phsyics for the 3rd year students.

2010-2011 **High School Teacher of Physics and Mathematics, Directorate of Education, Hama, Syria**

Faculté des Sciences
Aix Marseille Université

ACADEMIC TRANSCRIPTS

Session 1

ALKHATEEB Mohammed

Student number : **17020639** INE : **0KEEPR03O3 5**

Born : **January 06, 1989** at : **SALAMIEH – HAMA (SYRIE)**

Registered **Master 2R Theoretical Physics, Mathematics, Astrophysics Particle Physics**

As received the following grades :

	Rank	ECTS	Note	Result	Mention
SPHCSA0L - Semester 3 M2 Physics Specialty P3TMA		**30**	**11.379/20**	**Admitted**	
SPHCU2L - Mathematical and Statistical Methods		3	10.25/20	Acquired	
SPHCU9L - Relativistic Quantum Field Theory		6	6/20	Acquired	
SPHCU8L - Particle Physics		6	10.62/20	Acquired	
SPHCU20L – General relativity		6	16/20	Acquired	
SPHCU18L - Search for New Physics and Physics of Neutrinos		3	11.3/20	Acquired	
SPHCU13L - Physical Cosmology		3	13/20	Acquired	
SPHCU17L - Astroparticles		3	14/20	Acquired	
SPHDSA0L - Semester 4 M2 Physics Specialty P3TMA		**30**	**14.108/20**	**Admitted**	
SPHDU1L - Internship and Research Thesis		**21**	**14.83/20**	**Admitted**	
SPHDU2L - High Level Practice Work		**3**	**13.6/20**	**Admitted**	
SPHDU5L - Education + Computer Project		**3**	**13.17/20**	**Admitted**	
SPHDX1L - 3 credits to choose		**3**	**10.5/20**	**Acquired**	
SPHCU12L - Experimental Particle Physics Standard Model Tests			10.5/20	Acquired	
Result of admission		**120**	**12.744/20**	**Admitted**	**Pretty good**

Marseilles, July, Wednesday 18, 2018

The Director of the Luminy Faculty of Science

Prof. José BUSTO

Important Notice : Only one copy of this transcript can be issued. No duplicate will be provided.

RELEVE DE NOTES ET RESULTATS

Session 1

ALKHATEEB Mohammed

N° Etudiant : 17020639 INE : 0KEEPR03O3 5

Né le : 6 janvier 1989 à : SALAMIEH - HAMA (SYRIE)

inscrit en **Master 2R Phys. théorique, math., astroph. phys. particules**

a obtenu les notes suivantes :

	Rang	Crédits	Note/Barème	Résultat	Session	Pts jury
SPHCSA0L - Semestre 3 M2 Physique Spécialité P3TMA		**30**	**11.379 / 20**	**Admis**	**S1 2017/18**	
SPHCU2L - Méthodes mathématiques et statistiques		3	10.25 / 20		S1 2017/18	
SPHCU9L - Théorie des champs quantiques relativistes		6	6 / 20		S1 2017/18	
SPHCU8L - Physique des Particules		6	10.62 / 20		S1 2017/18	
SPHCU20L - Relativité Générale		6	16 / 20		S1 2017/18	
SPHCU18L - Recherche de nouvelle physique et physique des neutrinos		3	11.3 / 20		S1 2017/18	
SPHCU13L - Cosmologie physique		3	13 / 20		S1 2017/18	
SPHCU17L - Astroparticules		3	14 / 20		S1 2017/18	
SPHDSA0L - Semestre 4 M2 Physique Spécialité P3TMA		**30**	**14.108 / 20**	**Admis**	**S1 2017/18**	
SPHDU1L - Stage et Mémoire de recherche		**21**	**14.83 / 20**	**Admis**	**S1 2017/18**	
SPHDU2L - Travaux Pratique de haut niveau		**3**	**13.6 / 20**	**Admis**	**S1 2017/18**	
SPHDU5L - Cours + Projet informatique		**3**	**13.17 / 20**	**Admis**	**S1 2017/18**	
SPHDX1L - 3 crédits à choisir		3	**10.5 / 20**		**S1 2017/18**	
SPHCU12L - Physique particules expérimentale tests du modèle Standard			10.5 / 20		S1 2017/18	

Résultat d'admission : **120** **12.744 / 20** **Admis** **Assez Bien**

Fait à Marseille, le 18 juillet 2018

Le Président

Université d'Aix-Marseille · AMU ·

Yvon BERLAND

Avis important : Il ne peut être délivré qu'un seul exemplaire du présent relevé de note. Aucun duplicata ne sera fourni.

HIGHER INSTITUTE FOR APPLIED SCIENCES AND TECHNOLOGY
Prof. Dr. Nidal Chamoun,
Department of Physics, P.O. Box 31983, Damascus, SYRIA
Tel: 963-(0)11-5122603: ext. 2552 (w), 963-(0)944-251450 (m),
Fax: 963-(0)11-2237710,
E-mail: nidal.chamoun@hiast.edu.sy or **nchamoun@th.physik.uni-bonn.de**

HIAST

Date: 8/2/2019

To Whom It May Concern

Mohammed ALKHATEEB

I am writing in support of Mr. Mohammed ALKHATEEB who has applied to your organization in order to pursue his studies/career.

Mohammad read for his B.Sc. degree at Damascus University graduating in 2013 with an average ~76%. He was accepted into the M.Sc. program, and attended many applied and theoretical courses during the academic year 2013-2014, including my two introductory courses on "Group Theory" & "Particle Physics". He succeeded well the corresponding exams.

In Fall 2014, Mohammed started his research project for the entitlement of his M.Sc. degree at Damascus University under my supervision. I allocated him a project on "Neutrino Physics" related to specific textures of the neutrino mass matrix and their ability to accommodate experimental oscillation data, in particular the newly established non-vanishing value of the angle θ_{13} in Daya Bay Neutrino Reactor experiments in China.

Mohammed showed he was a hardworking student in that he completed the bibliographical study, and presented some promising results during 2015. However, and because of the sad events in Syria, Mohammad decided Spring 2016 to leave Syria for France. He obtained a fellowship to read for an M.Sc. degree in theoretical physics. He spent one year (Fall 2016-summer 2017) in Cergy Pontoise University, carried out his second year (2017-2018) and graduated at Marseille University in Summer 2018, while he performed his graduation project in Lattice QCD in Germany during Spring 2018. In the meantime, he continued his collaboration with me on neutrino physics, albeit at a much slower rate.

Actually, we have just finished a first draft of our project and intend to submit it fast for publication. The project consists of studying the neutrino texture characterized by a vanishing subtrace in the neutrino mass matrix, see whether or not it can meet the newly updated experimental results, then conceive a model to justify this specific form for the texture. Muhammad contributed much to this project., and although at a distance having to read for his M.Sc. degree in Europe, he kept liaising with me and carried out the complete phenomenological analysis on his own. I am pleased by my work with Muhammad, and feel that he can excel in other projects provided he has suitable tutoring.

I find Mohammed to be perceptive, intelligent and very pleasant. He is an enthusiastic individual, cheerful, and a pleasure to work with. It seems clear to me that Mohammed is a suitable candidate for your Program and that he will make full use of any awarded grant.

I recommend Mohammed strongly indeed.

Nidal CHAMOUN,
Professor of Theoretical Physics
(ancien élève de Centrale Paris, M.A.St. Cambridge, D.Phil Oxford,
Alumnus der Stipendien der AvH; Senior Associate of ICTP)

Nidal Chamoun

CENTRE DE PHYSIQUE THÉORIQUE
CNRS Luminy, Case 907, F-13288 Marseille Cedex 9, France

Dr. Laurent Lellouch
Directeur de recherche au CNRS
ph: +33 (0) 491 26 95 17
fax: +33 (0) 491 26 95 53
email: lellouch@cpt.univ-mrs.fr

8 August 2018

Dear Colleague,

I am writing in support of **Mohammed Alkhateeb**'s application for a Ph.D. position in your group.

In fall 2017, Mohammed joined our second year Master's program in Theoretical and Mathematical Physics, Particle and Astroparticle Physics. We interacted during a seminar project, which he carried out under my supervision in the first term, and a computer project, which he undertook in the first month of 2018. These are "small" projects that students have to carry out in parallel with a full course load.

Seminar projects consist in reading scientific literature and presenting the material during a 10 minute talk. I assigned him Michael Creutz's famous paper "Monte Carlo study of quantized SU(2) gauge theory" from 1980. As you may know, it is not an obvious paper for someone who is just learning quantum field theory. With some help from me he got his head around the subject, put together a good presentation about the main physical ideas and results, delivered a clear talk and was able to answer questions about what he presented. While this exercise was not graded, his presentation was well received.

For the computer project, I asked him to implement (from scratch), as much as he could of Creutz's calculation. I discussed the main algorithms with him and he set off to write an SU(2) Monte-Carlo simulation code on his own. Quite effectively, he game back with a Fortran code which had an adequate structure, compiled and ran. Though the simulation seemed to converge, it converged to the wrong point, as exhibited by the average plaquette. Before helping him, I suggested that he systematically debug his code, designing tests for each of its components. He did so and got the code to give the correct plaquette values, with little help from me. Unfortunately, this did not leave him time to study Wilson loops of different size and to show that SU(2) Yang-Mills theory exhibits confinement and asymptotic freedom. He produced a 10 page report on his implementation and results, as well as gave a 10 minute presentation. Both were well structured and confirmed that he understood the material. He obtained a grade of 13.2/20, indicating that his work was solid but not exceptional.

Mohammed is very interested in particle theory and wants to do thesis work in that field. As only the top two or three students in the Master's program can hope to get a Ph.D. fellowship to study theoretical physics in Marseille, I suggested that he do his required, three-month research internship in another institute. He found one with the group of Prof. Gunnar Bali in which he worked on determining the charm quark mass using the results of large scale numerical simulations in lattice quantum chromodynamics. Because of administrative difficulties, he had 12 weeks instead of 15 to work on this project, with a further interruption for wrist surgery. This probably explains why the quality and quantity of his personal results were somewhat limited. Nevertheless, his Master's thesis document demonstrated a good understanding of the steps required to perform a lattice QCD determination of renormalized quark masses in general and of the charm quark mass in particular. As the document explained, there are many ingredients involved and the fact that Mohammed was able to put them together and explain them was already an achievement. For this work he obtained a very solid grade of 14.8/20. I am sure that someone from the Regensburg group will be happy to tell you more about his performance with them.

When working with me, Mohammed asked good questions and assimilated the answers. He was also receptive to suggestions and implemented them effectively. Given his obvious motivation, his hard work and my impression of his understanding, I was surprised that he did not do better on his first semester examinations. The situation improved significantly in the second semester, reflecting his abilities more accurately I believe. His spoken and written English are good. More generally, Mohammed is a very nice man and is very easy to get along with. If given sufficient guidance, he may turn out to be a solid Ph.D. student.

Sincerely yours,

Universität Regensburg

FAKULTÄT FÜR PHYSIK

Institut für Theoretische Physik

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Universitätsstraße 31
D-93053 Regensburg

sara.collins@ur.de

13th February 2019

Letter of recommendation for Mr Mohammed Alkhateeb

Dear Sir/Madam,

I have been asked by Mr Mohammed Alkhateeb to provide a letter of recommendation to support his application for a PhD position within your group. Mohammed completed a Masters course at the Aix-Marseille University supported by the A*MIDEX scholarship. As part of the Masters programme he was required to undergo an internship for three months, which he started in the Theoretical Physics Group here in Regensburg at the beginning of April 2018, supervised by myself and Prof. Gunnar Bali.

The topic of the internship project was the determination of the charm quark mass via lattice simulations performed on ensembles generated within the Coordinated Lattice Simulations (CLS) effort. Precision determination of Standard Model parameters is essential for the search for hints of new physics and this requires thorough control of all associated systematics (finite volume, finite lattice spacing and unphysical quark masses). This project is complementary to an on-going study together with Dr. Jochen Heitger in Münster of the leptonic decay constants of the D and D_s mesons. The correlation functions needed to extract the charm quark mass had already been generated within the latter project and Mohammed's task was to write a C++ program to combine these correlation functions and to perform the necessary statistical analysis.

While this project was relatively straightforward in execution it required knowledge of a number of lattice techniques (for example, simulations involving fermions, extraction of physical properties from correlation functions and techniques for reducing discretisation effects) which Mohammed had to acquire during a short period of time. His previous experience of lattice simulations was gained computing Wilson loops in SU(2) gauge theory as part of a project together with Prof. Laurent Lellouch at the Aix-Marseille University for which he wrote a Fortran program. Throughout his time in Regensburg he demonstrated himself to be an enthusiastic and motivated student who wished to understand all aspects of the project. He is also committed to pursuing a PhD in theoretical physics. Due to the brief time he spent in Regensburg it is difficult to assess his abilities fully. While there was some delay due to the fact that he broke his arm, he managed to generate some initial results and demonstrated a grasp of the necessary concepts. Overall, he made very reasonable progress given the time he needed to learn the physics background, write the necessary pieces of code and complete his thesis. The final grade he achieved for the Masters course, including the internship project, placed him among the top 20% of his year at the Aix-Marseille University.

On a personal level he is a very pleasant and professional person with a good grasp of English and would have no problem fitting into any research group.

Yours faithfully,

Sara Collins

(PD Dr. S. Collins)

amiri, rahemeh

Address		**Email** ramapz@yahoo.com (update 2015/11/28)	
Nader Paramont Shiraz, Iran, The Islamic Republic of		**Home Phone** (98) 7132307196 **Cell Phone** (98) 9173003200 **Office Phone**	
Current Institution		**Department**	
Location	Iran, The Islamic Republic of		
Highest Degree	Ms	**Institution** Shiraz university	**Date** 2014/03
Thesis Advisor	Mahmoud hosseini farzad		
Thesis Title	Investigation and simulation the effect of two dimentional metal nano particle array on the light transmition their substrate		
Research Interests	**Primary** nano technology		
Secondary	optical science; medcal hysics		
Discipline(s)	Physics		
Position(s) applied	PHD		
1. Ahmad poostoroush, , poostoroush@shirazu.ac.ir			
2. Mahmood hosseini farzad, , mhf110ir@yahoo.com			
3. Abdolnaser zakeri, , zakeri@susc.ac.ir			
Received Materials	**PHD**	**Cover Letter:** file (TEXT, PDF 2019/01/26)	

Barone, Alessandro

Address		**Email** alessandro.barone@studio.unibo.it (update 2019/01/27)	
Frazione Cré 37 Gignod (AOSTA), Valle d'Aosta 11010 Italy		**Home Phone** **Cell Phone** (+39) 3492762844 **Office Phone**	
Current Institution	University of Bologna	**Department**	
Location	Bologna, Emilia Romagna , Italy		
Highest Degree	Master (M.Sc.)	**Institution** Master in Theoretical Physics at University of Bologna	**Date** 2019/03 exp
Thesis Advisor	Professor Michele Cicoli		
Thesis Title	The cosmological moduli problem in multi-field string inflationary models		
Research Interests	**Primary** Project A1b		
Secondary	Project B1a; Project C3a		
Discipline(s)	Particle and Astroparticle Phenomenology; Theoretical Physics; Physics		
Position(s) applied	PHD		
1. Michele Cicoli, University of Bologna, michele.cicoli@unibo.it (2019/01/29)			file (PDF, PDF, 2019/01/29)
Received Materials	**PHD**	**Cover Letter:** file (PDF, PDF 2019/01/28) **Curriculum Vitae:** file (PDF, PDF 2019/01/28) **Research Statement:** file (PDF, PDF 2019/01/28) **Copies of grades transcripts:** file (PDF, PDF 2019/01/28)	

Alessandro Barone
Frazione Cré 37, Gignod (AO), CAP 11010, Italy
Cell. +39 349 2762844
alessandro.barone@studio.unibo.it

Object: Cover letter

To whom it may concern,

I am writing to express my interest in applying for the graduate program of the Collaborative Research Center "Particle Physics Phenomenology after the Higgs discovery". My name is Alessandro Barone and I am a 24 years old student, enrolled in the last year of the Master in Theoretical Physics at the University of Bologna; I am currently working on a thesis titled "The cosmological moduli problem in multi-field string inflationary models" under the supervision of Professor Cicoli and I will graduate in March 2019.

Five years ago I decided to study physics driven by my strong skills in mathematics and the interest for particle physics, which I learned about from a presentation of the nuclear engineering degree at the summer school of Politecnico di Milano.
During my bachelor at University of Pavia, I built a strong mathematical background and successfully passed the core courses. I graduated *cum laude* working on a thesis about quark physics, titled "Hadronic physics: from quark model to QCD", where I deepened my knowledge of group theory and give a thorough description of Gell-Mann quark model and of the foundations of QCD as a gauge theory. My supervisor, Prof. Daniela Rebuzzi, particularly praised my work for the independence and the sense of initiative I showed in addressing the topic.

In 2016 I enrolled in the master in Experimental Particle Physics of University of Bologna, as this institution has many collaborations and several different research groups. My decision for the major was based on the fact that I wanted to pursue the study of elementary particles from a wide perspective, from the theoretical foundations to the practical tools necessary for experimental research.
The choice of University of Bologna was made even more appealing from the fact that I won a highly competitive scholarship and entered the Collegio Superiore, Bologna's School of Excellence. The additional interdisciplinary programme offered by Collegio Superiore and the interaction with outstanding students from all disciplines made me more flexible towards different subjects and areas that are far from my own.
However, few months later I noticed that the theoretical courses of the Experimental Physics curriculum lacked of some profound insight on the mathematical derivation and on the physical interpretation of the models. I realized that doing the math and reasoning on its physical meaning is the very thing that makes me passionate about physics, even when this means spending time in long and difficult calculations to finally get some results. For these reasons I decided to switch to the curriculum in Theoretical Physics of the same master degree, while still keeping my focus on the physics of fundamental interactions.
In order to make the change, I had to take all possible exams that were common to both curricula and to autonomously study some others, like "Quantum field theory I and II" and "Theoretical physics I and II", which provided me with the foundations and methods I required. Since the exams were successful, I finally made it to the new course path in the same regular time as my cohort.

My research experience is mainly linked to my master thesis, for which I choose an ambitious project on cutting-edge topics of string inflation. My main work consists in studying an inflationary model, derived from the 4D low-energy limit of string compactifications, promising for a successful description of inflation with Kahler moduli.
After a thorough study of the main subjects, I was able to create the specific scenario we wanted to investigate and to perform a qualitative analysis of the model under study to gather an approximate physical behavior of the system of differential equations.
In order to test my work, I learned how to use Wolfram Mathematica to numerically solve this system. Since there were no previous works of a numerical multi-field analysis for more than three fields, I invented a technique to handle a large number of variables and developed an approximate method to assign the free parameters of the model. With this code, I successfully verified my assumptions and I was also able to recreate some known results of different papers with simpler scenarios and substantially improve their predictions and plots.

For what concerns my future research, I am very interested in particle theory and particle phenomenology. This sector has the peculiarity of creating a bridge between theory and experiments, which is one of

my primary ambitions as a future scientist. Indeed, I believe that making this link is an essential step to go forward in our understanding of Nature.
What I am aiming to do is to join a research group that performs precision studies in order to give my contribution to reveal phenomena which cannot be explained within the Standard Model and thus require an extension of the theory. I regard the possibility to find a hint of new physics, thanks to these precise theoretical predictions and the experimental data, as the most impressive implication of these calculations. Besides the very important tests of the Standard Model, what really makes me excited about entering this research field is the hunt for a signature of exotic particles, because they might connect particle physics with astrophysics and cosmology, addressing some of the most fascinating and mysterious puzzles of modern physics.

I chose to apply to the graduate program of the Collaborative Research Center for "Particle Physics Phenomenology after the Higgs discovery" because growing in an international research environment is the best way to pursue my objectives and to acquire the fundamentals to become a well-trained scientist. I believe that your new established collaboration is a rare opportunity to improve my abilities and learn the cutting-edge topics of particle theory and particle phenomenology, as I would have the chance to study and interact with lots of world leading scientists working on different aspects of this field. Furthermore, as this is a large network project, I believe that it will be a very stimulating environment for a PhD thesis and that there will be lots of occasions to connect with other projects. I consider that the exchange of ideas among students and expert researchers with different experiences is key to succeed in research.

I believe that this joint program between different universities offers a unique opportunity to enrich and strengthen my education, not only in my specific area of interest but also in the related ones: indeed, the courses offered by all four universities cover a wide range of topics of elementary physics and high energy physics and would give me the chance to enhance and extend my knowledge on diverse subjects. In fact, I also value the possibility of getting skilled in a wide range of areas, both from a theoretical and experimental point of view.

I feel I am the right person to enter your PhD program as I believe that my educational path and *forma mentis* fit the scientific purposes of your research center. I always face with commitment every problem I encounter and up until now I always met all personal and external expectations. I consider that my ability to adapt to different working environments and vary among diverse subjects is an important skill for a PhD student and it is consistent with your PhD offer.

I thank you in advance for your consideration.
Best regards,

Alessandro Barone

Curriculum Vitae

PERSONAL INFORMATION

Alessandro Barone

Frazione Cré 37, 11010, Gignod (AO), Italy

0165 56029 +39 349 2762844

barone1618@gmail.com
alessandro.barone@studio.unibo.it

Sex Male | Date of birth 16/05/1994 | Nationality Italian

EDUCATION AND TRAINING

2016 - present

Master in Theoretical Physics
University of Bologna, Italy

- I started the master in Experimental Particle Physics but then switched to the Master in Theoretical Physics. I focused my studies especially on Nuclear Physics, Particle and Astroparticle Physics and Quantum Field Theory. I am currently working on my Master thesis project under the supervision of Prof. Michele Cicoli. In particular I am focusing on phenomenological and cosmological implications of 4D string compactifications. The title of my Master thesis is going to be: "The cosmological moduli problem in multi-field string inflationary models".

2013 - 2016

Bachelor in Physics
University of Pavia, Italy

- Final project on hadron physics, quark model and QCD with title “Fisica adronica: dal modello a quark alla cromodinamica quantistica” under the supervision of Prof. Daniela Rebuzzi.
- Degree result: 110/110 cum laude

September 2008 - July 2013

Secondary school diploma
Liceo scientifico Edouard Bérard , Aosta , Italy

- From 2010 to 2013 I followed a double degree program (ESABAC Project) to obtain the equivalent of the French diploma (Baccalauréat)
- Diploma result: 98/100
- ESABAC Project result: Très Bien (Maximum)

SCHOLARSHIPS

- Scholarship for Excellent Students, Ministry of Education (MIUR), a. y. 2013/2014
- Scholarship for Excellent Students, Ministry of Education (MIUR), a. y. 2014/2015
- Scholarship for Excellent Students, Ministry of Education (MIUR), a. y. 2015/2016
- Bonus Scholarship for Excellent Students, Ministry of Education (MIUR), a. y. 2015/2016
- Scholarship for Excellent Students of Collegio Superiore, University of Bologna, a. y. 2016/2017
- Scholarship for Excellent Students of Collegio Superiore, University of Bologna, a. y. 2017/2018

ADDITIONAL TRAINING ACTIVITIES

2016 - present

Collegio Superiore II cycle
University of Bologna , Italy

- The Collegio Superiore is the school of Excellence of University of Bologna: it is a highly competitive program with strict selection criteria.
  It offers a multidisciplinary and multisectorial educational programme to highly motivated students enrolled in degree course of University of Bologna, integrating the curricular study plans with advanced courses of multidisciplinary kind.

- Seminars and interdisciplinary classes complete the University activities:
  - First year
    - Professional scientific communication
    - Game theory and human behaviour
    - Introduction to topology
    - Costitutional reform
    - Nature of time in archeological and historical research on ancient Mesopotami and beyond
    - Atmospheric flight: history, technology and applications
  - Second year
    - Frontier of autonomous systems
    - Quantum mechanics and its interpretations
    - Cancer and environment.
    - Mathematics and democracy
    - Archimedes, forgotten genius
    - Aging and longevity

7-11 May 2018

International School on High Energy Physics
Institute of Scientific Studies , Cargèse, Corse, France

- Lectures: Cosmology, Standard Model, Flavour Physics, Top Quark Physics, Neutrino Physics, Introduction to Axions, Future Project for Particle Physics
- We also tested the moodle platform for the iTHEPHY Project

4-7 April 2017

International School on High Energy Physics
Institute of Scientific Studies , Cargèse, Corse, France

- Lectures: Cosmology, Standard Model, Flavour Physics, Top Quark Physics, Neutrino Physics, Beyond Standar Model Physics

25-26 September 2012

Marine biology stage (Atelier des sciences “Biologie marine”)
Portovenere, Italy

18 June 2012 - 22 June 2012

Summer school
Polytechnic of Milano, Italy

19-20 January 2012

Biotechnology stage
University of Torino, Italy

PERSONAL SKILLS

Language Skills: Italian (Native), English (Fluent), French (Fluent).

Certificates: IELTS overall score: 7.5, ESABAC degree score: Très Bien.

Digital competences

- C++ programming
- Linux and Linux Shell Programming
- Latex and Beamer
- Microsoft Office
- Wolfram Mathematica

Alessandro Barone
Frazione Cré 37, Gignod (AO), CAP 11010, Italy
Cell. +39 349 2762844
alessandro.barone@studio.unibo.it

Object: Research Interests

I enrolled into University with one goal: to learn the basis of physics and to further improve on them in order to be able to give significant contributions to research and to disclose new aspects of elementary particle physics. Even now that I possess an extensive training in many areas of physics, I still find particle physics the most appealing one. I have a genuine interest in the physics of fundamental interactions and in its theoretical foundations, as well as its connection with experiments. The subjects that intrigue me the most are Quantum Field Theory, Standard Model, Supersymmetry and Beyond Standard Model Physics, as well as their connection with Collider Physics.

For what concerns my future research, I would like to continue with the study of particle theory and phenomenology and to become an expert on this area of physics. This sector has the peculiarity of creating a bridge between theory and experiments, which is one of my primary ambitions as a future scientist. Indeed, I believe that making this link is an essential step to go forward in our understanding of Nature.
For my mindset, I appreciate the combination of theoretical study and computational tools. In fact, the opportunity to translate a mathematical problem into some functional code challenges me and keeps me focused on what I am working on.

More precisely, I am interested in higher-order QCD and EW calculations and in Standard Model extensions, as they are necessary to predict accurately important observables at colliders. These studies are fundamental to further test the Standard Model and to address the Higgs sector at LHC: thanks to the Higgs boson discover in 2012, it is now crucial to provide realistic predictions for the production and the decay of this particle in order to compare them with the experimental data that will be available in the next future. Indeed, there are very important production channels at LHC we need to further explore through a deeper study of higher orders in perturbation theory, as for example the gluon and vector boson fusion.
This kind of studies are extremely challenging to me, as the complexity of the theory requires sophisticated mathematical tools and advanced computational techniques. Indeed, in such field it is important to combine both theoretical and computational aspects in order to fully address the topic and test the calculations.
Having said that, I find I would be a suitable candidate to adress the project “A1b” or the project “B1a” as they are in line with my interests and abilities.

I am also interested in EFT and model building, as I believe that, hopefully, LHC and future colliders will soon show signs of new particles and that we should be ready to recognize and interpret them with the help of new models. In particular, I am interested in new models of CP-violating and flavor-violating interactions, as they are promising to enlighten anomalies with the Standard Model predictions. Indeed, new physics at TeV scale generally introduce such effects and there is a need to study them, as they could have a strong impact on new particles produced at LHC. It is then fundamental to further look for models that could account for these effects and to predict possible outcomes arising from these interactions with high precision.
For this reason, I would also like to be consider as candidate for the project “C3a”, as I find this proposal extremely challenging and stimulating.

Beside this, I am also interested in getting more experience with Monte Carlo simulations and with scientific programming. As my approach suggests, I believe that in order to write a well working code that can simulate the complex final states of fundamental interactions one needs to master the theory behind such processes. At the same time, the computational results are crucial to understand the deepest meaning and implications of the theory. I believe that the event generator approach is a powerful tools at our disposal if we wish to gain a detailed and realistic understanding of physics at the LHC.

PA Code: 22-0000245283-0001432931

Matriculation Number 418483

DECLARATION IN LIEU OF CERTIFICATION

(ARTS.46 ET SEQUA, PRESIDENTIAL DECREE N. 445, 28 DECEMBER 2000, AND ART. 15, LAW N. 183, NOVEMBER 2011)

The undersigned BARONE ALESSANDRO,

born on 16/05/1994 in Aosta (AO)Italy

Fiscal Code: BRNLSN94E16A326R

DECLARES

that on 21/07/2016 he was awarded an undergraduate degree from the University of Pavia in Physics belonging to the class of Degrees (L-30 - Physics D.M. 270/04)
with a final score of 110/110 e lode (one hundred and ten/one hundred and ten e lode)

The standard duration of the course is three years.

IT IS FURTHERMORE DECLARED

that the undersigned defended his dissertation entitled

"Hadronic physics: from the quark model to quantum chromodynamics"

Supervisor: REBUZZI DANIELA MARCELLA

HE ALSO CERTIFIES

to have matriculated

on 27/08/2013

in the 2013/2014 Academic Year

First cycle degree/Bachelor in PHYSICS

at the University:University of PAVIA

HE ALSO DECLARES

that the student successfully passed the following exams :

DATE	SUBJECT	MARK	YEAR	COURSE CREDITS	TYPE OF TRAINING	SSD	SVR	NOTE	UNIVERSITY
30/06/2014	COMPLEMENTS OF MATHEMATICAL ANALYSIS I	30/30	1°	6	C	MAT/05			
27/01/2014	LINEAR ALGEBRA	24/30	1°	9	A	MAT/03			

DATE	SUBJECT	MARK	YEAR	COURSE CREDITS	TYPE OF TRAINING	SSD	SVR	NOTE	UNIVERSITY
24/09/2014	MECHANICS AND THERMODYNAMICS	30/30	1°	12					
	Mechanics			6	A	FIS/01			
	Thermodynamics			6	A	FIS/01			
25/06/2014	CHEMISTRY	30/30	1°	6	A	CHIM/03			
18/09/2014	PHYSICS LABORATORY AND DATA ANALYSIS I	30/30	1°	12					
	PHYSICAL LAB			6	A	FIS/01			
	Physical measurements)			6	A	FIS/01			
25/09/2014	COMPUTER SCIENCE FOR PHYSICS	30/30	1°	6	F	FIS/01			
03/02/2014	MATHEMATICAL ANALYSIS 1	28/30	1°	9	A	MAT/05			
31/07/2015	PHYSICS LABORATORY AND DATA ANALYSIS II	29/30	2°	12					
	Physical measurements - 2			6	B	FIS/01			
	Physical measurements -1			6	B	FIS/01			
13/07/2015	English Language	29/30	2°	3	E	L-LIN/12			
25/02/2015	COMPLEMENTS OF MATHEMATICAL ANALYSIS II	30/30 L	2°	6	C	MAT/05			
20/01/2015	ELECTROMAGNETISM I	29/30	2°	6	B	FIS/01			
23/09/2015	DIFFERENTIAL EQUATIONS AND DYNAMICAL SYSTEMS	30/30	2°	6	D	MAT/05			
14/07/2015	MATHEMATICAL METHODS OF PHYSICS I	30/30	2°	6	B	FIS/02			
23/09/2015	INTRODUCTION TO MODERN PHYSICS	30/30 L	2°	6	A	FIS/02			
16/06/2015	ELECTROMAGNETISM II	27/30	2°	6	B	FIS/01			
25/09/2015	CLASSICAL MECHANICS	28/30	2°	9	C	MAT/07			
21/07/2016	Final exam	Pass	3°	6	E				
08/02/2016	QUANTUM MECHANICS	30/30 L	3°	12					
	QUANTUM MECHANICS - B			6	B	FIS/02			
	QUANTUM MECHANICS -			6	B	FIS/02			
24/06/2016	ELECTRODYNAMICS AND RELATIVITY	30/30 L	3°	6	D	FIS/02			
16/02/2016	INTRODUCTION TO NUCLEAR PHYSICS	30/30 L	3°	6	B	FIS/04			
16/06/2016	INTRODUCTION TO SUBNUCLEAR PHYSICS	30/30 L	3°	6	B	FIS/04			
27/06/2016	STRUCTURE OF MATTER	30/30 L	3°	12	B	FIS/03			
18/01/2016	MATHEMATICAL METHODS OF PHYSICS II	30/30	3°	6	B	FIS/02			

DATE	SUBJECT	MARK	YEAR	COURSE CREDITS	TYPE OF TRAINING	SSD	SVR	NOTE	UNIVERSITY
23/02/2016	PHYSICS LABORATORY III	30/30 L	3°	6	B	FIS/01			
Total Course Credits:				**180.00**					

This course of studies terminated on 21/07/2016, upon conferment of the degree.

The above information was last updated on: 20/09/2018

The student is aware that whoever issues false statements shall be punished according to the penal code and to special laws regarding the matter, and pursuant to the effects of arts. 75 and 76 of presidential decree n.445/2000.

He is knowledgeable of the provisions of art. 13 of legislative decree 196/03 relating to the protection of personal data.

Pavia, 20/09/2018

SIGNATURE OF THE DECLARANT (legible and in full)

Alessandro Barone

Exempt from stamp duty in accordance with art. 37, Presidential Decree 445/2000

NOTE for Public Administration (PA):
It is possible to verify the accuracy of the present declaration by means of the PA code given at the top of the first page.
For information: http://esse3pa.kion.it

ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

TRANSCRIPT OF RECORDS

reg. 368018

MATRICULATION NUMBER: 0000807267

NAME OF THE STUDENT: Family Name: BARONE First Name: ALESSANDRO GENDER: M

DATE, PLACE AND COUNTRY OF BIRTH: Date (dd/mm/yyyy): 16/05/1994 Place AOSTA Country ITALIA

CLASS (MAIN FIELD OF STUDY FOR THE QUALIFICATION): Class n. LM-17 Physics
DEGREE PROGRAMME: Physics (Second cycle degree programme)
OFFICIAL LENGTH OF THE PROGRAMME: 2 academic years
ADMINISTRATIVE OFFICE: Bologna
LANGUAGE OF INSTRUCTION : Italian

ACADEMIC YEAR OF LAST ENROLLMENT: 2017/2018

YEAR OF ENROLLMENT: 2nd (regularly enrolled)

MATRICULATION DATE (dd/mm/yyyy): 26/09/2016

FIRST ACADEMIC YEAR OF ENROLLMENT: 2016/2017

LEARNING ACTIVITIES RECOGNIZED IN THE CURRENT PROGRAMME

Learning activities	Grade	ECTS Scale	Date (dd/mm/yy)	SSD	CFU/ECTS
Additional Credits for English Language Skills	RC				3

LEARNING ACTIVITIES SUCCESSFULLY COMPLETED IN THE CURRENT PROGRAMME

Learning activities	Grade	ECTS Scale	Date (dd/mm/yy)	SSD	CFU/ECTS
Dynamics of Stellar Systems	30	B(1)	07/02/2018	FIS/05	6
Field Theory 1	30	B(1)	28/06/2017	FIS/02	6
Field Theory 2	27	D(1)	26/03/2018	FIS/02	6
History of Physics	30	B(1)	17/07/2018	FIS/08	6
Laboratory of Nuclear and Subnuclear Physics 1	30	B(1)	09/02/2017	FIS/07	6
Nuclear Physics	30	B(1)	20/07/2017	FIS/04	6
Particle Astrophysics	30	B(1)	27/03/2017	FIS/01	6
Particle Physics	30 e lode	A(1)	20/01/2017	FIS/01	6
Particles and Fields	30	B(1)	28/07/2017	FIS/02	6
Relativity 2	30	B(1)	06/06/2017	FIS/02	6
Statistical Mechanics 1	30	B(1)	09/01/2018	FIS/02	6
Theoretical Physics 1	30 e lode	A(1)	10/01/2018	FIS/02	6
Theoretical Physics 2	30 e lode	A(1)	16/02/2018	FIS/02	6

USEFUL CREDITS (RECOGNISED AND/OR OBTAINED IN THE LAST DEGREE PROGRAMME): 78

Notes

(1)
Exam taken at the School of 10 - Science
ECTS grading scale - Institutional grading system of the School of 10 - Science (second cycle degree programmes)

ECTS Scale	Grade	% of students who have obtained such grade
A	30 e lode	15
B	30	32
C	29	9
C	28	16
D	27	11
D	26	6
D	25	4
E	24	3
E	23	1
E	22	1
E	21	0
E	20	1
E	19	0
E	18	1

Passing grade for each exams or learning activity can range from 18 to 30. The highest possible grade is "30 e lode" (30L), i.e. 30 with honours.
For some exams and activities there is no grade, but only an "approved" (ID).
The percentages of students obtaining a given grade are rounded up to the nearest whole number. The highest percentage is calculated by the difference between 100 and the sum of the percentages of the students obtaining the other grades.
1 CFU = Credit Unit = 1 ECTS = 25 working hours (teaching, independent study, examinations, tutorials)
N.A. = Not applicable in a different Faculty in the Univesity system before 1999 reform or in a different University.
SSD = Scientific field/Discipline
RC = Recognised
RP = Replaced
SO = Sobstitute

The Italian University System

(DM 509/99 and DM 270/2004)

Since 1999, Italian university studies have been reformed so as to meet the objectives of the "Bologna process". The university system is now organised in 3 cycles: the Laurea, the 1st cycle academic degree, grants access to the 2nd cycle, and the *Laurea specialistica/magistrale*, the main degree of the 2nd cycle, gives access to 3rd cycle courses awarding the *Dottorato di ricerca*. In addition to the three sequential degrees mentioned above, the system offers other programmes with their respective degrees.

First cycle. First cycle studies consist exclusively in *Corsi di Laurea*, aimed at guaranteeing students an adequate command of general scientific methods and contents as well as specific professional skills. The general access requirement is the school leaving qualification awarded on completion of 13 years of global schooling and after the relevant State examinations; also comparable foreign qualifications may be accepted. Admission to individual degree courses may be subject to specific course requirements. *Laurea* courses last 3 years. The *Laurea* (1st degree) is awarded to students who have earned 180 credits; the completion of a training period and the defence of a thesis may also be required. The *Laurea* grants access to competitions for the civil service, to regulated and non-regulated professions, and to 2nd cycle courses.

Second cycle. Second cycle studies include the following typologies:
A) *Corsi di Laurea specialistica/Corsi di Laurea magistrale*; they are aimed at providing students with an advanced level of education for the exercise of a highly qualified activity in specific areas. Access is usually by a Laurea or a comparable foreign degree; admission is subject to specific course requirements determined by individual universities; workload: 120 credits; length: 2 years. The awarding of the degree, *Laurea specialistica/magistrale* (2nd cycle degree of the "Bologna process") is conditional on the defence of a thesis. The change of the name from *Laurea specialistica* into *Laurea magistrale* was decided in 2004.
A limited number of 2nd cycle programmes (dentistry, human medicine, pharmacy, veterinary medicine, architecture, law), are defined *Corsi di Laurea specialistica/magistrale a ciclo unico* (one-block LS/LM courses); access is by the school leaving diploma or a comparable foreign qualification; admission is subject to selective entrance exams; each degree course is organised in just one-block of 5 years and 300 credits (only human medicine requires 6 years and 360 credits). All *Lauree specialistiche/magistrali* grant access to competitions for the civil service, to regulated and non-regulated professions, research doctorate programmes and all the other degree courses of the 3rd cycle.
B) *Corsi di Master universitario di primo livello*. They consist in advanced scientific courses or higher continuing education studies open to the holders of a *Laurea* or a comparable foreign degree; admission may be subject to additional conditions. Length: minimum 1 year; workload: 60 credits at least. The *Master universitario* di primo livello does not give access to the 3rd cycle.

Third cycle. Third cycle studies include the following typologies:
A) *Corsi di Dottorato di Ricerca* aim at training students for very advanced scientific research; they adopt innovative teaching methodologies, updated technologies, training periods abroad and supervised activities in specialized research centres. Admission requires a *Laurea specialistica/ magistrale* (or a comparable foreign degree) and to pass a specific competition; studies last a minimum of 3 years; the doctoral student must work out an original dissertation to be defended in the final examination.
B) *Corsi di specializzazione* are devised to provide students with knowledge and abilities as requested in the practice of highly qualified professions; they mainly concern medical, clinical and surgical specialities. Admission requires a *Laurea specialistica/magistrale* (or a comparable foreign degree) and the passing of a competitive examination; course length varies in relation to subject fields. The final degree, *Diploma di specializzazione*, gives the right to the title as *Specialista.*
C) *Corsi di Master universitario di secondo livello* consist in advanced scientific courses or higher continuing education studies, open to the holders of an LS or a comparable foreign degree. Length: minimum 1 year; workload: 60 credits at least.

Credits: degree courses are usually structured in credits. A university credit generally corresponds to 25 hours of global work per student, time for personal study included. The average workload of a full time student is conventionally fixed at 60 credits per year.

Classes of degree courses: all degree courses sharing educational objectives and teaching-learning activities are organised in groups called *classi*. The content of individual degree courses is autonomously determined by universities; however, when establishing a degree course, individual institutions have to adopt some general requirements fixed at national level. Degrees belonging to the same class have the same legal validity.

Academic titles: the *Laurea* confers the title "*Dottore*", the *Laurea specialistica/magistrale* that of *Dottore magistrale*, the *Dottorato di ricerc*a that of "*Dottore di ricerca*".

Joint degrees: Italian universities may establish degree courses in cooperation with foreign partner universities; on completion of integrated curricula joint or double/multiple degrees are awarded.

Esenzione: Art. 11 dell'Allegato B DPR 642-1972

Head of Division Dott.ssa Angela Negrini. Issued on: 16/09/2018

ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

Prof Michele Cicoli
Associate Professor
Email: michele.cicoli@unibo.it
Department of Physics and Astronomy
University of Bologna

TO WHOM IT MAY CONCERN 03 January 2019

Recommendation Letter in support of Alessandro Barone

I am writing to give my support to Alessandro Barone's application for a PhD position at your Institution. I met Alessandro for the first time in Spring 2017 when he attended the lectures of my "Theory of the Standard Model" course of the Master degree in Theoretical Physics of the University of Bologna. During the course, Alessandro learnt the basics of the theory of the Standard Model of particle physics. He was one of the best students of the course since he always asked clever questions and could clearly follow and understand each lecture very well. Alessandro took also other important courses on quantum field theory, general relativity, statistical mechanics, cosmology and group theory. He has therefore a solid background in theoretical high energy physics. He also attended a few courses on experimental particle physics.

At the beginning of 2018 he asked me to work under my supervision on a thesis project for the "Laurea Magistrale" in Physics at the University of Bologna. Given that he was interested in working on a topic in quantum field theory with phenomenological applications, I asked him to study the cosmological behaviour of string moduli. The moduli are gravitationally coupled scalar fields which naturally emerge in the 4D low-energy limit of string compactifications. They generically develop masses via supersymmetry breaking effects. During inflation, however, they acquire additional large contributions to their masses proportional to the Hubble constant. Hence they tend to get displaced from their minimum. Due to this shift, the moduli store energy and redshift as non-relativistic matter when they start oscillating around their minimum after the end of inflation. In order not to destroy the successful predictions of Big-bang nucleosynthesis, it is therefore important that the moduli decay at temperatures larger than 5 MeV.

In his thesis, Alessandro, however considered the possibility that the moduli, even if they are displaced during inflation, do not come to dominate the energy density of the universe due to the inflationary dynamics. In particular, he focused on a type IIB multi-field model called Kahler Moduli Inflation. In this model, the inflation is a blow-up mode which develops a potential due to tiny non-perturbative effects. On top of this field, there are several spectator modes during inflation: (i) the volume mode which generically suffers from the cosmological moduli problem described above, and (ii) several auxiliary blow-up modes which keep the volume mode constant during inflation, guaranteeing that the single-field approximation is under good control. Alessandro studied how the volume mode behaves depending on the number of auxiliary blow-up modes. He found that if this number is small, the volume shift during inflation is large and the Hubble friction is effective, so to induce a period of volume mode domination after the end of inflation. If instead the number of blow-up modes is large, both the volume shift and the effect of the Hubble friction are negligible, resulting in the absence of a post-inflationary period of moduli domination. Alessandro is now completing his Master thesis work, studying the reheating process at the end of inflation. Depending on the presence or not of a low-energy period of volume mode domination, the SM degrees of freedom can be produced from the gravitational decay of the inflaton or the volume mode.

Alessandro’s thesis is almost complete and he will defend it in March 2019. In order to carry on his thesis project, Alessandro had to study formal theoretical issues like supersymmetry, supergravity and Kaluza-Klein theories, but also more phenomenological issues like moduli stabilisation and inflation. Some of these topics are very different from each other and, above all, rather technical and complicated. However, Alessandro managed to learn each of them to a very good level. Moreover, he has been rather independent in both learning the background material and in performing long computations. He has also learnt how to use Mathematica to perform numerical studies of the multi-field inflationary dynamics. On the other hand, even if he has a very good physical intuition, he has still to improve his knowledge of the background material and some more theoretical and formal tools.

Summarising, I have to say that Alessandro performed very well under my supervision and I consider him as a very good Master student. During his Master thesis he has already shown to be able to tackle hard and advanced problems in modern physics. Hence I am sure he will definitely perform very well at the PhD programme in Physics at your Institution.

Best Regards
Prof Michele Cicoli

AcademicJobsOnline.org

Bellagente, Marco

Address		**Email** marco.bellagente@gmail.com (update 2018/12/27)	
Via Madonnina 90 Varedo, Monza e Brianza 20814 Italy		**Home Phone** **Cell Phone** (+39) 3396718719 **Office Phone**	
Current Institution		**Department**	
Location	, Lombardia , Italy		
Highest Degree	MS	**Institution** Università degli Studi di Milano	**Date** 2018/11
Thesis Advisor	Stefano Forte		
Thesis Title	High energy resummation of double Higgs production		
Research Interests	**Primary** Theoretical particle physics		
Secondary	QCD; Machine Learning		
Current Research Interests: *I am interested in various aspects of quantum field theories, concerning in particular the Standard Model and the search of signals of physics beyond the standard model.*			
Discipline(s)	Theoretical Physics; Mathematical Physics; Machine Learning; Probability; Physics		
Position(s) applied	PHD		
Received Materials	**PHD**	**Cover Letter:** file (PDF, PDF 2019/01/04) **Curriculum Vitae:** file (PDF, PDF 2018/12/27) **Research Statement:** file (PDF, PDF 2019/01/06) **Copies of grades transcripts:** file (PDF, PDF 2019/01/04)	

January 4, 2019

Via Madonnina 90
Varedo, 20814, Italy
Phone: (+39) 3396718719
Email: marco.bellagente@gmail.com

Dear Prof. Plehn,

I send this letter as part of an application for a doctoral position in Heidelberg, as suggested by Prof. Plehn after a first interview at the Max-Planck-Institute for Nuclear Physics.

As part of my Master's degree at the University of Milan I wrote a thesis under the supervision of Prof. Forte with title: *High energy resummation of double Higgs production*, focused on perturbative-QCD and in particular on finite top mass effects. This work gave me the opportunity to read some of your papers and notes on Higgs physics and the Standard Model.

During my academic years I tried to gain a solid background of quantum field theories and to expand it with specific courses on related topics such as conformal field theory, advanced quantum field theory, electroweak interactions and particle physics, in order to ensure a wide basis of theoretical knowledge.

Thank you very much for taking the time to consider my application. I look forward to hearing from you.

Sincerely,

Marco Bellagente

Marco Bellagente

Curriculum Vitae

Personal Details

Birth 02 March 1993

Address Via Madonnina 90, Varedo 20814 (MB)

Phone +39 3396718719

Mail marco.bellagente@gmail.com

Education

2016 - 2018 **MSc. in Physics**, *University of Milan*, Milan.
Thesis: "High-energy resummation of double Higgs production"
Advisor: Stefano Forte
Final grade: 110/110 cum laude

2017 - 2018 **MSc. in Physics**, *Ludwig-Maximilians-Universität*, Munich.
36 ECTS aquired as an exchange student

2012 - 2016 **BSc. in Physics**, *University of Milan*, Milan.
Thesis: "Sliding on a quasicrystal, a colloidal model"
Advisor: Nicola Manini
Final grade: 103/110

Professional Skills

Programming C/C++, Python, Mathematica, LaTeX, UNIX/Linux systems, shell-scripting

Languages Italian (mother tongue), English (advanced), German (basic)

Master's degree courses and grades

October 2017 **Many Body Theory**, non-relativistic QFT, Hedin equations, quasiparticles, Lehmann representation, linear response, elastic media and phonons.
Prof. L. Molinari. Grade: 29/30

March 2017 **Classical Electrodynamics**, Maxwell equations, dispersive media, special relativity, Lienard-Wiechert potentials and fields, radiation of moving charges.
Prof. M. Rome. Grade: 30/30 cum laude

May 2017	**Electroweak interactions**, relativistic QM, Dirac equation, Lagrangian formalism and conservation laws, β-decay, weak interactions, electroweak unification and Higgs mechanism. Prof. F. Ragusa. Grade: 30/30
July 2017	**Quantum Field Theory 1**, classical field theory, symmetries, quantization of fields, interacting fields, path integral, Feynman rules, amplitudes and cross sections, introduction to renormalization. Prof. S. Forte. Grade: 30/30
January 2018	**Quantum Field Theory in Curved Space**, quantization in de Sitter universe, Unruh effect, Hawking effect, thermodynamics of black holes, Casimir effect. Prof. V. Mukhanov. Grade: 2.3 (German grading system)
February 2018	**Conformal Field Theory**, renormalization group and scale invariance, conformal transformations and conformal bootstrap, CFT in D=2, Virasoro algebra and representations, minimal models, BCFT, conformal perturbation theory. Prof. I. Sachs. Grade: 1 (German grading system)
February 2018	**String Theory**, classical bosonic string, quantized bosonic string, conformal field theory, string perturbation theory, compactification, T-duality. Prof. E. Plauschinn. Grade: 1.3 (German grading system)
March 2018	**Advanced Quantum Field Theory**, gauge theories and linearized gravity, massive gravity, UV completion and unitarity, p-forms, topological defects, non-linear QFT, dualities, instantons, anomalies, theta vacuum. Prof. G. Dvali. Grade: 1 (German grading system)
May 2018	**Quantum Field Theory 2**, optical theorem, Ward identities, Goldstone theorem, geometry of gauge invariance, quantization of non-abelian gauge theories, Higgs mechanism, renormalization, Callan-Symanzik equation, OPE. Prof. S. Forte. Grade: 30/30
September 2018	**Particle Physics**, fundamental interactions, detectors, quark model, weak interactions, Standard Model. Prof. M. Giammarchi. Grade: 30/30

Research Statement

Physics research

I am a soon to become doctorand with interests in theoretical physics, in particular in theoretical particle physics and everything concerning QCD.

At the moment, I have the possibility to start my doctoral studies at the Max Planck Institute for nuclear physics.

My short-term goal is to finish the novel research work started with my master thesis on double Higgs production via gluon fusion in order to quantify the phenomenological impact of high-energy resummation on this process, which will be of primary interest in the next years at hadronic colliders.

As a long-term project, during my phd studies I would like to deepen my knowledge of various aspects of theoretical physics, in particular I would like to focus on jet physics, as an ideal bridge bewteen theoretical and experimental physics.

UNIVERSITÀ DEGLI STUDI
DI MILANO

DIPLOMA SUPPLEMENT

The Diploma Supplement was developed by the European Commission, Council of Europe and by UNESCO/CEPES. The purpose of the supplement is to provide sufficient independent data to improve the international transparency and fair academic and professional recognition of qualifications (diplomas, degrees, certificates etc.). It is designed to provide a description of the nature, level, context, content and status of the studies that were pursued and successfully completed by the individual named on the original qualification to which this supplement is appended. It is free from any value judgements, equivalence statements or suggestions about recognition. Information is provided in eight sections. Where information is not provided, an explanation will give the reason why.

1 Information identifying the holder of the qualification

1.1 Family Name
BELLAGENTE

1.2 First Name
MARCO

1.3 Date, Place, Country of Birth
02/03/1993 DESIO ITALIA

1.4 Student Code
BLLMRC93C02D286Y

1.5 Student Number
901379

2 Information identifying the qualification

2.1 Name of Qualification
Laurea Magistrale in : PHYSICS
Name of Title: Dottore

2.2 Main Field(s) of Study for the Qualification
Class LM-17 - Physics

2.3 Name of Institution Awarding Qualification Status
UNIVERSITA' DEGLI STUDI DI MILANO - Via Festa del Perdono, 7 - 20122 Milano - State University

2.4 Name of Institution Administering Studies Status
See 2.3

2.5 Language(s) of Instruction/Examination
ITALIAN

3 Information on the level of the Qualification

3.1 Level of Qualification
Second cycle

3.2 Official Length of Programme
2 YEARS, 120 ECTS

3.3 Access Requirement(s)
First cycle degree or an equivalent title according to the current law. To access programme, an admission procedure is required.

4 Information on the contents and results gained

4.1 Mode of Study
Full Time
Lectures, seminars, workshop and internship.

4.2 Programme Requirements
The aim given to the Master's course in Physics is to enable the graduate student to either continue with further studies or to take part in research or professional activity with the necessary competence, having learnt the use of scientific methods and experimental basis, theoretical and mathematical, on which physics is based.
The Master¿s degree course will enable the student to deepen acquired knowledge in classic physics, relativity and quantum physics as regards to phenomenological aspects, theoretical aspects and their mathematical formulas.
Having acquired adequate mathematical and computer instruments, the student will be able to carry out tests in formulations in the use of mathematical models and in the use of calculus techniques for problem solving in physics.
The Master¿s Degree course is open to further development and in-depth study in post graduate courses. It foresees different majors which permit the graduate student to enter basic research and/or applied research and in work-related areas which require experimental-applicative competences, the knowledge of innovative methods, the use of complex equipment.

	Formative Activities	**Credits**	
b)	TYPICAL FORMATIVE ACTIVITIES	42,00	
	Experimental and Applied Studies		6,00
	Astrophysics, Geophysics and Spacial Physics		12,00
	Theory and Foundations of Physics		12,00
	Microphysics and Material Structure		12,00
c)	RELATED OR ADDITIONAL FORMATIVE ACTIVITIES	18,00	
	Related or Additional Studies		18,00
d)	FREE STUDENT'S ACTIVITIES	12,00	
	Free Student's activities		12,00
e)	FINAL EXAM AND FOREIGN LANGUAGE	45,00	
	Final Exam		45,00
f)	OTHER ACTIVITIES	3,00	
	Computer and telematic skills		3,00
	Total	120,00	

4.3 Programme Details and the individual grades/marks/credits obtained

Subjects	Mark	Date		Credits	Site
MANY BODY THEORY 1............ S.S.D. FIS/02	TWENTY-NINE--	10/01/2017		6,00	
CLASSICAL ELECTRODYNAMICS..... S.S.D. FIS/01	THIRTY LAUDE	22/03/2017		6,00	
ELECTROWEAK INTERACTIONS...... S.S.D. FIS/04	THIRTY-------	22/05/2017		6,00	
THEORETICAL PHYSICS 1......... S.S.D. FIS/02	THIRTY-------	30/06/2017		6,00	
THEORETICAL PHYSICS 2 .... S.S.D. FIS/02	THIRTY-------	14/05/2018		6,00	
PARTICLE PHYSICS.............. S.S.D. FIS/04	THIRTY-------	13/09/2018		6,00	
ABILITY IN THE USE OF COMPUTER FACILITIES	APPROVED-----	14/09/2018		3,00	
FINAL EXAM....................	APPROVED-----	23/11/2018		45,00	

Moreover Mr BELLAGENTE MARCO has passed the following exams as an Erasmus student:

Subjects	Mark	Date		Credits	Site
QUANTUM FIELD THEORY IN CURVED SPACES........................ S.S.D. FIS/05	TWENTY-SEVEN-	12/04/2018	CV	9,00	86
STRING THEORY I............... S.S.D. FIS/02	THIRTY-------	12/04/2018	CV	9,00	86
CONFORMAL FIELD THEORY........ S.S.D. FIS/02	THIRTY-------	12/04/2018	CV	9,00	86
ADVANCED QUANTUM FIELD THEORY. S.S.D. FIS/02	THIRTY LAUDE	12/04/2018	CV	9,00	86

Total credits: 120,00

Legenda: CV Validated
FP Out plan of studies
AC From the plan of studies of another degree course

Sectors description :

FIS/01	Experimental Physics
FIS/02	Theoretical Physics, Mathematical Models and Methods
FIS/04	Nuclear and Subnuclear Physics
FIS/05	Astronomy and Astrophysics

Description of examination sites:
86 LUDWIG MAXIMILIANS UNIVERSITAT

Erasmus periods:

YEAR	From	To	University
2017	28/09/2017	06/03/2018	Ludwig-Maximilians-Universitat Munchen

Title of thesis:
HIGH ENERGY RESUMMATION OF DOUBLE HIGGS PRODUCTION
Relator : FORTE STEFANO

4.4 Grading Scheme, grade distribution guidance

Individual subject are graded on a scale from 18 to 30. The maximun grade is 30 'cum laude'. The statistic distribution of grades refers to the data of programmes belonging to the same class. The number of years considered corresponds to the normal duration of the programme.

Grade	%
30 cum laude	20
30	35
29	11
28	14
27	9
26	5
25	2
24	2
23	1
22	0
21	0
20	0
19	0
18	1
TOTAL	100

4.5 Overall Classification

Final graduation mark: 110/110 cum laude
Final graduation date: 23/11/2018

The final grade is based on a scale from 66 to 110. The maximun grade is 110 'cum laude'. The statistic distribution of grades refers to the data of programmes belonging to the same class. The number of years considered corresponds to the normal duration of the programme.

Grade	%
110 cum laude	62
110	14
109	5
108	9
107	1
106	4
105	2
104	1
103	0
102	0
101	0
100	0
99-80	1
79-66	1
TOTAL	100

5 Information on the function of the Qualification

5.1 Access to Further Study

The qualification grants access to thyrd cycle studies: dottorato di ricerca, second level master courses and to specialisation courses.

5.2 Professional Status

Among the line of study that graduate students will undertake, are the following:
-scientific research in Italian and foreign universities;
-scientific research in public and private institutions, Italian and foreign;
-scientific research in industries;
- professional and project work in fields related to physics, industry, the environment, health, art and in public administration;
-the high-level diffusion of scientific education with particular reference to theoretical aspects, experimental and applicative aspects to classic and modern physics;

-promotion and development of scientific innovation and technology.

6 Additional Information

6.1 Additional Information

Information unavailable

6.2 Additional Information Sources

www.ccdfis.unimi.it

7 Date and Signature

Milano, 03/01/2019 nr. 021239

THE HEAD OF THE STUDENTS OFFICE
EMANUELA DELLAVALLE

The signature is omitted in accordance with legislative decree n. 39 dated 12/02/93.

8 Information on the National Higher Education System

The Italian University System

The Italian university system is organised in three cycles, according to the Bologna structure: the main academic degrees are the Laurea (1st cycle), the Laurea Magistrale (2nd cycle) and the Dottorato di Ricerca (3rd cycle). The system also offers other study programmes and related qualifications.

First cycle. This cycle consists exclusively of Corsi di Laurea. These degree programmes provide students with an adequate command of general scientific methods and contents as well as with specific professional skills. The general access requirement is the Italian school leaving qualification awarded after completion of 13 years of schooling and passing the relevant State examination; comparable foreign qualifications may also be accepted. Admission to some degree courses may be based on specific course requirements. The studies last 3 years.
The Laurea is awarded to students who have gained 180 ECTS credits (called Crediti Formativi Universitari - CFU) and satisfied all curricular requirements, including the production of a final written paper or equivalent final project.
The Laurea gives access to the Corsi di Laurea Magistrale as well as to other 2nd cycle study programmes.

Second cycle. The main degree programmes in this cycle are the Corsi di Laurea Magistrale. They provide education at an advanced level for the exercise of highly qualified activities in specific areas. Access is by a Laurea degree or a comparable foreign degree; admission is based on specific course requirements determined by single universities. The studies last 2 years. The Laurea Magistrale degree is awarded to students who have gained 120 ECTS/CFU credits and satisfied all curricular requirements, including the production and public defence of an original dissertation. Some programmes (namely, those in dentistry, medicine, veterinary medicine, pharmacy, architecture, construction engineering/architecture, law, primary education) are defined "singlecycle programmes" (Corsi a ciclo unico); for these programmes access is by the Italian school leaving qualification (or a comparable foreign qualification); admission is based on entrance exams. The studies last 5 years (6 years and 360 ECTS/CFU credits in the cases of medicine and dentistry). A Laurea Magistrale degree is awarded to students who have gained 300 ECTS/CFU credits and satisfied all curricular requirements, including the production and public defence of an original dissertation. A Laurea Magistrale degree gives access to Corsi di Dottorato di Ricerca as well as to other 3rd cycle study programmes.

Third cycle. The main degree programmes in this cycle are Corsi di Dottorato di Ricerca (research doctorate programmes); the students/young researchers enrolled in these programmes will acquire methodologies for advanced scientific research, will be trained in new technologies and will work in research laboratories, wherever appropriate. Access is by a Laurea Magistrale degree (or a comparable foreign degree); admission is based on a competitive exam; studies last at least three years and include the completion and public defence of an original research project.

Other programmes
- Corsi di Specializzazione. These are 3rd cycle programmes intended to provide students with the knowledge and skills required for the practice of highly qualified professions, mainly in medical, clinical and surgical specialities.
Admission is by a Laurea Magistrale degree (or by a comparable foreign degree) and is based on a competitive exam; studies may last from 2 (120 ECTS/CFU credits) to 6 years (360 ECTS/CFU credits) depending on the discipline. The final degree awarded is a Diploma di Specializzazione.
- Corsi di Master Universitario di primo livello. These are 2nd cycle programmes intended to provide students with further specialization or higher continuing education after completion of the first cycle. Access is by a Laurea degree (oracomparable foreign degree);admission may be subject to additional requirements. Studies last at least 1 year (60 ECTS/CFU credits). The

qualification awarded (Master Universitario di prima livello) does not give access to Corsi di Dottorato di Ricerca or to any other 3rd cycle programme, since this type of course does not belong to the general requirements established at national level, but it is offered under the autonomous responsibility of each university. - Corsi di Master Universitario di secondo livello. These are 3rd cycle programmes intended to provide students with further specialization or higher continuing education studies after completion of the second cycle. Access is by a Laurea Magistrale degree (or a comparable foreign degree); admission may be subject to additional requirements. Studies last at least 1 year (60 ECTS/CFU credits). The qualification awarded (Master Universitario di secondo livello) does not give access to Corsi di Dottorato di Ricerca or to any other 3rd cycle programmes, since this type of course does not belong to the general requirements established at national level, but it is offered under the autonomous responsibility of each university.

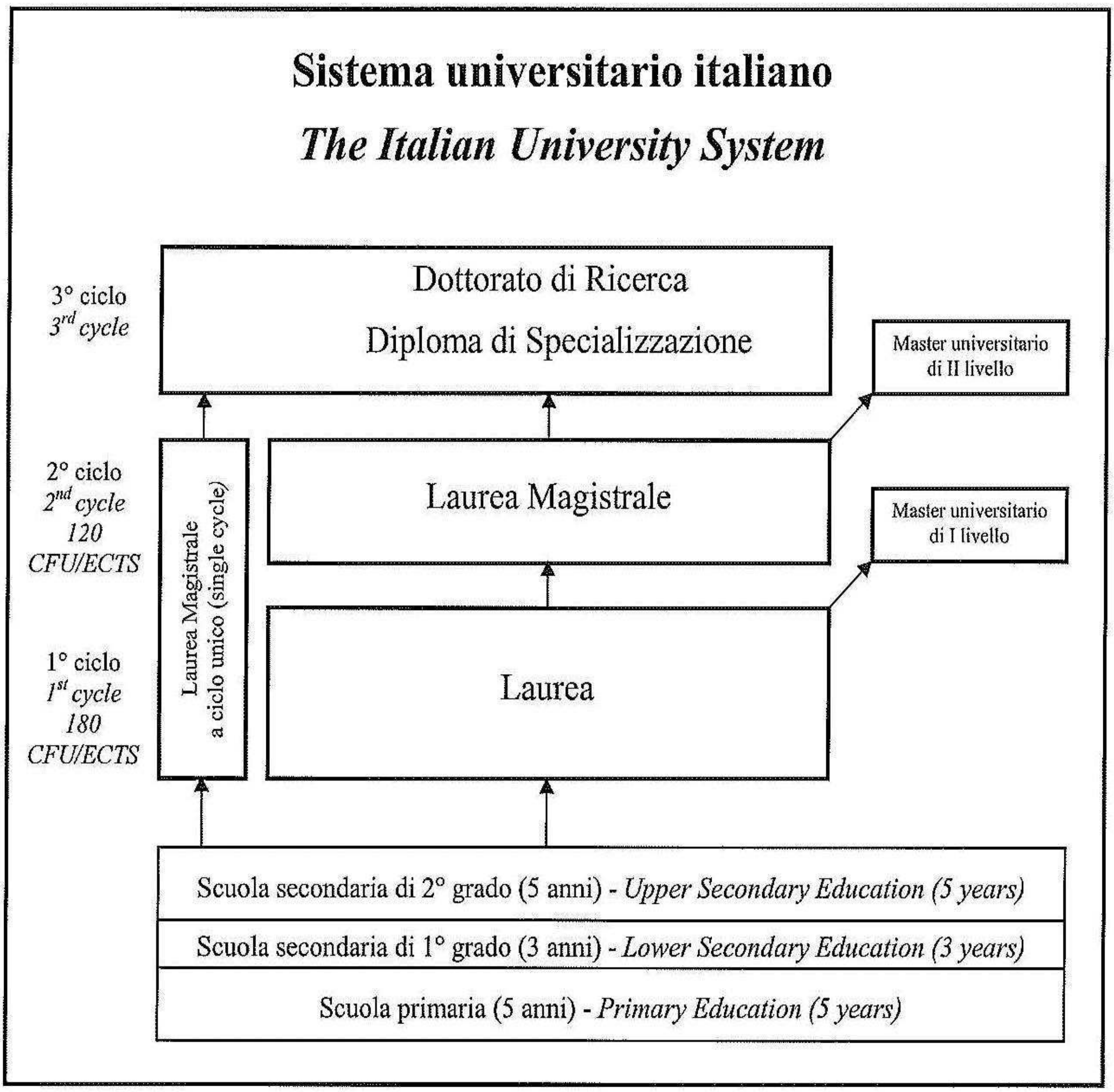
Credits: degree courses are structured in credits (Crediti Formativi Universitari CFU). University credits are based on the workload students need in order to achieve the expected learning outcomes. Each credit corresponds to 25 hours of student workload, including independent study. The average workload of a full time student is conventionally fixed at 60 credits per year. Thus, the CFU fully coincide with ECTS credits.

Classes of Degree Courses: all degree programmes of Laurea and Laurea Magistrale sharing general educational objectives are grouped into "classes". In developing the specific learning outcomes of single programmes, Universities have to comply with some national requirements for each class concerning the types (and corresponding amount of credits) of teaching-learning activities to be included.
Degrees belonging to the same class have the same legal value.

Academic Titles: Those who receive the Laurea are entitled to be called "Dottore", the holders of a Laurea Magistrale have a right to the title of "Dottore Magistrale", the Dottorato di ricerca confers the title of "Dottore di Ricerca" or "PhD".

Joint Degrees: Italian universities are allowed to establish degree programmes in cooperation with Italian and foreign partner universities, on completion of which joint or double/multiple degrees can be awarded.

Further information:
Italian Qualifications Framework (Quadro dei Titoli Italiani QTI) http://www.quadrodeititoli.it


Sistema universitario italiano
The Italian University System
3° ciclo
3rd cycle
Dottorato di Ricerca
Diploma di Specializzazione
Master universitario di II livello
2° ciclo
2nd cycle
120
CFU/ECTS
Laurea Magistrale a ciclo unico (single cycle)
Laurea Magistrale
Master universitario di I livello
1° ciclo
1st cycle
180
CFU/ECTS
Laurea
Scuola secondaria di 2° grado (5 anni) - Upper Secondary Education (5 years)
Scuola secondaria di 1° grado (3 anni) - Lower Secondary Education (3 years)
Scuola primaria (5 anni) - Primary Education (5 years)

Brancaccio, Colomba

Address		**Email** colombabrancaccio@gmail.com (update 2019/02/09)	
Via Solferino, 78 Porto Sant'Elpidio, Italy 63821 Italy		**Home Phone** (+39) 0734903630 **Cell Phone** (+39) 3460514730 **Office Phone** (+39) 3460514730 **Skype Name** colombabrancaccio	
Current Title / Dates	BSc in Physics, 21-09-2017		
Current Institution	Sapienza University	**Department**	Sapienza University
Location	Piazzale Aldo Moro, 5, Roma, Roma 00161, Italy		
Highest Degree	MSc in theoretical physics	**Institution** Sapienza University	**Date** 2019/10 exp
Thesis Advisor	Roberto Bonciani		
Research Interests	**Primary** Quark-mass effects in Higgs-boson production in gluon fusion		
Secondary	New sources of flavour- and CP-violation at high transverse momenta; Dark sector at LHC		
Current Research Interests: *Last summer I was a Summer Student at CERN working on how to discriminate BSM disappearing tracks using neural networks. I am going to start my Master thesis with Prof. Roberto Bonciani and I will compute the cross section of the process pp in γγ involving two loops, one of which with a massive fermion.*			
Discipline(s)	Theoretical Physics		
Position(s) applied	PHD		
1. Maurizio Pierini, Cern, Maurizio.Pierini@cern.ch (teaching) (2019/01/22)		file (PDF, PDF, 2019/01/26)	
2. Daniele Del Re, Infn, daniele.delre@roma1.infn.it (teaching) (2019/01/22)		file (PDF, PDF, 2019/02/07, tailored)	
3. Guido Martinelli, Infn, guido.martinelli@roma1.infn.it (teaching) (2019/01/22)		file (PDF, PDF, 2019/01/25)	
4. Omar Benhar, Infn, omar.benhar@roma1.infn.it (teaching) (2019/01/22)		file (PDF, PDF, 2019/01/28)	
Received Materials	**PHD**	**Cover Letter:** file (PDF, PDF 2019/01/26) **Curriculum Vitae:** file (PDF, PDF 2019/01/22) **Research Statement:** file (PDF, PDF 2019/02/13) **Copies of grades transcripts:** file (PDF, PDF 2019/01/22)	

Cover Letter

I am writing to apply for the PhD position in Theoretical Particle Physics. I am a master student at Sapienza University of Rome expecting to graduate in October 2019. I am confident that my experience and my research interests make me an ideal candidate for your open position.

I attained my B.Sc. Physics degree in 2017 with grade 110/110 cum laude. My bachelor thesis was "Search of Dark Matter at LHC" with the supervision of Prof. Daniele Del Re. In my thesis I analyzed the different possible models of dark matter and how to research it in experiments at LHC considering the way this matter can interact with the barionic one. Thanks to my thesis, I won a competition in my university to visit CERN, where I definitely confimed my passion for particle physics. Furthermore, I started the master at Sapienza University in theoretical physics in which I studied, among other subjects, relativistic quantum mechanics, group theory, electroweak interaction, QED and QCD. However, my wish to do phenomelogy leads me not to neglect experiments. In fact, last summer I was a Summer Student at CERN, where I was supervised by Maurizio Pierini. The aim of my CERN Summer School Project was to compile a Neural Network aimed to discriminate BSM disappearing tracks using dE/dx to distinguish the background from the signal researched. This Summer Project enhanced my programming skills and provided an opportunity to study Supersymmetry.

Not only does my master study suits the needs of your PhD program but also my research interests fit perfectly with your description of the ideal candidate. I am going to start my Master thesis with Prof. Roberto Bonciani and I will compute the cross section of the process $pp \rightarrow \gamma\gamma$ involving two loops, one of which with a massive fermion. This process is the main source of background at LHC, hence the importance of performing these calculations with greater precision. Which will help me to refine certain mathematical skills as well as other computing skills. Furthermore, this research is promising since it could lead to additional work with a probability of a publication.

I am sure that my studies and my experiences helped me acquire the necessary skills to face the proposed program and to work in a research team. Moreover, the research proposals offered by your institution are in line with my idea of research, which combined with my huge passion for theoretical particle physics, would result in a fructuous collaboration. I have attached my curriculum vitae and all the requested documents. Thank you very much for your attention; I look forward to hearing from you.

Sincerely,

Colomba Brancaccio

europass Curriculum vitae

PERSONAL INFORMATION

Colomba Brancaccio

Via Solferino 78, Porto Sant'Elpidio 63821, Italy

+39 346051473 +39 0734903630

colombabrancaccio@gmail.com

Skype colomabrancaccio

Gender Female | Date of birth 29 September 1995 | Nationality Italian

JOB APPLIED FOR PhD in Physics

WORK EXPERIENCE

July 2018 - August 2018

Summer Student at CERN

CERN, Geneva, Switzerland

I spent 9 weeks at Cern working on a dE/dx discriminator for beyond the standard model disappearing tracks using machine learning.

8/1/2018–now

Laboratory assistant for undergraduate students at Physics Department

Sapienza, University of Rome

It is a grant for students which is won in the department of physics, according to merit (academic records).

EDUCATION AND TRAINING

25/9/2017–now

Master physics student at Sapienza University in Rome

21/09/2017

Bachelor in physics

Sapienza University, Rome, Italy
Grade 110/110 cum laude

30/9/2014–21/9/2017

Physics student at Sapienza University in Rome

Physics student with 29.5/30 grade point average.

5/9/2017–7/9/2017

Visit with grant at CERN

CERN, Geneva, Switzerland

9/2009-6/2014

Scientic high school

Grade 100/100 cum laude

15/7/2014–18/7/2014

Summer school "Fisica in moto" at Ducati

The Ducati fondation (Bologna, Italy) offers the oppotunity at 25 italian student to follow seminars and do some experiments.

BACHELOR THESIS

Title: **Search for dark matter at LHC**

Supervisor: Prof. Daniele Del Re

AWARDS

5/9/2017–7/9/2017 **Premio per i migliori studenti in sica nucleare e subnucleare**

Award (three-day visit) for third year undergraduate best students given by INFN.

PERSONAL SKILLS

Mother tongue: Italian

Other languages

	UNDERSTANDING		SPEAKING		WRITING
	Listening	Reading	Spoken interaction	Spoken production	
English	B2	B2	B2	B2	B2

Levels: A1/A2: Basic user - B1/B2: Independent user - C1/C2: Proficient user
Common European Framework of Reference (CEF) level

Communication skills
- team work: I have worked in team for laboratory experience at University and during the period of summer school at CERN, where I met people from all over the world.

Computer skills
- In-depth knowledge of C, C++, Python
- Basic knowledge of shell scripting (BASH), Perl, LabView
- Advanced knowledge of Open-Office, Linux, Microsoft Windows and Latex

Other skills: I love traveling and dancing.

Driving licence: B

Research Statement

My main interest is theoretical particle physics. My master studies were focused on relativistic quantum mechanics, group theory, electroweak interaction, QED, QCD and QFT. The discovery of a Higgs boson at the LHC brought enthusiasm to the high energy physics community and made physicists even more aware that accurate theoretical predictions are of the utmost importance in order to achieve a deeper understanding of the fundamental laws of nature. The next years will be dedicated to the study of the detailed properties of this new particle and to extend the energy frontier looking for physics beyond the Standard Model. For this reason, a detailed study of high-energy processes will be necessary in order to understand whether we are observing Standard Model physics or new physics when performing precision measurement in hadron colliders.

Summary of present and past research

I worked on dark matter during my bachelor thesis, which the title was “Search of Dark Matter at LHC” with the supervision of Prof. Daniele Del Re. We analyzed the evidence of the existence of dark matter which represents about 27% of the total matter/energy. Due to the fact that Dark Matter (DM) cannot be observed, the properties of DM particles have been deduced by the interaction of these particles with Standard Model (SM) particles only through weak and gravitational forces. The LHC searches dark matter particles thanks to high energy collisions and the assumption that interaction between two MS particles could create a pair of DM particles. To observe them the initial state radiation is used and the fact that the DM particles do not interact with the detector implying high transverse energy missing. In this type of measurements accurately determining the missing transverse energy is crucial to discriminate between the events of the SM and of DM. The results did not show any significant excess of events in the distribution of E_{Tmiss} and were compatible with the hypothesis of only background. However, these results were useful since they allowed to place limits on the cross section of the DM production process.

Last summer I was a Summer Student at CERN where my supervisor was Maurizio Pierini. The aim of my CERN Summer School Project was to study how to discrimate a BSM disappearing tracks using the dE/dx. Such disappearing tracks are the products of a new charged particles (called chargino) decaying within the tracker volume. The research was focused on chargino with a short life time. Therefore, a Dense Neural Network was developed, that using the dE/dx of the four layers of the inner tracker as main feature, allowed the discrimination of the background and the signal searched. This Summer Project strengthened my programming skills and presented me an opportunity to study Supersymmetry. The work developed can be found in [1].

As a master student I am working on master thesis with Professor R. Bonciani at Sapienza University of Rome. The aim of the work is to compute the cross section of the process pp $\rightarrow \gamma\gamma$ involving two loops, one of which with a massive fermion. The study of interactions between particles is usually done in the quantum field theory using a perturbative method, in which the contribution to the cross section at each perturbative order involves the calculation of one or more Feynman diagrams. Technological development leads the experimental apparatus to carry out measurements with a greater degree of precision, this should be supported by a progression in the theoretical calculation, which corresponds, in particle physics, to the increase in the perturbative order to which Feynman diagrams are evaluated. Excluding the simplest case, in every diagram there is at least one loop, which is a part of the diagram where the incoming and outgoing particles conserve the momentum without placing any constraints on the momentum of some of the internal particles. Since the momentum of these particles is not fixed, for quantum principles, it must be added to all the possible states of definite momentum. What we obtain is an integral, on all 4 non-defined momenta, of an expression consisting of a combination of propagators that is determined by the internal structure of the diagram. Integrals, which are usually of tensor type, can always be reduced to tensor quantities multiplied by a scalar integrals. Therefore the study of the Feynman diagrams is reduced to the calculation of integral scalars. These integrals are often defined in four dimensions but they are not convergent. Then the so-called dimensional regularization is used, which consists in defining the integral in a generic number d of dimensions, to then evaluate the limit $d \rightarrow 4$. The integrand of the integral over the internal momenta contains scalar products among the momenta in the numerator and propagators in the denominator. Integrals with same dimension of the denominator and same total number of scalar products are denoted as a class of integrals. Not all the integrals of a given class are independent but integration-by-part identities and Lorentz invariance allow us to express some in terms of others. The task is performed automatically by a computer program Reduze [2] and KIRA [3]. This procedure can result either in a reduction towards a small number of integrals of the considered topology and integrals of simpler topology or even in a complete reduction of all integrals of the considered topology towards integrals with simpler topology. Left-over integrals of the considered topology are called master integrals. Different techniques to solve them are developed as the negative dimension approach [4], the Mellin-Barnes transformation method [5], the differential equation method [6]. Another approach could be the Taylor expansion (for a suitable variable) of the scalar integrals subsequently reduced in terms of a basis Master Integrals. All of these Master integrals can be expressed in terms of multiple polylogarithms, already known in the literature [7]. Using the tools discussed above, in particular the last one, we want to compute the cross section of the process $pp \rightarrow \gamma\gamma$ and studying the range of validity of the approximation carried out with Taylor expansion for small p_T.

Future directions

In the future I would be keen on continue working in the area of multi-loop computations, but I would also be extremely interested to investigate different directions. I would like to continue to work on precision calculations for a more correct understanding of Standard Model. I strongly believe that this research is in parallel to the one I am conducting now since experimental results are getting more accurate and the introduction of multi-loop computations are necessary to explain these results. This will permit a further polishing and use of the mathematical tools I am acquiring within my master's thesis. Furthermore, the cross-section of the gluon fusion in Higgs boson is completely known only numerically, while analytical results have been obtained in heavy mass top limit [7]. A NNLO computation might allow the knowledge of the cross section of this process for a greater region of phase space, hence permitting a comparison between the experimental and theoretical studies. Keeping in mind the reasons stated before, my first choice is the "Quark-mass effects in Higgs-boson production in gluon fusion" project.

On a different direction I would like to investigate new physics models, since it is known that the Standard Model presents problems such as dark matter, the "hierarchy" problem and the unification of gravity. In order to solve those problems, using and improving my skills, I would like to work on possible new physics models such as new sources of flavour and CP violation since they could have a significant impact on the phenomenology at the LHC in the production of new particles.

As already stated one of the problems of the SM is the presence of dark matter, which is one of the biggest unknowns in today's physics. For these reasons, dark matter has always interested me as my bachelor thesis shows, where I analysed different models trying to explain DM's nature as well as how to search it at the LHC. Even if no evidences of DM existence were found keeping on searching is extremely important since the possible evidence of DM would represent an important step for physics and for the understanding of our universe. Moreover, the discovery of DM could be a proof for Supersymmetry, a theory beyond the MS, and DM would be only the lightest of a new spectrum of particles yet to be discovered. The Summer School Project also helped me develop new skills and expanded my knowledge regarding the phenomenological processes of dark matter. Therefore, for my knowledge in this field, combined with the new theoretical skills developed during my master, I strongly believe that I can bring a great input in the project regarding dark sector at LHC.

References

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------------------------------------CERTIFICATO DI LAUREA--
Dall'archivio informatico di questo Ateneo, alla data odierna, risulta quanto segue:-----------
La Dott.ssa BRANCACCIO COLOMBA---
- matricola n.1672992 nata a TORRE DEL GRECO (NA) il 29/09/1995---------------------------------
- codice fiscale: BRNCMB95P69L259A--
- nazione di nascita: ITALIA--
iscritta al Corso di laurea in FISICA [L (DM 270/04) - ORDIN. 2015] (classe L-30), facoltà di -
SCIENZE MATEMATICHE, FISICHE E NATURALI---
la cui durata legale è di 3 anni accademici---
ha conseguito, in questa Universita', in data 21/09/2017---------------------------------------
la laurea in FISICA [L (DM 270/04) - ORDIN. 2015] (classe L-30)--------------------------------
con voti 110 e lode /110--
si certifica, inoltre, che la stessa ha ottenuto negli esami di profitto le seguenti ----------
votazioni :---
 1 AAF1137 ABILITA' INFORMATICHE (-)--------------------29/01/2015---idoneo-------cred.: 3---
 2 1035105 LABORATORIO DI CALCOLO (FIS/01)----------------29/01/2015---30/30--------cred.: 6---
 3 1015375 GEOMETRIA (MAT/03)-----------------------------30/01/2015---30 e lode/30-cred.: 9---
 4 1018864 ANALISI (MAT/05)-------------------------------25/02/2015---29/30--------cred.: 9---
 5 1022782 CHIMICA (CHIM/03)------------------------------13/07/2015---30/30--------cred.: 6---
 6 1012088 LABORATORIO DI MECCANICA (FIS/01)--------------14/07/2015---30/30--------cred.: 12--
 7 1018843 MECCANICA (FIS/01)-----------------------------27/07/2015---30/30--------cred.: 12--
 8 1012086 LABORATORIO DI FISICA COMPUTAZIONALE I (INF/01)26/01/2016---30/30--------cred.: 6---
 9 1018971 TERMODINAMICA E LABORATORIO (FIS/01)-----------02/02/2016---30 e lode/30-cred.: 9---
10 1012112 MECCANICA ANALITICA E RELATIVISTICA (FIS/02)---11/02/2016---28/30--------cred.: 6---
11 1018970 ANALISI VETTORIALE (MAT/05)--------------------26/02/2016---28/30--------cred.: 9---
12 1018973 MODELLI E METODI MATEMATICI DELLA FISICA (FIS/02)---------------------------------
   --27/06/2016---30/30--------cred.: 12--
13 1018972 ELETTROMAGNETISMO (FIS/01)---------------------07/07/2016---30 e lode/30-cred.: 12--
14 1022852 LABORATORIO DI ELETTROMAGNETISMO E CIRCUITI (FIS/01)-------------------------------
   --22/07/2016---30/30--------cred.: 6---
15 1018975 LABORATORIO DI SEGNALI E SISTEMI (FIS/01)------31/01/2017---29/30--------cred.: 9---
16 1038470 ASTRONOMIA (FIS/05)----------------------------14/02/2017---30/30--------cred.: 6---
17 1018852 MECCANICA QUANTISTICA (FIS/02)-----------------23/02/2017---27/30--------cred.: 9---
18 1018853 MECCANICA STATISTICA (FIS/02)------------------01/03/2017---27/30--------cred.: 6---
19 AAF1101 LINGUA INGLESE (-)---------------------------19/05/2017---idoneo-------cred.: 3---
20 1012075 FISICA NUCLEARE E SUBNUCLEARE I (FIS/04)-------16/06/2017---30 e lode/30-cred.: 6---
21 1044375 ISTITUZIONI DI FISICA APPLICATA (FIS/01)-------27/06/2017---30 e lode/30-cred.: 6---
22 1012093 STRUTTURA DELLA MATERIA (FIS/03)---------------06/07/2017---27/30--------cred.: 6---
23 1018976 OTTICA E LABORATORIO (FIS/01)------------------21/07/2017---30/30--------cred.: 9---
24 AAF1001 PROVA FINALE (-)-----------------------------21/09/2017---superato-----cred.: 3---
Totale Crediti: 180 --
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Agenzia Entrate
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00090097 28/12/2018 08:47:47
4578-00088 871C41E9EACD7816
IDENTIFICATIVO : 01180390606249

0 1 18 039060 624 9

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- matricola n.1672992 nata a TORRE DEL GRECO (NA) il 29/09/1995--------------------------------
- codice fiscale: BRNCMB95P69L259A--
- nazione di nascita: ITALIA--
. e' stata immatricolata nell' anno accademico 2017/2018-------------------------------------
. nell' anno accademico 2018/2019 è stata iscritta al 2 anno in corso del Corso di laurea ----
magistrale in FISICA [LM - ORDIN. 2018] (classe LM-17)--
facoltà di SCIENZE MATEMATICHE, FISICHE E NATURALI--
. la cui durata legale è di 2 anni accademici---
Ha sostenuto i seguenti esami di profitto:---
1 1055344 CONDENSED MATTER PHYSICS (FIS/03)--------------26/01/2018---30 e lode/30-cred.: 6---
2 1012186 RELATIVITA' GENERALE (FIS/02)------------------05/02/2018---30 e lode/30-cred.: 6---
3 1055345 RELATIVISTIC QUANTUM MECHANICS (FIS/02)--------05/02/2018---30 e lode/30-cred.: 6---
4 1055356 COMPUTING METHODS FOR PHYSICS (INF/01)---------20/02/2018---30/30--------cred.: 6---
5 1055349 PHYSICS LABORATORY I (FIS/01)-----------------28/02/2018---30/30--------cred.: 6---
6 1055348 MATHEMATICAL PHYSICS (MAT/07)-----------------28/06/2018---29/30--------cred.: 6---
7 1055346 ELECTROWEAK INTERACTIONS (FIS/02)-------------28/06/2018---30/30--------cred.: 6---
8 1055350 PHYSICS LABORATORY II (FIS/01)----------------20/09/2018---30 e lode/30-cred.: 12--
9 1047767 ELETTRODINAMICA QUANTISTICA (FIS/08)-----------09/11/2018---30 e lode/30-cred.: 6---
Esami Superati: 9--
Totale Crediti: 60 --
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--------------------------CERTIFICATO DI ESAMI SOSTENUTI---------------------------------
---Studente:BRANCACCIO COLOMBA--
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Il Capo Settore
Sig.ra Graziella Censi

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MARCA DA BOLLO
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00090096 28/12/2018 08:47:43
4578-00088 8B70DABE6078C406
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0 1 18 039060 625 0

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DEGREE CERTIFICATE

As resulting from the electronic records of this University on the date hereof:
Mrs. COLOMBA BRANCACCIO
- registration no. 1672992, born in TORRE DEL GRECO (NA) on 29/09/1995
- tax code: BRNCMB95P69L259A
- country of birth: ITALY

enrolled in the Degree Programme *[TN: Bachelor's]* in PHYSICS [L (DM 270/04) - 2015 UNIVERSITY SYSTEM] - (class L-30 of degrees),
Faculty of MATHEMATICAL, PHYSICAL AND NATURAL SCIENCES
with a legal duration of 3 academic years
has obtained, in this University, on 21/09/2014
the degree *[TN: Bachelor's]* in PHYSICS [L (DM 270/04) - 2015 UNIVERSITY SYSTEM] - (class L-30 of degrees)
with a score of 110/110 cum laude
this is also to certify that the aforementioned has obtained the following final course examination grades:

No.	*Code*	*Course name*	*Date*	*Grade*	*Cfu* Credits*
1	AAF1137	COMPUTER SKILLS (-)	29/01/2015	competent	3
2	1035105	LABORATORY OF COMPUTING (FIS/01)	29/01/2015	30/30	6
3	1015375	GEOMETRY (MAT/03)	30/01/2015	30/30 cum laude	9
4	1018864	ANALYSIS (MAT/05)	25/02/2018	29/30	9
5	1022782	CHEMISTRY (CHIM/03)	13/07/2015	30/30	6
6	1012088	LABORATORY OF MECHANICS (FIS/01)	14/07/2015	30/30	12
7	1018843	MECHANICS (FIS/01)	27/07/2015	30/30	12
8	1012086	LABORATORY OF COMPUTATIONAL PHYSICS 1 (INF/01)	26/01/2016	30/30	6
9	1018971	THERMODYNAMICS AND LABORATORY (FIS/01)	02/02/2016	30/30 cum laude	9
10	1012112	ANALYTICAL AND RELATIVISTIC MECHANICS (FIS/02)	11/02/2016	28/30	6
11	1018970	VECTORIAL ANALYSIS (MAT/05)	26/02/2016	28/30	9
12	1018973	MODELS AND MATHEMATICAL METHODS IN PHYSICS (FIS/02)	27/06/2016	30/30	12
13	1018972	ELECTROMAGNETISM (FIS/01)	07/07/2016	30/30 cum laude	12
14	1022852	LABORATORY OF ELECTROMAGNETISM AND CIRCUITS (FIS/01)	22/07/2016	30/30	6
15	1018975	LABORATORY OF SIGNALS AND SYSTEMS (FIS/01)	31/01/2017	29/30	9
16	1038470	ASTRONOMY (FIS/05)	14/02/2017	30/30	6
17	1018852	QUANTUM MECHANICS (FIS/02)	23/02/2017	27/30	9
18	1018853	STATISTICAL MECHANICS (FIS/02)	01/03/2017	27/30	6
19	AAF1101	ENGLISH LANGUAGE (-)	19/05/2017	competent	3
20	1012075	NUCLEAR AND SUBNUCLEAR PHYSICS 1 (FIS/04)	16/06/2017	30/30 cum laude	6
21	1044375	APPLIED PHYSICS PRIMER (FIS/01)	27/06/2017	30/30 cum laude	6
22	1012093	STRUCTURE OF MATTER (FIS/03)	06/07/2017	27/30	6
23	1018976	OPTICS AND LABORATORY (FIS/01)	21/07/2017	30/30	9
24	AAF1001	FINAL EXAM (-)	21/09/2017	passed	3

Total credits: 180
* *[Translator's Note. Credit system: 1 CFU = 1 ECTS]*
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DEGREE CERTIFICATE

Student: COLOMBA BRANCACCIO

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Information Engineering, Computer Science and Statistics Student Office Sector
Sector Manager
Mrs. Graziella Censi
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Registration no.: 1672992 certified on 28/12/2018 09:06 Page 01

TRANSCRIPT OF RECORDS/CERTIFICATE OF TAKEN EXAMS

As resulting from the electronic records of this University on the date hereof:
Mrs. COLOMBA BRANCACCIO
- registration no. 1672992, born in TORRE DEL GRECO (NA) on 29/09/1995
- tax code: BRNCMB95P69L259A
- country of birth: ITALY
. matriculated in the academic year 2017/2018
. enrolled for the academic year 2018/2019 in the 2nd year in corso *[TN: as regular, within prescribed time]* in the Master's Degree Programme in PHYSICS [LM - 2018 UNIVERSITY SYSTEM] - (class LM-17 of degrees)
faculty of MATHEMATICAL, PHYSICAL AND NATURAL SCIENCES
. with a legal duration of 2 academic years
Has passed the following exams:

No.	*Code*	*Course name*	*Date*	*Grade*	*Cfu* Credits*
1	1055344	CONDENSED MATTER PHYSICS (FIS/03)	26/01/2018	30/30 cum laude	6
2	1012186	GENERAL RELATIVITY (FIS/02)	05/02/2018	30/30 cum laude	6
3	1055345	RELATIVISTIC QUANTUM MECHANICS (FIS/02)	05/02/2018	30/30 cum laude	6
4	1055356	COMPUTING METHODS FOR PHYSICS (INF/01)	20/02/2018	30/30	6
5	1055349	PHYSICS LABORATORY I (FIS/01)	28/02/2018	30/30	6
6	1055348	MATHEMATICAL PHYSICS (MAT/07)	28/06/2018	29/30	6
7	1055346	ELECTROWEAK INTERACTIONS (FIS/02)	28/06/2018	30/30	6
8	1055350	PHYSICS LABORATORY II (FIS/01)	20/09/2018	30/30 cum laude	12
9	1047767	QUANTUM ELECTRODYNAMICS (FIS/08)	09/11/2018	30/30 cum laude	6

Exams Passed: 9
Total Credits: 60
* *[Translator's Note. Credit system: 1 CFU = 1 ECTS]*
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TRANSCRIPT OF RECORDS/CERTIFICATE OF TAKEN EXAMS

Student: COLOMBA BRANCACCIO

THE RESPONSIBLE FOR THE REGISTRAR'S OFFICE OR EMPOWERED PERSON

SAPIENZA UNIVERSITY OF ROME
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The Sector Manager
Mrs. Graziella Censi
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Colomba Francesco

Il Cancelliere, previa ammonizione sulla responsabilità penale (art.483 c.p.) derivante da dichiarazioni mendaci, invita il comparente al giuramento, che egli presta ripetendo: "*Giuro di avere bene e fedelmente adempiuto all'incarico affidatomi al solo scopo di far conoscere la verità.*"

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IL CANCELLIERE

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Rome, 14 January 2019

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hereby certify

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- *Transcript of records of the Master's Degree course*

has been professionally executed by the aforementioned Company and it is a true and faithful rendering of the Italian original document.

In witness whereof

Giovanni Borghi

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To Whom it may concern:

Colomba Brancaccio, Applicant for a PhD position **at the Institut für Theoretische Teilchenphysik**

Colomba Brancaccio is a **master student in Physics at Sapienza University in Rome**. I have known her **since 2017**. She asked me to give her a possible topic for a Laurea dissertation. I proposed her one of the **hottest topics in Particle Physics, i.e. the search for Dark Matter**. In particular, I proposed her to prepare a review of the different indications of the existence of Dark Matter from astrophysical observations and to describe the possible ways to search for it (direct, indirect and at accelerators). Then I suggested her to focus on the **searches at the accelerators and at the LHC**. This is an absolutely non-trivial topic for a Laurea student, since it requires a good understanding of theoretical and experimental particle physics, given that Dark Matter searches at accelerators are complicated because of the analysis methods and background determination.

Colomba has made a very nice job and the **quality** of the dissertation was **well above average**. Her dissertation was very well written and she understood all physics beyond it. Also the two reviewers were very satisfied and she got full grades for the thesis work.

Later, **Colomba has visited CERN twice**. The first time for a few days, as she was selected as **one of the best 5 students which followed the course in particle physics in the Sapienza Physics departmen**t. Later she was selected as **Summer Student** and spent the Summer at CERN.

In summary, **Colomba Brancaccio is a very talented student and a hard worker**. I think she has the **proper skills to do in research in Physics**. I **fully endorse** her application for a PhD position at the Institut für Theoretische Teilchenphysik.

I will be happy to give you more information or answer any question. Please contact me by email (delre@roma1.infn.it) or by phone (+39 335 6767 912).

Sincerely,

Daniele del Re
Associate Professor
University of Rome “Sapienza"

ORGANISATION EUROPÉENNE POUR LA RECHERCHE NUCLÉAIRE
EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH
Laboratoire Européen pour la Physique des Particules
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Compact Muon Solenoid Collaboration, CMS

GENÈVE, SUISSE
GENEVA, SWITZERLAND

Adresse postale / Postal address *:

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Direct +41 22 76 71543
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Direct +41 22 767 8940
Electronic mail : maurizio.pierini@cern.ch

26 January 2019

Dear Colleagues:

I write you to support Colomba Brancaccio's application to your Graduate Student Program in Physics.

I am a research staff at the European Center for Nuclear Research (CERN), working since 2007 on the CMS experiment at the Large Hadron Collider (LHC). As part of my research, mainly focused on the search for new physics phenomena, I contributed to several computing-related aspects of the CMS experiment, including data distribution, data quality assessment, and large-scale computation related to data analysis. I mainly conduct research in the area of physics beyond the standard model. Miss Brancaccio worked for two months with me as a Summer Student during Summer 2018. To access this project, Miss Brancaccio was selected from a list of thousands of candidates from all CERN member states. I previously met her during a trip to CERN that was arranged by INFN Rome for the top-five students in particle physics from Univ. of Rome La Sapienza.

Miss Brancaccio is a very bright physics student, with a strong passion for particle physics and a clear orientation towards theoretical particle physics. She is particularly interested in calculations of physics processes, and in this respect she will match very well the research activity of your theory group. Miss Brancaccio is very determined to pursue her studies in particle physics and complete her PhD, to start a career in academia. I consider her one of the best particle-physics prospects of Univ. or Rome La Sapienza in the last year, based on my direct experience with her Summer research project and the opinion of many of her teacher there, who are my colleagues in CMS.

Miss Brancaccio's project consisted in designing a tagger for short tracks in the CMS inner tracker, to be used to search for the so-called “disappearing tracks” signature of compressed Supersymmetry. Her task was to select a set of meaningful quantities, capable of separating the signal from the background, and then to train a deep neural network to optimize the tagging performance. Miss Brancaccio had previous experience with programming, but she was new to python and to python libraries for deep learning. With the short introduction to the problem that I gave her, and moderate help in the learning process, she embarked in a self-teaching process (through books, web lectures, and blog articles) that lasted about ten days. After this period, she was capable of mastering the subject and produced original results in a relatively short amount of time. I was very pleased with her work and I tried to propose her to continue the project as part of her final master project in Rome, together with my CMS colleagues there. On the other hand, it became quite clear that her vocation is to work on theoretical physics.

Looking at Miss Brancaccio, I see all the premises for a great physicist. Her skills are matched by a great passion for particle physics (more and more rare on these days) and for physics in general. I have no doubt that she will achieve great things, particularly if introduced in such a unique environment as your department. I think she would be a great match for your researchers in theoretical particle physics and a strong perspective for a career in academia and research. I then strongly recommend her application to your PhD program.

Sincerely,

Maurizio Pierini
mPP Principal Investigator
CERN Experimental Physics Department

SAPIENZA
UNIVERSITÀ DI ROMA

Roma 25/01/2019

Subject: Recommendation letter for Colomba Brancaccio

To whom it may concern

I am writing this letter in recommendation of Colomba Brancaccio, who is applying for a position as PhD student in your Institute. I apologize for this late letter, beyond the dead line, but I was travelling around and I completely forgot to write the letter before. I hope that, in spite do the delay, this recommendation letter can be taken into account.

Colomba is a good student, really enthusiastic with physics, keen to learn new things, with a strong drive. She likes particle phenomenology in all the possible directions including astroparticle implications. Let me add that he is also a very nice person to interact with. I am confident that a PhD in you institution will be a very useful and fruitful experience for her career and I recommend her without reservations.

Prof. Guido Martinelli

Guido Martinelli

Dipartimento di Fisica
Universita` La Sapienza
Piazzale Aldo Moro 5
00185 Roma Italy
tel. 06 49914378
email guido.martinelli@roma1.infn.it

INFN Istituto Nazionale di Fisica Nucleare
Sezione di Roma

Roma, January 28, 2019

TO WHOM IT MAY CONCERN

Oggetto: Reference letter for Ms. Colomba Brancaccio

I am pleased to have an opportunity to write this letter, in support of the application submitted by Ms. Colomba Brancaccio.

I have known Colomba for about two years, in my capacity of Professor of Physics at "Sapienza" University. She attended the courses of Relativistic Quantum Mechanics and Quantum Electrodynamics, that I taught in the fall of 2017 and spring 2018, respectively, and passed the final exams with the highest mark (30/30 *cum laude*). I rank her among the top 5% of the about fifty students of these classes.

Colomba has a very strong background in theoretical physics. During the two semesters, I had many opportunities to interact with her, and appreciate her strong motivations and intellectual curiosity.

In my opinion Colomba has reached a degree of maturity truly remarkable for his age, and has the potential to successfully continue his Physics studies at Ph.D. level. I recommend him *without any hesitations*, and hope that her application will be given the most serious consideration.

Sincerely,

Omar Benhar

Omar Benhar
INFN Research Director and Professor of Physi

AcademicJobsOnline.org

Famili, Roya

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Unit 3, Floor 2, No:15, Asman Bldg, Sina Alley, Mi shariati St Hamadan, Hamadan 6516738464 Iran, The Islamic Republic of		**Home Phone** **Cell Phone** (+98) 9376118184 **Office Phone**	
Current Institution		**Department**	
Location	, Various locations , Iran, The Islamic Republic of		
Highest Degree	MS	**Institution** Razi University	**Date** 2015/02
Thesis Advisor	Dr. Ardeshir Rabeie		
Thesis Title	coherent states and quantization of particle in quantum well		
Research Interests	**Primary** mathematical physics		
Secondary	coherent states and its application in quantum mechanics and many body systems		
Discipline(s)	Physics		
Position(s) applied	PHD		
1. Ardeshir Rabeie, , rabeie@razi.ac.ir (2019/01/14)			file (PDF, PDF, 2019/01/05)
2. Mohammad Vahid Takook, , takook@razi.ac.ir (2019/01/14)			file (PDF, PDF, 2019/01/14)
Received Materials	**PHD**	**Cover Letter:** file (PDF, PDF 2019/01/30) **Curriculum Vitae:** file (PDF, PDF 2019/01/30) **Research Statement:** file (PDF, PDF 2019/01/14) **Copies of grades transcripts:** file (PDF, PDF 2019/01/30)	

Roya Famili
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Mirhashemi Alley, shariati St
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Karlsruhe Institute of Technology
Germany

January 30, 2019

Dear Sir or Madam,

Based on the Ph.D position that I read from university site and the field of theoretical particle physics that is required, I believe that I have excellently fulfilled requirements that you are looking for in theoretical physics.
I graduated with a degree in theoretical physics, M.Sc course at Razi University in Iran. Since then I have been studying as a freelance researcher.
My thesis is about semi-classical states (coherent states) and their application in quantum mechanics. During this time I have really enjoyed from studying mathematics and group theory. Also, because of this situation, I had got acquainted with vast ranges of research from geometry, classical groups and many body systems in quantum well to some practical aspects like wevelet and programming. Although this knowledge is in shallow, It helps me to expand my view about research.

Actually, my thesis is in mathematical field, and I think it is helpful in the way of studying mathematical foundation of physics. My resume, motivation letter and transcripts are attached to required parts and I explained my work and abilities there completely. I was wondering if I had a chance.

Yours faithfully,

Roya Famili

Attached: C.V, Motivation letter, transcripts

Roya Famili **January 30, 2019**
Department of physics, University of Razi, Kermanshah, Iran.
Home Address: Unit 3, Floor 2, No:15, Asman Bldg, Sina Alley, Mirhashemi Alley, shariati St, Hammadan, Iran
Email: r.family285@gmail.com
Researchgate: Roya Famili
Tell: (+98)9376118184

Objective

- A PHD position in mathematical physics related to theoretical physics.

Education

- **Razi University** Kermanshah, Iran
  MSc, in theoretical physics *2012 - 2015*
  – Title of thesis: coherent states and quantization of particle in quantum well
  – Supervisor: Dr. Ardeshir Rabeie
- **Buali Sina University** Hammadan, Iran
  BSc, in Atomical and molecular physics *2007 - 2011*
  – Supervisor: Dr. Mahdi Hajvaleie

Research Interest

- Coherent states and semiclassical states and their application in quantum mechanics and quantum field theory.
- Coherent states and determining the movement of mass particle in De-sitter space.
- Group theory and Classical groups.
- Topology, geometry and linear Algebra(Lie Algebras) in physics.
- Operators and Self-adjoint extensions in quantum physics.
- mathematical structures in quantum gravity.
- Complexifier methods in general relativity and De-sitter space.
- Coherent states and their application in computer science and laser technology.
- Wavelet and their application in mathematics ,physics and programming.
- Heat kernel and statistical mechanics related to coherent states.

English Proficiency

- Mother Tongue: Persion
- Total IELTS score: 6, Listening: 5.5, Reading: 6, Writing: 6, Speaking: 6.5
  Date: 20/October/2018,
  I fluently speak English.(I have planned to retake a test)

Relevent Courses

- Advanced quantum mechanics
- Advanced statistical mechanics
- Electrodynamics
- Computational physics
- Special topics(coherent states in quantum mechanics)
- Group theory
- General relativity

Computer and programming skills

- Operating system: Windows (XP/7/8/10)/Linux
- Computer languages: Python, QBasic, Fortran
- Scientific Application: Matlab, Wevelet
- Software: Microsoft office. Latex, Winedit, texmaker

Schools and Workshops Attended

- Field theory
  Supervisor: M. V. takook
- Linear Algebra, Topology, Classical groups and their applications in physics
  Online courses
- Group theory seminar, BuAliSina university, April 2015
  Supervisors: Mohammad Sheikh Jabari, Yasaman Farzan
- Integral quantization of simple geometries' seminar, Razi University, 17 jan 2016
  Supervisor: Jean Pear Gazeau
- Coherent states and its application in quantum well (online seminar), Warsaw university, Poland, December 2017

Hobbies

- Philosophy(of science/ mathematics/ physics), Read novels, Painting, Mountain climbing

REFERENCES

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   Department of physics
   Razi university, Kermanshah/ Iran
   Email: rabeie@razi.ac.ir
   Office telephone: (+98)9183593936

2. Prof. Mohammad Vahid Takook, Ph.D.
   Department of physics
   Razi university, Kermanshah/ Iran
   Email: takook@razi.ac.ir
   Office telephone: (+98)9121991391

Statement of Purpose

Roya Famili

January 14, 2019

1 General Introduction

At early stage of my life, I was interested in the method of working of electronic tools so I tried to find out how they work. The strangest thing for me was the calculator. My curiosity was in particular about the the function of the calculator and how fast it calculates. I discovered the wonderful satisfaction derived from using one's own creativity by solving a mathematical problem. I was motivated enough to study hard to enter in a very competitive field of atomic, molecular physics in entrance exam and succeeded. I started to learn the fundamental rules of physics and passed some courses like optics, spectroscopy and laser.

1.1 Masters Degree

I was accepted master of science for the major " theoretical physics". It was an improvement for me because I got acquainted with group theory. I could see the fundamental of classical mechanics and quantum in new form. I've been studying the foundation of mathematics, linear algebra (lie algebra), classical gruops and topology due to my interest to the group theory. I've taken part some online courses and field theory classes too. Because of this interest, the professor I was working with, convinced to conduct a research that was related to mathematics for my thesis.
My research is related to coherent states and their application in quantum mechanics and quantum potential well. The idea of coherent states has a base in quantum mechanics and its connection with classical mechanics. One of the topics that is mentioned in different branches of physics, especially theoretical physics is the quantization of classical observables. I've realized that there are different methods for this quantization that each of them has some specific benefits. One of these methods is using semi-classical states that are named coherent states.These states are the consequences of superposition of quantum states and there are very similar to classical states.
The first step of my research started with Hilbert space, In spite of its complexity I had a lecture on it at university. Since finite and infinite Hilbert space has widespread application in quantum, using mathematical concepts is not completely done so we have some weakness in their applications. For example, studying of self-adjoint operators in a finite range (like potential well), self-adjointness is accompanied by some inconsistency because of the existence of any defects in defining some required operators with the specific determined domains. The momentum operator, as an important operator in quantum mechanics with wide range applications, is an unbounded operator in the form of differential form. To solve the problem of self-adjointness in a finite range, I realized that I need a background of study in Von Newman indices and self-adjoint extensions that is a circle U1 for

the momentum operator in a limited range.
In the next steps, I used coherent states because these states are the best for description of quantum mechanics and the operators that defined by them are non-divergent. They are well defined, therefore the technique of coherent states gives better result in comparison to the other methods. Since the particle's movement in a potential well can be defined by the particle's movement on a circle, I studied quantization of coherent states on a circle, then we defined new coherent states of the particle in infinite potential well by considering sufficient Hilbert space and using the heat kernel in statistical mechanics and checked out three conditions of being normalized, continues and established the relationship of identity. At least I quantized some useful observables, specified them in limited range and examine the uncertainty principle.

2 Intention and future goals

I have some personal challenges during this wide range of study in the mathematical concepts and coherent states. There is a list of my challenges:

1- After my graduation, I was interested in programming with Matlab and Python. I try to learn them because I want to have a visual estimation of the results of my work and compare it with the results of the quantum field theory in the limited ranges. Of course I need to study more specific about field theory. I suppose it can expand to black holes in the next steps.

2- during learning Matlab, I got acquainted with wavelet package and its connection with coherent states because of windowed Fourier states. I realized that it has useful application in finger print technology. I really like to see the application of coherent states in different fields.

3- After studying and taking part in some seminars about group theory and integral quantization of simple geometries these years I came to a conclusion that it is really important to determine sufficient measures for our space so I'm really excited about working on classical groups in mathematics.

4- In last 3 years (after graduation), I've focused on basics structures, substructures, their mapping and representation of them in mathematics and its foundemental connection with physics with help of one emeritus professor from Austria. He changed my mind and view deeply. Now I try more passionate for my interests that is mathematical physics.

3 Summary

I have been mostly a proposal and diligent person. I always look forward connection between my studies through my ideas. Each time I've had an idea, I've started to learn all aspects involved in it until I've found my way or a meaningful connection. I am determined that I should continue because as an alternative, I can learn some experience that it is informative. In addition, I really enjoy working in this group and learn a lot of things from them and I consider it my duty to share my knowledge with others.

علیرضا رضوی کامران

مترجم رسمی زبان انگلیسی، شماره پروانه ۲۸۳، دفتر ترجمه رسمی شماره یک

آدرس: همدان، میدان آرامگاه بوعلی سینا، ابتدای خیابان بین النهرین، نبش کوچه شهرداری، ساختمان آبادگران، طبقه دوم، واحد ۶

تلفن: ۳۸۲۷۴۰۱۱ (۰۸۱)

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توجه

اعتبار اسناد پلمب شده منوط به موارد زیر است:

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- عدم حک و اصلاح در ترجمه
- مخدوش نبودن پلمب

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جمهوری اسلامی ایران
قوه قضائیه - اداره مترجمین رسمی

سری ... شماره ۵۴۸۰۵۰۰
ردیف دفتر ثبت

OFFICIAL TRANSLATION

STATE EMBLEM

God raises up, in Ranks (And Degree), Those of you who believe and those Bestowed with Knowledge

UNIVERSITY EMBLEM

RAZI UNIVERSITY

CERTIFICATE OF TRANSCRIPT OF GRADES

(Photo of the holder)

No. : 95/49/241
Date : May 04, 2016
Encl. : --

This is to certify,

Ms. Roya Famili, (Bearer of the above photo), Daughter f Mansour, Holder of birth certificate no. 386-006736-2 and national no. : 386-006736-2, Issued at Hamedan, Born on Aug. 06, 1989 has been studying in day-shift course of Master of Science level of field of Physics – Fundamental Physics branch (Theoretical) of Faculty of Science of this university since the first semester of academic year of 2012-2013 up to Feb. 23, 2015.

Course units and transcript of examination grades of educational period of the said person, without erasure and correction, has been attached in -- sheet.

Moreover, the GPA of grades of the said person is :

(In figure) : 16.25 (In letter) : Sixteen point twenty five

Signed & sealed: Gholamreza Salemian, Ph.D., Director of post-graduation studies of the university

Student no. : 915504009

A.R. Razavi Kamran
Official translator to the Judiciary Power
License No. 283 - Hamedan
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مترجم رسمی زبان انگلیسی قوه قضائیه
شماره پروانه: ۲۸۳
همدان

To be continued

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جمهوری اسلامی ایران
قوه قضائیه - اداره مترجمین رسمی

سری ی شماره ۵۴۷۶۷۸
ردیف دفتر ثبت

RAZI UNIVERSITY OF KERMANSHAH
UNIVERSITY COMPREHENSIVE SYSTEM OF GOLESTAN
STUDENT NO. : 915504009
NAME AND SURNAME : ROYA FAMILI
TIME : 11:04 / DATE : MAY 03, 2016

COMPLETE TRANSCRIPT OF GRADES

(Photo of the holder)

Faculty	: Sciences	Father's name	: Mansour – Birth certificate no. 386-006736-2
Educational department	: Physics Dept.	National no.	: 386-006736-2
Field	: Physics – Fundamental Physics branch (Theoretical)		
Level	: Master of Science	Place of issue	: Hamedan
Course	: Day-shift	Date of birth	: Aug. 06, 1989
Admission type	: Free		

Course name	***Unit***	***Grade***	***Effect***	
Semester one – Academic year 2012-2013 / Studying – Ordinary – Conditioned 1				
Advanced quantum mechanics I	3	12		
Electrodynamics I	4	15		
Computational physics	2	12		

Semester average : 13.33 Unit attempted : 9 Effective passed units of the semester : 9
Total effective passed units : 9 GPA : 13.33

Semester two – Academic year 2012-2013 / Studying - Ordinary

General relativity	3	17.25	
Advanced quantum mechanics II	3	14	
Advanced statistical mechanics I	3	15	

Semester average : 15.42 Unit attempted : 9 Effective passed units of the semester : 9
Total effective passed units : 18 GPA : 14.38

Semester one – Academic year 2013-2014 / Studying - Ordinary

Seminar (Master of Science)	2	19.25	
Special topics	3	18	
Group theory (Master of Science of Physics)	3	18.3	

Semester average : 18.43 Unit attempted : 8 Effective passed units of the semester : 8
Total effective passed units : 26 GPA : 15.62

Semester two – Academic year 2013-2014 / Studying - Ordinary

Master of Science thesis (6 units)	6	--	3	Thesis continuation

Semester average : -- Unit attempted : 6 Effective passed units of the semester : 0
Total effective passed units : 26 GPA : 15.62

R. Razavi Kamran
علیرضا رضوی کامران
مترجم رسمی زبان انگلیسی قوه قضائیه
شماره پروانه: ۲۸۳
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To be continued

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سری ف ۵٤۷٦۷۹ شماره
ردیف دفتر ثبت

جمهوری اسلامی ایران
قوهٔ قضائیه _ اداره مترجمین رسمی

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Course name	*Unit*	*Grade*	*Effect*
Semester one – Academic year 2014-2015 / Studying - Ordinary			
Master of Science thesis (6 units)	6	19	

Semester average : --
Unit attempted : 6
Effective passed units of the semester : 6
Total effective passed units : 32
GPA : 16.25

The status of passed courses of the student according to course type
No. of attempted units till now : 32

Type of course	Unit passed	Average
Main	17	14.44
Optional	3	18.3
Specialized	6	17.63
Project	6	19

Summary of educational status :

The last status : Graduate, Dated : Feb. 23, 2015
GPA : Student : 16.25 (Sixteen point twenty five) University: 16.14 Faculty : 15.55 Filed : 14.04

Remarks :

In effect column, figure 1 represents non –effect of the course in general passed course, figure 2 represents non –effect of the course in GPA and figure 3 represents non –effect of the course in units passed and GPA of the student.

Signed & sealed: Gholamreza Salemian, Ph.D., Director of post-graduation studies of the university

---

True translation is certified
Official Translator to the Justice Administration
Iran – Hamedan
June 4, 2017

File # 40338

A.R.Razavi Kamran
علیرضا رضوی کامران
مترجم رسمی زبان انگلیسی قوه قضائیه
شماره پروانه: ۲۸۳
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License No. 283 - Hamedan

علیرضا رضوی کامران (شماره پروانه مترجمی ۲۸۳)
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جمهوری اسلامی ایران
قوه قضائیه - اداره مترجمین رسمی

شماره ٥٤٧٩٩٥ سری ف
ردیف دفتر ثبت

OFFICIAL TRANSLATION

STATE EMBLEM
God raises up, in Ranks (And Degree), Those of you who believe and those Bestowed with Knowledge
MINISTRY OF SCIENCE, RESEARCH AND TECHNOLOGY
RAZI UNIVERSITY

DIPLOMA

(Embossed seal photo of the holder)
Student no. 915504009

Date : May 04, 2016
No. : 95/49/242

By virtue of approval of the 103rd session dated Aug. 27, 1975 of Office for Development of Universities and State Higher Educational Institutes,

Roya Famili, Daughter of Mansour, Birth certificate no. 386-006736-2 and national no. 386-006736-2, Issued at Hamedan, Born in 1989 has successfully completed the educational course of faculty of Sciences on Feb. 23, 2015, so this diploma with Master of Science degree of field of Physics – Fundamental Physics (Theoretical) is awarded to the said person.

Signed : Mohammadebrahim Alamialeagha, Ph.D., President of the university
: Ali Salimi, Ph.D., Deputy of education and post-graduation studies of the university
Hologram affixed

True translation is certified
Official Translator to the Ministry of Justice
Iran – Hamedan
June 4, 2016

File # 40339

A.R.Razavi Kamran
Official translator to the Judiciary Power
License No. 283 - Hamedan
علیرضا رضوی کامران
مترجم رسمی زبان انگلیسی قوه قضائیه
شماره پروانه: ۲۸۳
همدان

Hamedan
Justice Administration
دادگستری همدان
Only the authenticity of the seal and signature of the Offical Translator is certified.
This certification does not include confirmation of the accuracy of the translation and the authenticity of the translated document.
Department of Official Translators' Affairs of the Judiciary of the Islamic Republic of Iran

مبلغ ۲۴۰ ریال بابت تعرفه
خدمات کنسولی دریافت گردید.

S.B.RAZAVI
LEGALIZATION OFFICER

The authenticity of the seal & signature marked (X) is certified without any consideration to the ... ts.

ISLAMIC REPUBLIC OF IRAN
MINISTRY OF FOREIGN AFFAIRS
REGISTRATION AND PERSONAL STATUS DEPARTMENT

1 JUL 2017

405241

بسمه تعالی

وزارت علوم تحقیقات و فناوری

دانشگاه رازی

شماره: ...۱۱

تاریخ: ۱۳۹۵/۰۲/۲۵

پیوست: ....

گواهی ریز نمرات

گواهی میشود:

خانم رویا فامیلی (صاحب عکس فوق) فرزند منصور دارای شناسنامه شماره ۳۸۶۰۰۶۷۳۶۲ و کد ملی ۳۸۶۰۰۶۷۳۶۲ صادره از همدان متولد ۱۳۶۸/۰۵/۱۵ از **نیمسال اول سال تحصیلی۹۲-۹۱** تا تاریخ **۱۳۹۳/۱۲/۰٤** در دوره **روزانه** مقطع کارشناسی ارشد رشته فیزیک-گرایش فیزیک بنیادی(نظری) دانشکده علوم این دانشگاه مشغول به تحصیل بوده است.

واحدهای درسی و ریز نمرات امتحانی دوران تحصیل نامبرده بدون قلم خوردگی و اصلاح در صفحه بپیوست میباشد.

ضمنا میانگین کل نمرات مشارالیه :

به عدد ۱۶/۲۵ به حروف شانزده و بیست و پنج صدم میباشد.

دکتر غلامرضا سالمیان

مدیر کل تحصیلات تکمیلی دانشگاه

دانشگاه رازی اداره کل تحصیلات تکمیلی

شماره دانشجویی: ۹۱۵۵۰٤۰۰۹

مهر و امضاء مسئولین دانشگاه مورد تأیید میباشد

از طرف

ناصر مطیعی

مدیر کل امور دانشجویان داخل

جاماسب نوزری

مشاور مدیر کل امور دانشجویان داخل

ردیف ۱.۲۱

۱۳۹۴/۱۲/۱۱

True Certified Copy
Alireza Razavikamran
Official English Translator
to the Judiciary of the I.R.of IRAN-Hamedan
License no: 283

کرمانشاه:طاق بستان
خیابان دانشگاه، سازمان
مرکزی دانشگاه
تلفن خانه: ۶-۴۲۷۷۶۰۴
وب سایت:
www.razi.ac.ir

دانشگاه رازی کرمانشاه

سیستم جامع دانشگاهی گلستان

شماره گزارش: ۱۰۰

کارنامه کلی

نام و نام خانوادگی: رویا فامیلی

شماره دانشجو: ۹۱۵۵۰۴۰۰۹

نام پدر: **منصور** شناسنامه : **۳۸۶۰۰۶۷۳۶۲**

شماره ملی: **۳۸۶۰۰۶۷۳۶۲**

محل صدور: **همدان**

تاریخ تولد: **۱۳۶۸/۰۵/۱۵**

نوع پذیرش: **آزاد**

دانشکده: **علوم**

گروه آموزشی: **گروه فیزیک**

رشته: **فیزیک-گرایش فیزیک بنیادی(نظری)**

مقطع: **کارشناسی ارشد**

دوره: **روزانه**

نیمسال اول سال تحصیلی ۹۲-۹۱ *مشروط۱*

مشغول به تحصیل _ عادی

شماره	نام درس	واحد	نمره	اثر
۲۰۲۲۴۱۱	مکانیک کوانتوم پیشرفته ۱	۳	۱۲	
۲۰۲۲۴۱۴	الکترودینامیک۱	۴	۱۵	
۲۰۲۲۴۱۵	فیزیک محاسباتی	۲	۱۲	

معدل ترم	اخذ شده	گذرانده موثر ترم	گذرانده موثر کل	معدل کل
۱۳/۳۳	۹	۹	۹	۱۳/۳۳

ترم دوم سال تحصیلی ۹۲-۹۱ *

مشغول به تحصیل _ عادی

شماره	نام درس	واحد	نمره	اثر
۲۰۲۲۴۰۸	نسبیت عام	۳	۱۷/۲۵	
۲۰۲۲۴۱۲	مکانیک کوانتمی پیشرفته۲	۳	۱۴	
۲۰۲۲۴۱۳	مکانیک آماری پیشرفته ۱	۳	۱۵	

معدل ترم	اخذ شده	گذرانده موثر ترم	گذرانده موثر کل	معدل کل
۱۵/۴۲	۹	۹	۱۸	۱۴/۳۸

نیمسال اول سال تحصیلی ۹۳-۹۲

مشغول به تحصیل _ عادی

شماره	نام درس	واحد	نمره	اثر
۲۰۲۲۴۱۶	سمینار(ارشد)	۲	۱۹/۲۵	
۲۰۲۲۴۲۰	موضوعات ویژه	۳	۱۸	
۲۰۲۲۴۲۴	نظریه گروهها(ارشدفیزیک)	۳	۱۸/۳	

معدل ترم	اخذ شده	گذرانده موثر ترم	گذرانده موثر کل	معدل کل
۱۸/۴۳	۸	۸	۲۶	۱۵/۶۲

ترم دوم سال تحصیلی ۹۳-۹۲

مشغول به تحصیل _ عادی

شماره	نام درس	واحد	نمره	اثر
۲۰۲۴۰۱۷	پایان نامه ارشد(۶واحدی)	۶	ادپ	۳

معدل ترم	اخذ شده	گذرانده موثر ترم	گذرانده موثر کل	معدل کل
	۶	۰	۲۶	۱۵/۶۲

نیمسال اول سال تحصیلی ۹۴-۹۳

مشغول به تحصیل _ عادی

شماره	نام درس	واحد	نمره	اثر
۲۰۲۴۰۱۷	پایان نامه ارشد(۶واحدی)	۶	۱۹	

معدل ترم	اخذ شده	گذرانده موثر ترم	گذرانده موثر کل	معدل کل
۱۹	۰	۶	۳۲	۱۶/۲۵

وضعیت دروس گذرانده دانشجو بر اساس نوع درس

تعداد واحد اخذ شده تا کنون: ۳۲

نوع درس	واحد گذرانده	معدل
اصلی	۱۷	۱۴/۴۴
اختیاری	۳	۱۸/۳
تخصصی	۶	۱۷/۶۳
پروژه	۶	۱۹

خلاصه وضعیت تحصیلی

آخرین وضعیت : فارغ التحصیل تاریخ : ۱۳۹۳/۱۲/۰۴

معدل کل :		
	دانشجو	۱۶/۲۵: (شانزده و بیست و پنج صدم)
	دانشگاه	۱۶/۱۴:
	دانشکده	۱۵/۵۵:
	رشته	۱۴/۰۴:

توضیحات کارنامه :

در ستون اثر، عدد ۱ معرف عدم تاثیر درس در واحد گذرانده کل، عدد ۲ معرف عدم تاثیر درس در معدل کل و عدد ۳ معرف عدم تاثیر درس در واحد گذرانده و معدل کل دانشجو است.

در ستون نمره، نمره دانشجو در درس به صورت عددی یا حرفی نمایش داده شده است. همچنین در این ستون از علائم اختصاری زیر استفاده شده است.

اع ش	اعلام شده
ادپ	ادامه پروژه

مدیر کل تحصیلات تکمیلی دانشگاه

دکتر غلامرضا سالمیان

اداره کل تحصیلات تکمیلی

دانشگاه رازی

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License no: 283

تاریخ: ۱۳۹۵/۰۲/۱۵

شماره: ۹۵/۴۹/۲۴۲

شماره دانشجویی ۹۱۰۵۵۰۴۰۰۹

هل یستوی الّذینَ یَعلَمون وَ الّذین لا یعلَمون

وزارت علوم تحقیقات و فناوری

دانشگاه رازی

به موجب مصوبه یکصد و سومین جلسه مورخ ۱۳۵۴/۶/۵ دفتر گسترش دانشگاهها و موسسات آموزش عالی کشور

خانم رویا فامیلی

فرزند **منصور** بشماره شناسنامه **۳۸۶۰۰۶۷۳۶۲** و کدملی **۳۸۶۰۰۶۷۳۶۲** صادره از **همدان** متولد سال **۱۳۶۸** در تاریخ **۱۳۹۳/۱۲/۰۴** دوره تحصیلات دانشکده **علوم** را با موفقیت به پایان رسانیده است لذا این دانشنامه با درجه **کارشناسی ارشد** رشته **فیزیک-گرایش فیزیک بنیادی (نظری)** به نامبرده اعطا می شود.

و ما توفیقی الاّ با ... علیه توکلت و الیه انیب

دکتر محمد ابراهیم اعلمی آل آقا

رئیس دانشگاه

دکتر علی سلیمی

معاون آموزشی و تحصیلات تکمیلی دانشگاه

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علیرضا رضوی کامران

مترجم رسمی زبان انگلیسی، شماره پروانه ۲۸۳، دفتر ترجمه رسمی شماره یک

آدرس: همدان، میدان آرامگاه بوعلی سینا، ابتدای خیابان بین النهرین، نبش کوچه شهرداری، ساختمان آباد گران، طبقه دوم، واحد ۶

تلفن: ۳۸۲۷۴۰۱۱ (۰۸۱)

Alireza Razavikamran

Official English Translator to the Judiciary of Islamic Republic of Iran
Translation License No.: 283
Official Translation Bureau No. : 1

Address: Unit 6, The 2nd Floor, Abadgaran Bldg., Corner of Shahrdari Alley, Beinonnahrain Street, Buali Sina Tomb Square, Hamedan-Iran
Tel.: 0098-81-38274011

توجه

اعتبار اسناد پلمب شده منوط به موارد زیر است:

- تصدیق کپی های پیوست ترجمه با مهر و امضای مترجم رسمی
- عدم حک و اصلاح در ترجمه
- مخدوش نبودن پلمب

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علیرضا رضوی کامران (شماره پروانه مترجمی ۲۸۳)
مترجم رسمی زبان انگلیسی قوه قضائیه جمهوری اسلامی ایران - عضو جامعه مترجمان رسمی ایران
همدان-میدان آرامگاه بوعلی-ابتدای خیابان بوعلی-کوچه شهرداری-ساختمان آبادگران-طبقه دوم-واحد ۶-تلفن ۳۸۲۷۴۰۱۱
تلفن همراه: ۰۹۱۸-۳۱۶۴۱۰۴ - دارالترجمه رسمی شماره یک همدان (اندیشه)-صندوق پستی ۸۶۵-۶۵۱۵۵
پست الکترونیک: andisheh.translation1@gmail.com

شماره ۵۴۹۰۰۱ سری ف
ردیف دفتر ثبت

جمهوری اسلامی ایران
قوه قضائیه - اداره مترجمین رسمی

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E-mail: andisheh.translation1@gmail.com

OFFICIAL TRANSLATION

IN THE NAME OF GOD
UNIVERSITY EMBLEM
BU-ALI SINA UNIVERSITY
GENERAL ADMINISTRATION OF EDUCATION AFFAIRS
(GRADUATES DEPARTMENT)

CERTIFICATE OF TRANSCRIPT OF GRADES

(Sealed photo of the holder affixed)

Date : Apr. 09, 2016
No. : 31/1-466

This is to certify that Ms. Roya Famili (Bearer of the above photo), Daughter of Mansour, Holder of birth certificate no. 386-006736-2, Issued at district 1 of Hamedan, Born in 1989 has been studying in Bachelor of Science course of field of Atomic Physics – Molecular of faculty of Base Sciences of this university since the first semester of academic year of 2007-2008 until Sept. 19, 2011.

Course units and transcript of examination grades of educational period of the said person (Which was issued without erasure) has been attached in one sheet.

General average of this transcript of grades is 14.87 (Fourteen point eighty seven).

Signed & sealed: For, Seyed Mehdi Masbough, Ph.D., Director of Educational Affairs of the University

Grades value in Bu-Ali Sina University

Alphabetic system (Previous)

Grade in Letter	*Coefficient*	*Point*	*Equivalent no. in figure*
A	4	Very Good	18-20
B	3	Good	16-17.99
C	2	Medium	14-15.99
D	1	Poor	12-13.99
E	0	Fail	0-11.99

Numeric system (New)

Number of units	*Grade*	*Grade in letters*	*Grade with coefficient*	*Equivalent grade in figure*
-	1	A	17	20
-		B	14	16.99
-	To	C	12	13.99
-		D	10	11.99
-	20	E	0	9.99

To be continued

علیرضا رضوی کامران (شماره پروانه مترجمی ۲۸۳)
مترجم رسمی زبان انگلیسی قوه قضائیه جمهوری اسلامی ایران - عضو جامعه مترجمان رسمی ایران
همدان-میدان آرامگاه بوعلی-ابتدای خیابان بوعلی-کوچه شهرداری-ساختمان آبادگران-طبقه دوم-واحد ٦-تلفن ۳۸۲۷٤۰۱۱
تلفن همراه :۰۹۱۸-۳۱٦٤۱۰٤ - دارالترجمه رسمی شماره یک همدان (اندیشه)-صندوق پستی ٦٥۱٥٥-۸٦٥
پست الکترونیک: andisheh.translation1@gmail.com

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جمهوری اسلامی ایران
قوه قضائیه _ اداره مترجمین رسمی

شماره ۵٤۹۰۰۳ سری ف
ردیف دفتر ثبت

UNIVERSITY EMBLEM
BU-ALI SINA UNIVERSITY
GENERAL ADMINISTRATION OF EDUCATION AFFAIRS
DATE OF PREPARATION: JUN. 03, 2015

COMPLETE TRANSCRIPT OF GRADES

Surname and name	: Famili – Roya	Faculty	: Sciences
Student no.	: 8632111027	Tutor	: Haji Valiei - Mehdi, Ph.D.
Father's name	: Mansour	Field of education:	Atomic Physics – Molecular
Birth certificate no.	: 386-006736-2	Graduation level	: Bachelor of Science
Place of issue	: District 1 of Hamedan	Quota	: Zone 2
National code	: 386-006736-2	Type of course	: 2nd shift
Date of birth	: 1989		
Level	: Bachelor of Science		
Matriculation	: Acceptance in overall entrance examination		

Course name	***Unit***	***Grade***	***Status***
***Semester : 1 – 2007-2008 Student Status**	**: Studying**		
Foreign language	3	17.5	1
Islamic education and ethics – fundamentals and concepts	2	19	1
Basic physics I	4	14	1
General chemistry	3	12.5	1
General chemistry lab	1	16.75	1
General mathematics I	4	10	1

Semester : Attempted : 17, Passed : 17, Failed : 0, Average : 14.16, Grade point : 240.75, Withdraw : 0
Cumulative : Attempted : 17, Passed : 17, Failed : 0, Average : 14.16, Grade point : 240.75, Effective : 17

***Semester : 2 – 2007-2008 Student Status : Studying**

Islamic thought I – Origin and Resurrection	2	12.5	1
Basic physics II	4	13	1
Basic physics I lab	1	13	1
Basic physics III	4	15.2	1
General mathematics II	4	13.25	1

Semester : Attempted : 15, Passed : 15, Failed : 0, Average : 13.59, Grade point : 203.8, Withdraw : 0
Cumulative : Attempted : 32, Passed : 32, Failed : 0, Average : 13.89, Grade point : 444.55, Effective : 32

***Semester : 1 – 2008-2009 Student Status : Studying**

Persian language	3	16	1
Analytical history of early Islam	2	16.5	1
Basic physics III lab	1	15.75	1
Analytical mechanics I	3	11.75	1
Thermodynamics and statistical mechanics	4	17	1
Differential equations	3	14.5	1
Basic physics II lab	1	14	1

Semester : Attempted : 17, Passed : 17, Failed : 0, Average : 15.15, Grade point : 257.5, Withdraw : 0
Cumulative : Attempted : 49, Passed : 49, Failed : 0, Average : 14.33, Grade point : 702.05, Effective : 49

A.R.Razavi Kamran
Official Translator to the Judiciary Power
License No. 283 - Hamedan
علیرضا رضوی کامران
مترجم رسمی زبان انگلیسی قوه قضائیه
شماره پروانه: ۲۸۳
همدان

To be continued

علیرضا رضوی کامران (شماره پروانه مترجمی ۲۸۳)
مترجم رسمی زبان انگلیسی قوه قضائیه جمهوری اسلامی ایران - عضو جامعه مترجمان رسمی ایران
همدان-میدان آرامگاه بوعلی-ابتدای خیابان بوعلی-کوچه شهرداری-ساختمان آبادگران-طبقه دوم-واحد ۶-تلفن ۳۸۲۷۴۰۱۱
تلفن همراه :۰۹۱۸-۳۱۶۴۱۰۴ - دارالترجمه رسمی شماره یک همدان (اندیشه)-صندوق پستی ۸۶۵-۶۵۱۵۵
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جمهوری اسلامی ایران
قوه قضائیه - اداره مترجمین رسمی

شماره ۵۴۹۰۰۲ سری ف
ردیف دفتر ثبت

Course name	***Unit***	***Grade***	***Status***

***Semester : 2 – 2008-2009 Student Status : Studying**

Islamic revolution of Iran	2	17	1
Modern physics I	4	11	1
Physical mathematics I	3	14.75	1
Electronics I	3	15	1

Semester : Attempted : 12, Passed : 12, Failed : 0, Average : 13.94, Grade point : 167.25, Withdraw : 0
Cumulative : Attempted : 61, Passed : 61, Failed : 0, Average : 14.25, Grade point : 869.3, Effective : 61

***Semester : 1 – 2009-2010 Student Status : Studying**

Islamic thought II – Prophecy and Imamate	2	16.25	1
Analytical mechanics II	3	16.5	1
Electromagnetism I	4	14	1
Quantum mechanics I	4	16.5	1
Relativity	3	13	1
Preliminary astrophysics	3	18	1

Semester : Attempted : 19, Passed : 19, Failed : 0, Average : 15.63, Grade point : 297, Withdraw : 0
Cumulative : Attempted : 80, Passed : 80, Failed : 0, Average : 14.58, Grade point : 1,166.3, Effective : 80

***Semester : 2 – 2009-2010 Student Status : Studying**

Physical education I	1	18	1
Modern physics lab	2	13	1
Electromagnetism II	4	11.5	1
Astrophysics	3	16.5	1
Spectroscopy	3	15.5	1
Fundamentals of computer programming	3	16.2	1

Semester : Attempted : 16, Passed : 16, Failed : 0, Average : 14.66, Grade point : 234.6, Withdraw : 0
Cumulative : Attempted : 96, Passed : 96, Failed : 0, Average : 14.59, Grade point : 1,400.9, Effective : 96

***Semester : 1 – 2010-2011 Student Status : Studying**

Physical education II	1	18	1
Birth control and population	1	17	1
Physical mathematics II	3	13.5	1
Quantum mechanics II	4	12.5	1
Optics	3	16.25	1
Electronics I lab	2	18.5	1
Statistical mechanics	3	17	1

Semester : Attempted : 17, Passed : 17, Failed : 0, Average : 15.43, Grade point : 262.25, Withdraw : 0
Cumulative : Attempted : 113, Passed : 113, Failed : 0, Average : 14.72, Grade point : 1,663.15, Effective : 113

***Semester : 2 – 2010-2011 Student Status : Studying**

Thematic interpretation of Quran	2	14.5	1
Optics lab	2	16	1
Physics of solid state I	3	10	1
Atomic physics I and lab	4	13	1
Laser	3	20	1
Applied optics	3	17	1
Theoretical Bachelor of Science project	3	19	1

To be continued

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شماره پروانه: ۲۸۳
همدان

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همدان-میدان آرامگاه بوعلی-ابتدای خیابان بوعلی-کوچه شهرداری-ساختمان آبادگران-طبقه دوم-واحد ۶-تلفن ۳۸۲۷۴۰۱۱
تلفن همراه: ۳۱۶۴۱۰۴-۰۹۱۸ - دارالترجمه رسمی شماره یک همدان (اندیشه) صندوق پستی ۸۶۵-۶۵۱۵۵
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سری ق ۵٤۷٦۷۵ شماره

ردیف دفتر ثبت

جمهوری اسلامی ایران
قوه قضائیه - اداره مترجمین رسمی

Course name	***Unit***	***Grade***	***Status***

Semester : Attempted : 20, Passed : 20, Failed : 0, Average : 15.55, Grade point : 311, Withdraw : 0
Cumulative : Attempted : 133, Passed : 133, Failed : 0, Average : 14.84, Grade point : 1,974.15, Effective : 133

***Summer semester : 2010-2011 Student Status : Studying**

Course name	Unit	Grade	Status
Vacuum technique	3	16	1

Semester : Attempted : 3, Passed : 3, Failed : 0, Average : 16, Grade point : 48, Withdraw : 0
Cumulative : Attempted : 136, Passed : 136, Failed : 0, Average : 14.87, Grade point : 2,022.15, Effective : 136

No. of conditioned semesters : 0
Student general status : Graduate
Date of acceptance in entrance examination : Sept. 11, 2007
Date of education completion : Sept. 19, 2011
General average in figure : 14.87
General average in letter : Fourteen point eighty seven

No. of semesters : Studying = 8

Grades status description :
1 = Ordinary course : Passed

Table of situation of passed courses

Type of course	General	Basic	Specialized	Optional	Compensatory	Pre-requisite	Total
No. of unit	21	33	52	30	0	0	136
Average	16.4	13.6	14.46	15.82	0	0	14.87

Position of GPA of the student in matriculated course : 22/5
Average value of the students of the same field of matriculated course : 13.74
Average value of passed units of students of the same field of matriculated course : 72.55

Signed & sealed : Director of educational affairs, Bu-Ali Sina University

---

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Official Translator to the Justice Administration
Iran - Hamedan
June 4, 2017

File # 40336

A. Razavi Kamran
علیرضا رضوی کامران
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شماره پروانه: ۲۸۳
همدان
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همدان-میدان آرامگاه بوعلی-ابتدای خیابان بوعلی-کوچه شهرداری-ساختمان آبادگران-طبقه دوم-واحد ۶-تلفن ۳۸۲۷۴۰۱۱
تلفن همراه: ۰۹۱۸-۳۱۶۴۱۰۴ - دارالترجمه رسمی شماره یک همدان (اندیشه)-صندوق پستی ۸۶۵-۶۵۱۵۵
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جمهوری اسلامی ایران
قوه قضائیه - اداره مترجمین رسمی

سری ف شماره ۵۴۹۰۷۴
ردیف دفتر ثبت

OFFICIAL TRANSLATION

IN THE NAME OF GOD

God Raises Up, in Ranks (And Degree), Those of you who Believe and those Bestowed with Knowledge

STATE EMBLEM

ISLAMIC REPUBLIC OF IRAN

MINISTRY OF SCIENCE, RESEARCH AND TECHNOLOGY

BU-ALI SINA UNIVERSITY

DIPLOMA

(Embossed seal photo of the holder affixed)

No. : 31/1-465
Date : Apr. 09, 2016

According to Article of Association approved in the 94th session of Higher Education Promotion Council dated Nov. 27, 1973:

Ms. Roya Famili

Daughter of Mansour, Holder of birth certificate no. 386-006736-2, Issued in district 1 of Hamedan, Born in 1989 has successfully completed the educational course of this university on September 2011, so this diploma with Bachelor of Science degree in field of Atomic Physics – Molecular is granted to the said person.

May God grace her with success in putting her learning into practice, following the path of piety, seeking God's gratification and serving the people.

Signed : Mansour Gholami, Ph.D., President of the university
- Abbas Afkhami, Ph.D., Deputy of education and post-graduation studies
Embossed sealed : Bu-Ali Sina University
Hologram affixed - 124399

True translation is certified
Official Translator to the Justice Administration
Iran - Hamedan
June 4, 2017

ISLAMIC REPUBLIC OF IRAN
MINISTRY OF FOREIGN AFFAIRS
REGISTRATION AND PERSONAL STATUS DEPARTMENT
The authenticity of the seal & signature marked (X) is certified
to the contents
File # 40337

S.B.RAZAVI
LEGALIZATION OFFICER
JUL 2017
405241

Hamedan
Justice Administration
Only the authenticity of the seal and signature of the Offical Translator is certified. This certification does not include confirmation of the accuracy of the translation and the authenticity of the translated document.
Department of Official Translators' Affairs of the Judiciary of the Islamic Republic of Iran.

A.R.Razavi Kamran
Official Translator
the Judiciary Power
Hamedan

مبلغ ۳۰ ریال بابت تعرفه خدمات کنسولی دریافت گردید.

بسمه تعالی

دانشگاه بوعلی سینا

مدیریت امور آموزشی دانشگاه

اداره دانش آموختگان

گــواهی ریزنمــرات

تاریخ: ۱۳۹۵/۰۱/۳۱

شماره: ۳۱/۱-٤٦٦

گواهی می شود که **خانم رؤیا فامیلی** [صاحب عکس فوق] فرزند **منصور** دارنده شناسنامه شماره **۳۸۶۰۰۶۷۳۶۲** صادره از **حوزه یک همدان** متولد سال **۱۳۶۸** از نیمسال **اول** سالتحصیلی **۸۷-۱۳۸۶** تا تاریخ **۱۳۹۰/۰۶/۲۸** در دوره **کارشناسی** رشته **فیزیک اتمی -مولکولی** **دانشکده علوم پایه** این دانشگاه مشغول به تحصیل بوده است.

واحدهای درسی و ریزنمرات امتحانی دوران تحصیل نامبرده (که بدون قلم خوردگی صادر شده) در **یک** برگ پیوست گردیده است.

میانگین کل این ریزنمرات [**۱۴/۸۷ چهارده و هشتاد و هفت صدم**] می باشد.

توضیحات:

از طرف **دکتر سیدمهدی مسبوق**

مدیر امور آموزشی دانشگاه

«ارزش نمرات در دانشگاه بوعلی سینا»

نظام حرفی- سابق				نظام عددی- جدید			
نمره به حروف	ضریب	امتیاز	نمره معادل بعدد	تعداد واحد نمره	نمره به حروف	نمره با ضریب	نمره معادل بعدد
الف	۴	بسیار خوب	۱۸-۲۰	۱	الف	۱۷	۲۰
ب	۳	خوب	۱۶-۱۷/۹۹		ب	۱۴	۱۶/۹۹
ج	۲	متوسط	۱۴-۱۵/۹۹	الی	ج	۱۲	۱۳/۹۹
د	۱	ضعیف	۱۲-۱۳/۹۹		د	۱۰	۱۱/۹۹
هـ	۰	مردود	۰-۱۱/۹۹	۲۰	هـ	۰	۹/۹۹

ردیف ۲۱

۱۳۹۶/۲/۱۱

صحت امضاء مسئولین دانشگاه مورد تأیید میباشد

ناصر مطیعی

مدیر کل امور دانشجویان داخل

از طرف

جهانبخش نوروزی

معاون مدیر کل امور دانشجویان داخل

True Certified Copy
Alireza Razavikamran
Official English Translator
to the Judiciary of the I.R. of IRAN-Hamedan
License no: 283

اداره کل امور
تاریخ تهیه ۰۳/۰۳/۱۳
صفحه ۱

باسمه تعالی

کارنامه کل

دانشگاه بوعلی سینا

نام خانوادگی ونام: فامیلی-رؤیا
شماره دانشجویی: ۸۶۳۲۱۱۱۰۲۷
نام پدر: منصور
شماره شناسنامه: ۳۸۶۰۰۶۷۳۶۲
محل صدور: حوزه یک همدان
کد ملی: ۳۸۶۰۰۶۷۳۶۲

تاریخ تولد: ۱۳۶۸
مقطع: کارشناسی
دانشکده: علوم
استاد راهنما: دکتر حاجی ولیئی-مهدی

مقطع فارغ التحصیلی: کارشناسی
سهمیه: منطقه دو
نوع دوره: نوبت دوم
نحوه ورود: قبولی در آزمون سراسری

رشته تحصیلی: فیزیک اتمی مولکولی

نیمسال اول ۸۷-۸۶ — وضعیت دانشجو در حال تحصیل

کد درس	نام درس	واحد	نمره	وضع
۱۰۰۸	زبان خارجی	۳	۱۷.۵۰	۱
۱۱۲۱	اخلاق اسلامی مبانی و مفاهیم	۲	۱۹.۰۰	۱
۲۱۰۵۳۰۰۱	فیزیک پایه ۱	۴	۱۴.۰۰	۱
۲۹۹۹۲۰۰۳	شیمی عمومی	۳	۱۲.۵۰	۱
۲۹۹۹۲۰۰۴	آز-شیمی عمومی	۱	۱۶.۷۵	۱
۲۹۹۹۲۰۰۷	ریاضی عمومی ۱	۴	۱۰.۰۰	۱

نیمسال: اخذ شده: ۱۷ گذرانده: ۱۷ مردودی: ۰ — معدل: ۱۴.۱۶ امتیاز: ۲۴۰.۷۵ حذف: ۰
کل: اخذ شده: ۱۷ گذرانده: ۱۷ مردودی: ۰ — معدل: ۱۴.۱۶ امتیاز: ۲۴۰.۷۵ موثر: ۱۷

نیمسال دوم ۸۷-۸۶ — وضعیت دانشجو در حال تحصیل

کد درس	نام درس	واحد	نمره	وضع
۱۱۱۰	اندیشه اسلامی ۱ مبدا ومعاد برابر	۲	۱۲.۵۰	۱
۲۱۰۵۳۰۰۲	فیزیک پایه ۲	۴	۱۳.۰۰	۱
۲۱۰۵۳۰۰۳	آزمایشگاه فیزیک پایه ۱	۱	۱۳.۰۰	۱
۲۱۰۵۳۰۰۵	فیزیک پایه ۳	۴	۱۵.۲۰	۱
۲۹۹۹۲۰۰۸	ریاضی عمومی ۲	۴	۱۳.۲۵	۱

نیمسال: اخذ شده: ۱۵ گذرانده: ۱۵ مردودی: ۰ — معدل: ۱۳.۵۹ امتیاز: ۲۰۳.۸ حذف: ۰
کل: اخذ شده: ۳۲ گذرانده: ۳۲ مردودی: ۰ — معدل: ۱۳.۸۹ امتیاز: ۴۴۴.۵۵ موثر: ۳۲

نیمسال اول ۸۸-۸۷ — وضعیت دانشجو در حال تحصیل

کد درس	نام درس	واحد	نمره	وضع
۱۰۰۷	زبان فارسی	۳	۱۶.۰۰	۱
۱۱۴۱	تاریخ تحلیلی صدر اسلام	۲	۱۶.۵۰	۱
۲۱۰۵۳۰۰۶	آزمایشگاه فیزیک پایه ۳	۱	۱۵.۷۵	۱
۲۱۰۵۳۰۰۹	مکانیک تحلیلی ۱	۳	۱۱.۷۵	۱
۲۱۰۵۳۰۱۱	ترمودینامیک ومکانیک آماری	۴	۱۷.۰۰	۱
۲۹۹۹۲۰۰۲	معادلات دیفرانسیل	۳	۱۴.۵۰	۱
۲۹۹۹۲۰۱۰	آزمایشگاه فیزیک پایه ۲	۱	۱۴.۰۰	۱

نیمسال: اخذ شده: ۱۷ گذرانده: ۱۷ مردودی: ۰ — معدل: ۱۵.۱۵ امتیاز: ۲۵۷.۵ حذف: ۰
کل: اخذ شده: ۴۹ گذرانده: ۴۹ مردودی: ۰ — معدل: ۱۴.۳۳ امتیاز: ۷۰۲.۰۵ موثر: ۴۹

نیمسال دوم ۸۸-۸۷ — وضعیت دانشجو در حال تحصیل

کد درس	نام درس	واحد	نمره	وضع
۱۱۳۰	انقلاب اسلامی ایران برابر با انقلاب	۲	۱۷.۰۰	۱
۲۱۰۵۳۰۰۷	فیزیک جدید ۱	۴	۱۱.۰۰	۱
۲۱۰۵۳۰۱۲	ریاضی فیزیک ۱	۳	۱۴.۷۵	۱
۲۱۰۵۳۰۲۰	الکترونیک ۱	۳	۱۵.۰۰	۱

نیمسال: اخذ شده: ۱۲ گذرانده: ۱۲ مردودی: ۰ — معدل: ۱۳.۹۴ امتیاز: ۱۶۷.۲۵ حذف: ۰
کل: اخذ شده: ۶۱ گذرانده: ۶۱ مردودی: ۰ — معدل: ۱۴.۲۵ امتیاز: ۸۶۹.۳ موثر: ۶۱

نیمسال اول ۸۹-۸۸ — وضعیت دانشجو در حال تحصیل

کد درس	نام درس	واحد	نمره	وضع
۱۱۱۱	اندیشه اسلامی ۲ نبوت وامامت	۲	۱۶.۲۵	۱
۲۱۰۵۳۰۱۰	مکانیک تحلیلی ۲	۳	۱۶.۵۰	۱
۲۱۰۵۳۰۱۴	الکترومغناطیس ۱	۴	۱۴.۰۰	۱
۲۱۰۵۳۰۱۶	مکانیک کوانتمی ۱	۴	۱۶.۵۰	۱
۲۱۰۵۳۰۳۳	نسبیت	۳	۱۳.۰۰	۱
۲۱۰۵۳۰۷۶	فیزیک نجومی مقدماتی	۳	۱۸.۰۰	۱

نیمسال: اخذ شده: ۱۹ گذرانده: ۱۹ مردودی: ۰ — معدل: ۱۵.۶۳ امتیاز: ۲۹۷ حذف: ۰
کل: اخذ شده: ۸۰ گذرانده: ۸۰ مردودی: ۰ — معدل: ۱۴.۵۸ امتیاز: ۱۱۶۶.۳ موثر: ۸۰

نیمسال دوم ۸۹-۸۸ — وضعیت دانشجو در حال تحصیل

کد درس	نام درس	واحد	نمره	وضع
۱۰۰۹	تربیت بدنی ۱	۱	۱۸.۰۰	۱
۲۱۰۵۳۰۰۸	آزمایشگاه فیزیک جدید	۲	۱۳.۰۰	۱
۲۱۰۵۳۰۱۵	الکترومغناطیس ۲	۴	۱۱.۵۰	۱
۲۱۰۵۳۰۲۶	اختر فیزیک	۳	۱۶.۵۰	۱
۲۱۰۵۳۰۶۲	اسپکتروسکپی	۳	۱۵.۵۰	۱
۲۹۹۹۲۰۰۱	مبانی برنامه نویسی کامپیوتر	۳	۱۶.۲۰	۱

نیمسال: اخذ شده: ۱۶ گذرانده: ۱۶ مردودی: ۰ — معدل: ۱۴.۶۶ امتیاز: ۲۳۴.۶ حذف: ۰
کل: اخذ شده: ۹۶ گذرانده: ۹۶ مردودی: ۰ — معدل: ۱۴.۵۹ امتیاز: ۱۴۰۰.۹ موثر: ۹۶

نیمسال اول ۹۰-۸۹ — وضعیت دانشجو در حال تحصیل

کد درس	نام درس	واحد	نمره	وضع
۱۰۱۰	تربیت بدنی ۲	۱	۱۸.۰۰	۱
۱۰۱۱	تنظیم خانواده و جمعیت	۱	۱۷.۰۰	۱
۲۱۰۵۳۰۱۳	ریاضی فیزیک ۲	۳	۱۳.۵۰	۱
۲۱۰۵۳۰۱۷	مکانیک کوانتمی ۲	۴	۱۲.۵۰	۱
۲۱۰۵۳۰۱۸	اپتیک	۳	۱۶.۲۵	۱
۲۱۰۵۳۰۲۱	آزمایشگاه الکترونیک ۱	۲	۱۸.۵۰	۱
۲۱۰۵۳۰۲۹	مکانیک آماری	۳	۱۷.۰۰	۱

نیمسال: اخذ شده: ۱۷ گذرانده: ۱۷ مردودی: ۰ — معدل: ۱۵.۴۳ امتیاز: ۲۶۲.۲۵ حذف: ۰
کل: اخذ شده: ۱۱۳ گذرانده: ۱۱۳ مردودی: ۰ — معدل: ۱۴.۷۲ امتیاز: ۱۶۶۳.۱۵ موثر: ۱۱۳

نیمسال دوم ۹۰-۸۹ — وضعیت دانشجو در حال تحصیل

کد درس	نام درس	واحد	نمره	وضع
۱۱۵۰	تفسیر موضوعی قرآن-برابر بامتون	۲	۱۴.۵۰	۱
۲۱۰۵۳۰۱۹	آزمایشگاه اپتیک	۲	۱۶.۰۰	۱
۲۱۰۵۳۰۲۲	فیزیک حالت جامد ۱	۳	۱۰.۰۰	۱
۲۱۰۵۳۰۲۳	فیزیک هسته ای ۱وآزمایشگاه	۴	۱۳.۰۰	۱
۲۱۰۵۳۰۲۸	لیزر	۳	۲۰.۰۰	۱
۲۱۰۵۳۰۶۱	اپتیک کاربردی	۳	۱۷.۰۰	۱
۲۱۰۵۳۱۱۳	پروژه کارشناسی نظری	۳	۱۹.۰۰	۱

نیمسال: اخذ شده: ۲۰ گذرانده: ۲۰ مردودی: ۰ — معدل: ۱۵.۵۵ امتیاز: ۳۱۱ حذف: ۰
کل: اخذ شده: ۱۳۳ گذرانده: ۱۳۳ مردودی: ۰ — معدل: ۱۴.۸۴ امتیاز: ۱۹۷۴.۱۵ موثر: ۱۳۳

تابستان ۹۰-۸۹ — وضعیت دانشجو معرفی به استاد

کد درس	نام درس	واحد	نمره	وضع
۲۱۰۵۳۰۶۶	تکنیک خلا	۳	۱۶.۰۰	۱

نیمسال: اخذ شده: ۳ گذرانده: ۳ مردودی: ۰ — معدل: ۱۶ امتیاز: ۴۸ حذف: ۰
کل: اخذ شده: ۱۳۶ گذرانده: ۱۳۶ مردودی: ۰ — معدل: ۱۴.۸۷ امتیاز: ۲۰۲۲.۱۵ موثر: ۱۳۶

تعداد نیمسال مشروط ۰ وضعیت کلی دانشجو فارغ التحصیل تاریخ قبولی در آزمون سراسری ۱۳۸۶/۰۶/۲۰ تاریخ توقف تحصیل ۱۳۹۰/۰۶/۲۸

معدل کل به عدد: ۱۴.۸۷ معدل کل به حروف: چهارده و هشتاد و هفت صدم

این کارنامه بدون مهر و امضا فقط برای اطلاع دانشجو صادر شده است و ارزش دیگری ندارد

۱

True Certified Copy
Alireza Razavikamran
Official English Translator
To the Judiciary of the I.R. of IRAN Hamedan
License no: 283

اداره کل امور آموزشی

تعداد نیمسال ها: در حال تحصیل (۸)

توضیح وضع نمرات: ۱مدرس عادی - قبول

سیستم مدیریت آموزش دانشگاهها سما - طرح و اجرا نرم افزاری سماسامانه 000.00000000.000

نوع درس	عمومی	پایه	تخصصی	اختیاری	جبرانی	پیشنیاز	مجموع		
جدول وضعیت دروس گذرانده (تعریف درس) تعداد واحد	۲۱	۳۳	۵۲	۳۰	۰	۰	۱۳۶	رتبه معدل کل دانشجو در رشته ورودی دوره	۲۲ / ۵
معدل	۱۶.۴	۱۳.۶	۱۴.۴۶	۱۵.۸۲	۰	۰	۱۴.۸۷	میانگین معدل دانشجویان هم رشته ورودی دوره	۱۳.۷۴
								میانگین واحد گذرانده دانشجویان هم رشته ورودی دوره	۷۲.۵۵

منتظری - افسانه_۳۸۹۶_305377_962_122_1394/03/13_10:30:43

جمهوری اسلامی ایران

وزارت علوم تحقیقات و فناوری

بسمه تعالی

یَرْفَعِ اللَّهُ الَّذِینَ آمَنُوا مِنکُمْ وَالَّذِینَ أُوتُوا الْعِلْمَ دَرَجَاتٍ

دانشگاه بوعلی سینا

شماره ۳۱/۱-٤٦٥

تاریخ ۱۳۹۵/۰۱/۲۱

به موجب اساسنامه مصوب نود و چهارمین جلسه شورای گسترش آموزش عالی مورخ ششم آذرماه یکهزار و سیصد و پنجاه و دو شمسی

نظر به اینکه خانم رؤیا فامیلی

فرزند **منصور** به شماره شناسنامه **۳۸٦۰۰٦۷۳٦۲** صادره از **حوزه یک همدان** متولد **۱۳٦۸** در تاریخ **شهریور** ماه سال **نود** دوره تحصیلات این دانشگاه را با موفقیت به پایان رسانیده، لذا این **دانشنامه** با درجه **کارشناسی** در رشته **فیزیک اتمی - مولکولی** به نامبرده اعطا می شود.

توفیق نامبرده را در توام کردن علم با عمل و خشیت و تقوی و کسب رضای خالق و تلاش در خدمت به خلق آرزومند است.

معاون آموزشی و تحصیلات تکمیلی دکتر عباس افخمی

رئیس دانشگاه دکتر منصور غلامی

True Certified Copy
Alireza Razavikamran
Official English Translator
to the Judiciary of the I.R.of IRAN-Hamedan

این دانشنامه بدون هولوگرام فاقد اعتبار است

17.12.2018

. *Mrs Roya Famili*

This is to certify that the above named lady was my student for several of her courses (Group Theory, Special topics) in M.Sc, here in Kermanshah. Also I was her supervisor in M.Sc.. She is a hard working and intelligent student. She was always among the top five percent of the class. She has a very good potential of understanding and solving the physics problems.
Now, having these points in mind, I would highly recommend her for higher education in physics. In doing so I am quit sure she will be very good and successful student.
If there is anything else to be known, please do not hesitate to contact me.

Ardeshir Rabeie

Assistant Professor in physics

Tel: +989183593936
e-mail: rabeie@razi.ac.ir

To Whom It May Concern

This is to certify that Ms. Roya Famili the student in graduate program in Razi University, department of physics, has successfully completed the following graduate courses with me

(1) General Relativity.

Considering motivation and creativity I recommend her for doctorate program in physics in any respected university or institute.

Yours Sincerely

M. V. Takook
Prof. of Physics
Razi University
takook@razi.ac.ir

Fu, Bowen

Address		**Email** fbw_2@163.com (update 2019/01/07)	
19-28-4 Chuangxin 2nd Road Shenyang, Liaoning 110169 China		**Home Phone** **Cell Phone** (86) 15850773098 **Office Phone**	
Current Institution		**Department**	
Location	, N/A		
Highest Degree	MSc	**Institution** University of Edinburgh	**Date** 2017/11
Thesis Advisor	José Miguel Figueroa-O'Farrill		
Thesis Title	Supersymmetric Field Theory in Nappi-Witten Superspace		
Research Interests	**Primary** Theories beyond the Standard Model		
Secondary			
Discipline(s)	Fundamental Theory/Cosmology; High Energy Physics; High-Energy Theory; Theoretical Physics; Particle and Astroparticle Phenomenology		
Position(s) applied	PHD		
1. José Figueroa-O'Farrill, MSc dissertation supervisor, j.m.figueroa@ed.ac.uk (2018/02/28)			file (PDF, PDF, 2017/11/27)
2. Richard Ball, , rdb@ph.ed.ac.uk (2018/02/28)			file (PDF, PDF, 2017/10/20)
Received Materials	**PHD**	**Cover Letter:** file (PDF, PDF 2019/01/15) **Curriculum Vitae:** file (PDF, PDF 2019/01/15) **Research Statement:** file (PDF, PDF 2019/01/15) **Copies of grades transcripts:** file (PDF, PDF 2019/01/15)	

19-28-4 Chuangxin 2nd Road
110179 Shenyang
China
Phone: +(86)158 5077 3098
Email: fbw_2@163.com

To Whom It May Concern,

I am writing to apply for the PhD position in the Collaborative Research Center "Particle Physics Phenomenology after the Higgs discovery", which is advertised on AcademicJobsOnline.

After I got my master degree in the UK, I intended to continue my study in Australia. However, my visa application was delayed for some political reasons and therefore I couldn't enroll until now. When I was waiting for the visa, I read some papers and became interested in the flavor anomalies. And the PhD position was announced nearly at the same time. Therefore I would like to try to apply for this position.

I have finished courses on almost every aspect of quantum field theory, including quantum electrodynamics, quantum chromodynamics, and Electroweak theory. Summarisation of my qualifications, training, and experiences can be found in my CV.

Thank you for taking the time to consider my credentials.

Sincerely,

Bowen Fu

Bowen Fu

19-28-4 Chuangxin 2nd Road
Hunnan District
Shenyang
China 110179

Tel: +86-15850773098

email: fbw_2@163.com

Born: March 26, 1994—Shenyang, China
Nationality: Chinese

Education

09/2016-08/2017 MSc in Theoretical Physics, The University of Edinburgh
09/2012-06/2016 BSc in Physics, Nanjing University

Dissertation

2017 MSc "Supersymmetric Field Theory in Nappi-Witten Superspace"
2016 BSc "Calculation of Electromagnetic Spin Angular Momentum in Hydrogen Atom"

Awards

2015 Meritocrat Scholarship by Institute of High Energy Physics, Chinese Academy of Science, Beijing

Publications

Journal articles

2017 F. Bo-wen, C. Yu-peng, Z. Shu, J. Long, and L. Jian, "The outburst observations of black hole binary system v404 cyg by swift/xrt in 2015," Chinese Astronomy and Astrophysics 41 (2017), no. 2, 198 – 207.

Internships

07/2015-08/2015 Department of High Energy Astrophysics, Institute of High Energy Physics (IHEP), China

Research Statement

Bowen Fu

January 15, 2019

This research statement is for application to the PhD position in the Collaborative Research Center "Particle Physics Phenomenology after the Higgs discovery", which is announced on the website of AJO. I know three projects should be indicated, but I strongly hope to work on the flavor anomalies. Therefore I will only illustrate my interest in project **C3b**.

As the uncertainties became smaller and smaller in recent collider results, flavor anomalies, including violations of lepton flavor universality in ratios $R(K^{(*)})$ and $R(D^{(*)})$, became an important topic of physics beyond the Standard Model. The anomalies are not only a strong motivation for building new models, but also provide an effective method for testing the models beyond the Standard Model. New constraints on the parameter space of the models can be obtained and therefore additional prediction can be made.

Multi-Higgs models have been studied a lot on its connection with the flavor anomalies. Alternatively, $SU(3)$ triplet leptoquarks with various SU(2) and Lorentz natures are also considered as prominent solutions to the problem, which can also be related to the radiative generation of lepton mass. The models also can be embedded in larger models with particular symmetries such as the E_6 symmetry and the Pati-Salam symmetry, which may also provide explanations for the muon anomalous magnetic moment and candidates for dark matter.

I'm interested in constructing new models to explain the flavor anomalies, testing new models with flavor anomalies, and connecting the flavor anomalies to other phenomena beyond the standard models. I have a master degree in theoretical physics and have finished courses covering QED, QCD, and the electroweak theory. It will be my honor to have the opportunity to work in the Center.

Information identifying the holder of the qualification

Full Name: Bowen Fu
Date of Birth: 26 March 1994
Matric / HUSID Number: S1620861 / 1611670241416

(HUSID (HESA Unique Student Identifier) is the unique identifying number for students registered at a UK university. It is defined by the UK's Higher Education Statistics Agency)

Information identifying the qualification

Name of qualification and (if applicable) title conferred: Master of Science; With Distinction
(The power to award degrees is regulated by law in the UK.)

Main field(s) of study for the qualification: Theoretical Physics
Name and status of awarding institution: The University of Edinburgh
(The University of Edinburgh is a recognised body granted powers by the Privy Council to award degrees.)

Language(s) of instruction/examination: English

Information on the level of the qualification

Level of qualification: SCQF level 11
Official length of programme: 1 Years
Access requirement(s): Detailed information regarding admission to the programme is available in the University's Prospectus

Information on the contents and results gained

Mode of study: Full-time
Programme requirements: Information not available. Please contact relevant School using the details in 'Further Information Sources'

Information on the function of the qualification

Access to further study:

Professional status (if applicable): Not applicable

Further Information Sources

Further information sources: http://www.ph.ed.ac.uk
Any enquiries regarding the above should be addressed to: School of Physics, University of Edinburgh, James Clerk Maxwell Building, King's Buildings, Mayfield Road, Edinburgh, EH9 3JZ; Tele: +44 (0) 131 651 7067; Web: http://www.ph.ed.ac.uk; email: info@ph.ed.ac.uk
Further information regarding the University of Edinburgh HEAR: http://www.ed.ac.uk/schools-departments/student-administration/other-info/overview

This Higher Education Achievement Report incorporates the model developed by the European Commission, Council of Europe and UNESCO/CEPS for the European Diploma Supplement. The purpose of the report is to provide sufficient recognition of qualifications (diplomas, degrees, certificates etc). It is designed to provide a description of the nature, level, context and status of the studies that were purposed and successfully completed by the individual named on the original qualification to which this report should be appended. It should be free from any value judgements, equivalence statements or suggestions about recognition. Information in all eight sections should be provided. Where information is not provided, an explanation should be given.

Programme details, and the individual grades/marks/credits obtained

Programme Start Date: 1 September 2016
Qualification Conferred Date: 30 November 2017
Qualification Conferred: Master of Science
Qualification Subject: Theoretical Physics
Overall Classification of the Qualification: With Distinction

Academic Year	Code	Name	Mark	Grade	Result	SCQF Level	No. of attempts	Credits Achieved*
2016/17	MATH11138	Geometry of General Relativity	67	B	P	11	1	10
2016/17	MATH11179	Variational Calculus	77	A3	P	11	1	10
2016/17	PGPH11085	Problem Solving in Theoretical Physics	95	A1	P	11	1	10
2016/17	PGPH11087	Dissertation in Theoretical/Mathematical Physics	80	A2	P	11	1	60
2016/17	PGPH11094	Modern Quantum Field Theory	70	A3	P	11	1	10
2016/17	PGPH11097	Symmetries of Particles and Fields	97	A1	P	11	1	10
2016/17	PGPH11098	Research Skills for Theoretical Physics	74	A3	P	11	1	20
2016/17	PGPH11099	Gauge Theories in Particle Physics	72	A3	P	11	1	20
2016/17	PHYS10101	Cosmology	68	B	P	10	1	10
2016/17	PHYS11010	General Relativity	62	B	P	11	1	10
2016/17	PHYS11021	Relativistic Quantum Field Theory	91	A1	P	11	1	10
								Sub Total: 180
		* 1 European Credit Transfer Scheme (ECTS) credit = 2 University of Edinburgh credits						Total: 180

Additional Information

Prizes and Medals: None awarded
Additional Recognised Activities: None recorded
Additional Notes: None recorded

Certification:

Robert Lawrie

Robert Lawrie, Head of Student Administration Services

Grading Scheme

Grade Expectations: http://www.studentsystems.ed.ac.uk/staff/FAQ/assessment_results.html
Grades followed by 'A' = Fail (Credits Awarded on Aggregation)
Grades 'ES' and 'PS' = fail result of 38 or 39 but pass and credits awarded due to special circumstances

Common Marking Scheme from 2005/2006

With effect from Academic Session 2005/2006, the marking scheme for undergraduate degree examinations in all Schools is as follows, except for the Royal (Dick) School of Veterinary Studies and the M.B.,Ch.B. curriculum in the College of Medicine and Veterinary Medicine.

HONOURS		NON HONOURS	
Honours Class	Mark (%)	Grade	Description
I	90-100	A1	Excellent
I	80-89	A2	Excellent
I	70-79	A3	Excellent
II.1	60-69	B	Very Good
II.2	50-59	C	Performance at a level showing the potential to achieve at least a lower second class honours degree
III	40-49	D	Pass, may not be sufficient for progression to an honours programme
Fail	30-39	E	Marginal Fail
Fail	20-29	F	Clear Fail
Fail	10-19	G	Bad Fail
Fail	0-9	H	Bad Fail

Bachelor of Veterinary Medicine and Surgery (BVMS), Royal (Dick) School of Veterinary Studies

70-100 = A (Excellent); 60-69 = B (Very Good); 55-59 = C (Good); 50-54 = D (Satisfactory); 46-49= E (Marginal Fail); 35-45= F (Clear Fail); 0-34 = G (Bad Fail)

BVMS is a Masters level degree and is not classified into any other GPA or similar system. Due to differences in examining systems, it is rare for students to receive a mark greater than 80% with 70% or greater equating to a distinction.

Postgraduate Extended Common Marking Scheme (with effect from Academic Session 2005/2006)

Mark (%)	Grade	Description
90-100	A1	An excellent performance, satisfactory for a distinction
80-89	A2	An excellent performance, satisfactory for a distinction
70-79	A3	An excellent performance, satisfactory for a distinction
60-69	B	A very good performance
50-59	C	A good performance, satisfactory for a master's degree
40-49*	D	A satisfactory performance for the diploma, but inadequate for a master's degree
30-39**	E	Marginal Fail***
20-29	F	Clear Fail***
10-19	G	Bad Fail ***
0-9	H	Bad Fail***

* Assessment of the dissertation: A mark of 47-49 may be used to denote the possibility that by minor revision the work may be upgraded to a Masters standard.
** Assessment of the dissertation: A mark of 37-39 may be used to denote the possibility that by minor revision the work may be upgraded to a diploma standard.
*** Assessment of the dissertation: In those programmes where a diploma may be awarded for the taught component only, a failed dissertation may be put aside for the diploma.

Information on the National Higher Education System

Description of Higher Education in Scotland

Scotland's distinctive higher education system has 20 higher education institutions (HEIs). The 14 Universities, the Open University in Scotland, 2 colleges of higher education, 2 art schools and a conservatoire are part-funded for research, teaching and learning through the Scottish Funding Council.
The HEIs are independent, self-governing bodies, active in teaching, research and scholarship. They decide the degrees they offer; the conditions on which they are awarded and the admissions arrangements. Degrees and other higher education qualifications are legally owned by the awarding institution, not by the state. The HEIs offer qualifications at undergraduate (Bologna first cycle) and postgraduate (Bologna second and third cycle) levels. In Scotland, the law distinguishes the power to award degrees on the basis of completion of taught programmes from the power to award research degrees. Universities have powers to award taught and research degrees. Some other HEIs have powers to award degrees while others offer programmes leading to degrees awarded by HEIs with degree powers.
Lists of institutions with powers toward degrees and institutions recognised by authorities in Scotland as being able to offer courses leading to a degree of another HEI may be found at (http://www.univsities-scotland.ac.uk). A small number of degrees are available in colleges of further education by the authority of a duly empowered HEI.

Qualifications

The types of qualification awarded at the undergraduate (first cycle) and postgraduate level (second and third cycles) in Scotland are described in the Framework for Higher Education qualifications in Scotland which includes qualifications descriptors, developed with the higher education sector (http://www.qaa.ac.uk). The Framework is an integral part of a wider national framework: the Scottish Credit and Qualifications Framework that covers all forms of programmes and qualifications from School to Doctorates (see table 1 and http://www.scqf.org.uk). Institutions use SCQF credit points for students entering or transferring between programmes or institutions, and use ECTS for transfers within the European area.

Admission

Requirements for particular programmes are set by the HEIs which offer a range of routes for entry and/or credit transfer into their programmes, and admit students whom they believe have the potential to complete their programmes successfully. The Open University is an open entry institution. The most common qualification for entry to higher education is the Higher or Advanced Higher or, for entrants from the rest of the U.K., the General Certificate of Education at 'Advanced' level (including the "advanced supplementary") or comparable qualifications. Four or five Highers are normally taken in the 5th and 6th year of secondary school or at college or further education and studied in considerable depth, involving coursework and final examinations. Advanced Highers are taken in the 6th year. A major route into Degrees, often with transfer of credit, is the higher National Qualifications offered in colleges or further education.

Quality Assurance

Standards of qualification and the quality of the student learning experience are maintained by the HEIs using a range of processes including extensive use of external examiners. In some subject areas, Professional and Statuary Bodies have a role to ensure that programmes meet the needs and standards of the particular profession. HEIs in Scotland demonstrate their public accountability for quality and standards through a national quality and standards through a national quality assurance framework that has a strong focus on enhancement as follows: HEIs take account of a QAA published U.K.-wide code of practice for quality assurance, and U.K. subject level 'benchmark' statements on standards (see http://www.qaa.ac.uk). Subject level issues are addressed by HEIs internal reviews conducted in accordance with guidance issued by the Scottish Funding Council (SHEFC)(see http://www.scf.ac.uk). External reviews are conducted by the Quality Assurance Agency for Higher Education in Scotland (QAA). The Agency is an independent body established to provide public confidence in the quality and standards of higher education. It involves students in its quality enhancement activities. The Agency publishes reports on the outcomes of reviews and the confidence that can be placed in the HEIs' arrangements for assuring and enhancing standards and quality, and for ensuring that they provide public information that is complete, accurate and fair (see http://www.qaa.ac.uk). A national development service supports students in their role as active participants in assuring and enhancing quality and standards (see http://www.sparqs.org.uk).

Table 1: The Scottish Credit and Qualifications Framework (SCQF)

The SCQF covers all the major qualifications in Scotland from school to Doctorate and including work based Scottish Vocational Qualifications (SVQs)

SCQF Level	Qualifications of Higher Education Institutions	SQA Higher National and National Units, Courses and Group Awards	SVQs
12	Doctoral Degrees (Minimum 540 SCQF credits)	-	-
11	Masters Degrees (Minimum 180 SCQF credits) Postgraduate Diploma (Minimum 120 SCQF credits) Integrated Masters Degrees (Minimum 600 SCQF credits)	-	SVQ 5
10	Bachelors Degree with Honours (Minimum 480 SCQF credits) Graduate Diplomas and Certificates	-	-
9	Bachelors Degree (Minimum 360 SCQF credit) Graduate Diplomas and Certificates	-	-
8	Diploma of Higher Education (Minimum 240 SCQF credits)	Higher National Diploma	SVQ 4
7	Certificate of Higher Education (Minimum 120 SCQF credits)	Advanced Higher Higher National Certificate	-
6	-	Higher	SVQ 3
5	-	Intermediate 2 Credit Standard Grade	SVQ 2
4	-	Intermediate 1 General Standard Grade	SVQ 1
3	-	Access 3 Foundation Standard Grade	-
2	-	Access 2	-
1	-	Access 1	-

Notes

1. SCQF levels represent increasing complexity and demand in learning outcome.
2. One credit represents the outcomes achievable by the average through 10 notional hours of learner effort. In general terms, one full-time undergraduate year is considered to be 120 credits worth of learning. A postgraduate year is 180 credits. 1 ECTS credit is deemed equivalent to 2 SCQF credits. Research degrees - Master of Philosophy (MPhil) and Doctor of Philosophy (PhD) are not credit rated.
3. Graduate Certificates (minimum of 60 SCQF credits) and Graduate Diplomas (minimum of 120 credits) are offered at levels 9 and 10 within the SCQF framework. They are offered for programmes that are for graduates but do not have outcomes that are at postgraduate level.
4. The Bachelors Degree (level 9) leads to employment and in some instances can give access to postgraduate study particularly when accompanied by relevant work or professional experience.
5. At Postgraduate levels, the framework and the higher education qualifications are the same as those for the rest of the UK. The Honours Degree levels of the frameworks are considered to be in broad alignment (the Honours Degree in Scotland normally takes 4 years and that in the rest of the UK takes 3 years). Below Honours level the frameworks reflect the different educational structures of Scotland and the rest of the UK.
6. Scotland has a distinctive higher education system and also operates under a devolved government, including for higher education. There is a separate Description of Higher Education in England, Wales and Northern Ireland where the system is different to that of Scotland.
7. This national description is endorsed by the Quality Working Group which is a national committee with members from The Quality Assurance Agency for Higher Education, Scotland; The Scottish Funding Council; Universities Scotland and the National Union of Students in Scotland.

Description of the University of Edinburgh

The University of Edinburgh was founded in 1583, and has 22 Schools in 3 Colleges: Humanities and Social Science, Medicine and Veterinary Medicine and Science and Engineering. It offers more than 300 degree programmes to its approximately 29,000 students. It is one of around a hundred universities in the United Kingdom and of 14 in Scotland. Higher Education, including universities, within Scotland is the responsibility of the Scottish Parliament, which has powers devolved from the U.K. Parliament.
The University is an independent, self-governing body that is active in both teaching and research. Its mission is the advancement and dissemination of knowledge and understanding. (See http://www.planning.ed.ac.uk/Strategic_Planning/MissionStatement.htm for fuller details of the University's mission and plan). Like all universities in the UK, its degrees are its own responsibility, not that of the State. The University is funded from a variety of sources, including a block grant from the Scottish government, academic fees, research grants, and other sources.
About 4,500 students graduate every year with a Bachelors degree with honours and after four-years of study. For long-standing historical reasons, many degrees at this level in humanities subjects are designated Master of Arts. There are also some "undergraduate masters degrees" in science subjects that require five years of study and take students to a postgraduate level of achievement without their having achieved an intermediate bachelors degree. The outcome of these honours degrees is quoted in terms of the "classification" of the degree: first (the highest), upper second, lower second, or third. Some students graduate with a non-honours "ordinary" degree. which is not classified, although a transcript showing their marks is available. This system is common to all the universities in the UK.
About 2,000 students each year graduate with postgraduate degrees, generally designated as Master or Doctor. These degrees are not classified.

A document describing the similar systems in the rest of the UK is also available (see http://www.uknec.org.uk/documents/ds_description.pdf).

8th November 2017

SCHOOL *of* MATHEMATICS

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Scotland, UK

Email J.M.Figueroa@ed.ac.uk
Telephone +44 31 650 5060
or direct dial +44 31 650 5066
http://www.maths.ed.ac.uk/~jmf

Dear Colleague,

It is a pleasure to write a letter of reference for Bowen Fu, who recently finished the MSc in Theoretical Physics at the University of Edinburgh, graduating with Distinction.

Although I am in the School of Mathematics, I know Bowen because he took my 5th year course on variational principles in the first semester, I tutored him in the Geometry of General Relativity course taught by my colleague Dr James Lucietti in the second semester, but mainly because I supervised his MSc project last summer. This is the first year that I was involved with the MSc in Theoretical Physics, so my interaction with that class of students was limited. Nevertheless I have interacted with many good students in Mathematics and Physics in Edinburgh, so I have a good sample size with whom to compare Bowen. Furthermore, I am assured from my colleagues in Physics that Bowen's strong performance in the MSc is usually a good predictor for the ability to cope with the demands of a PhD.

First of all, Bowen did very well in my variational principles course. Being a mathematics course in the final year, I expect substantial mathematical maturity from my students. Bowen had to work quite hard at the beginning due to his background being in Physics, but I'm glad to report that his hard work did pay off in the end: he was one of a handful of students (in a class of about 20) who obtained an A and I believe that he was the only Physics student to do so.

I proposed two MSc projects this year: one on supersymmetry in curved space and one on four-dimensional supergravity. Only one student can do any one project at the same time, and Bowen and another student both were interested in the supergravity project. We tossed a coin, Bowen "lost" and he chose the supersymmetry in curved space project. He did not realise it at the time, but this was actually the more interesting and more topical of the two projects. The idea was for him to look at the four-dimensional geometries admitting rigid supersymmetry and to construct supersymmetric field theories on them by developing the relevant superspace formalism. The project took him most of the summer, but because there is at present no course on supersymmetry in the MSc in Theoretical Physics[1], Bowen did quite a bit of self-study during the Spring semester to be able to "hit the ground running" when exams finished. Part of what he studied were some lectures of mine on four-dimensional $N = 1$ supersymmetry given in 2000 and 2001 at the British Universities Summer School in Theoretical Elementary Particle Physics (BUSSTEPP). The lectures contain many exercises and Bowen did them methodically and reproduced all the calculations and he even found some new typos in the lecture notes. I was quite impressed with his diligence and was delighted with his progress.

But the real work and where Bowen really shone was during the actual project. It was clearly early on that

[1] I hope to eventually be able to teach one, but this requires the School of Mathematics to be properly involved in the MSc.

there would only be time to do one of the geometries in detail, so I chose the Nappi-Witten geometry for two reasons: it has been studied the least and it is computationally closer to the classical Minkowski case. The calculation first involved computing the left- and right-invariant vector fields on the Nappi-Witten supergroup, for which Bowen first computed the left- and right-invariant Maurer–Cartan one-forms. Needless to say he had to learn this material, since this sort of differential geometry (let alone *super*geometry) is not taught in the MSc.

After this he came up with possible constraints satisfied by chiral and vector superfields in this geometry and constructed the analogue of the Wess–Zumino and the abelian super-Maxwell models.

He also noticed that the quadratic Casimir for the Nappi-Witten superalgebra is not just P^2 but has corrections coming from the supercharges. This has the interesting consequence that fields in a supermultiplet need not be mass degenerate: which provides a proof of concept that one does not need to break supersymmetry in order to have mass differences between bosons and fermions.

To recap, I'm not sure how typical it is for MSc projects to lead to original research, but Bowen's certainly did and we are currently writing a joint paper with these results.

Bowen applied to do his PhD with us in the School of Mathematics last year. At the time we reviewed his application (back in February), we thought that he would fit better in the School of Physics than in Mathematics: he is more interested in the physical consequences than in the mathematical formalism. Together with the fact that we had no funding for non-UK students this year, we did not offer him a place. After the summer project, I would take him as a student without a second thought, but alas the funding situation in the UK for overseas students remains dire.

In summary, I have the highest esteem for Bowen: he has proved to be a very hard working and creative student who can do good research under minimal supervision. I therefore have absolutely no hesitation to give him my strongest recommendation and to urge you to give him the chance to continue his research career at your institute. You will not regret it.

Yours truly,

JMFigueroa

José Figueroa-O'Farrill
Professor of Geometric Physics
Head of Research Theme

1 October 2017

HIGGS CENTRE
for THEORETICAL PHYSICS

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Scotland

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Letter of Recommendation for Bowen Fu

Bowen Fu has been an MSc student in Edinburgh for the academic year 2016-17, and has asked me to write him a recommendation letter.

Bowen took two courses taught by me – Relativistic Quantum Field Theory (RQFT) and Symmetries of Particles and Fields (SoPF). He was among the very best students in each class (or around fifty students). I was impressed early on by his insightful questions, and clear mastery of the material. In the final RQFT exam, he was the only student to achieve top marks in all three of the questions on the paper (students were only supposed to answer two out of three). In SoPF he scored 97%, which I believe made him top of the class.

A simple anecdote will give you an example of Bowen's thoroughness. He once sent me a question by email concerning a paradox he had discovered concerning associativity and the Baker-Campbell-Hausdorff formula. I confess I spent several hours trying to resolve this for him, without success. Eventually I went to talk to a colleague, and eventually after an hour in front of the blackboard we spotted the error. I hope this gives you an insight into just how challenging some of Bowen's questions were.

For his MSc thesis, Bowen chose a project on superspace algebras with Jose Figueroa O'Farrill. I have read his report, and it is excellent, both in content and in style. Apparently it will lead to a paper.

I have no hesitation in recommending Bowen Fu for a PhD position: he is hard working, smart, communicates easily, and is not afraid to tackle new and difficult problems. In short I believe he would make an excellent graduate student, and I wish we had the funding to give him a position here in Edinburgh.

Yours sincerely,

Prof. Richard Ball

Ghasemi, Mahdiyeh

Address		**Email** mahdiyeh.gh92@gmail.com (update 2019/02/01)	
Unit 1- No.13- End of Niloufar.St- Alaleh.Blvd-Ta Tehran, Tehran 13185/768 Iran, The Islamic Republic of		**Home Phone** (21) 44109651 **Cell Phone** (98) 9127989235 **Office Phone**	
Current Institution		**Department**	
Location	, Esfahan , Iran, The Islamic Republic of		

Highest Degree	MS	**Institution** Islamic Azad University (Central Tehran Branch)	**Date** 2015/09
Thesis Advisor	Dr.Hamidreza Shirvani-Mahdavi		
Thesis Title	Qualification Control of industrial composites by laser micro-plasma spectroscopy with self absorption effect correction		
Research Interests	**Primary** general relativity, gravity in the field of curved space time, Riemannian geometry		
Secondary	quantum dot or quantum bits, Black hole gravity & event horizon phenomenon; LIBS (laser-induced breakdown spectroscopy), Laser Physics, Quantum Optics, Optics Structure, Laser-induced Plasma		

Current Research Interests: *I have several studies in astronomy fields according to the text that was mentioned in my CV. I have a specific interest to general relativity and gravity in the field of curved space time and Riemannian geometry. On the other hand, my experts and masters during the period on an article about a Quantum Computer and how to build them using quantum dot or quantum bits with title:" Calculating the eigenvalues of the quantum dot operator method and exact diagonalization method "the article is preparing for publication get along with Mohammadreza Shokouhi under Dr. Mohammad Reza Tanhayi guidance from IPM.*

Discipline(s)	Quantum Information Science; Quantum Gravity; quantum gravity/quantum cosmology; Quantum Computing; Particle and Astroparticle Phenomenology; photonics; Quantum Optics; Plasma Physics; Physics; Applied Physics; Accelerator Science
Position(s) applied	PHD
Also Consider For	**Temporary:** 1 Year

1. Dr.Hamidreza Shirvani-Mahdavi, Thesis Advisor, hsm@iauctb.ac.ir (2019/02/01)	
2. Mohammad Reza Tanhayi, Thesis Advisor, mtanhayi@ipm.ir (2019/01/27)	

Received Materials	**PHD**	**Cover Letter:** file (PDF, PDF 2019/01/27) **Curriculum Vitae:** file (PDF, PDF 2019/01/27) **Research Statement:** file (PDF, PDF 2019/01/27) **Copies of grades transcripts:** file (PDF, PDF 2019/01/27)

Mahdiyeh Ghasemi
Department of Physics, faculty of basic science, Islamic Azad University (Central Tehran Branch)
Email: Mahdiyeh.gh92@gmail.com

Motivation Letter

I graduated in Atomic & Molecular Physics. I am writing you to apply for current PhD position under your supervisory and I am 29 years old.

During my Master program I worked on Laser-induced Breakdown Spectroscopy (LIBS) field that is a type of atomic emission spectroscopy which uses a method to verify the quality and quantity of ingredients to reach an appropriate weight percent of elements that existed in my project. So, human always need to know them.

In this process, the sample studied under laboratory conditions after spectroscopic surveys are analyzed and the concentration of elements is determined. Specially on two Nano-Composites Cu-Al2O3 (1.1%wt) as ARTRODE and Cu-Al2O3 (0.5%wt) structures. In this regard we wanted to compare the percent of main elements in both of them with ranges of different energy and delay generator. The primitive results were not submitted because in our opinion instrumental error for publishing was more than standard. I tried to decrease error for reaching a suitable results. For publishing, I checked some factors like self-absorption and Local Thermodynamic Equilibrium (LTE) and something like them. I was successful to write some programs to correct them .Thus, All of my experiments done in Photonics Research Laboratory, Department of Physics, Islamic Azad University (Central Tehran Branch) which is equipped by a LIBS set up (such as Nd:YAG Laser with 1064 nm wavelength from quantel Brilliant Thorlabs with 4 Harmonic Generation, Echelle Spectrograph, HR4000CG-UV-NIR : High Resolution Spectrometer , Delay Generator Tarashe.Sys, Optical fiber cable, Beam Splitter, Oscilloscope, Lens, Computer) and characterization (Planetary Micro Mill, incubator, etc.) apparatus under Professor Hamidreza Shirvani-Mahdavi supervisory, I began working on improving and modifying the parameters obtained from the experiment to reduce the errors. Accordingly, we could use some of our results in other experiments after that.

In fact, plasma can be considered as an electrical fire comparing with chemical flame has more stability, accuracy and sensitivity. Each element in the plasma emits unique atomic and ionic spectra. Since the induced plasma has a very short lifetime, the use of time-resolved quantification analysis of materials is very important. The wavelength components of the emitted light are separated by a spectrometer and recorded by a detector. By processing the information of the recorded wavelengths, the elements of the material and their concentrations can be determined. It should be noted that many factors including sample homogeneity, matrix effects, Signal to noise ratio, Local thermodynamic equilibrium (LTE) and Self-absorption phenomena are effective in determining the proper concentration. In the analysis of the sample in question, all the factors were considered, especially the self-absorption effect as an effective factor in determining the concentration.

However, I have several studies in astronomy fields according to the text that was mentioned in my CV. I have a specific interest to general relativity and gravity in the field of curved space time and Riemannian geometry, I had a lot of studies get along with my husband (Mohammad Reza Shokouhi that filled your

University form). So, we had some investigations on Black hole phenomenon, Black hole gravity & event horizon phenomenon.
As I found this opportunity as an excellent fit to my background besides my enthusiasm to your outstanding works, I would like to apply for this position under your supervisory. More importantly, I choose your University for my PhD program due to the leading high technology equipment and high ranking according to my major. On the other hand, my experts and masters during the period on an article about a Quantum Computer and how to build them using quantum dot or quantum bits with title:" Calculating the eigenvalues of the quantum dot operator method and exact diagonalization method "the article is preparing for publication get along with Mohammadreza Shokouhi under Dr. Mohammad Reza Tanhayi guidance from IPM.

In doing the theoretical and practical research, due to my motivated, self-studying, hard-working, innovative, diligent and ambitious characteristics, I can fulfill your expectations as a PhD candidate. For your consideration, attached please kindly find my Cv. I hope to receive your positive response in accepting me as a PhD candidate for your project.

Thank you very much for taking the time to consider our application.

Mahdiyeh Ghasemi
7_{th} November 2018

EXTENDED RESUME

Mahdiyeh Ghasemi

Mailing Address: Islamic Azad University (Central Tehran Branch)
POBOX: 13185/768
Phone: (98) 9127989235
Living Address: Unit 1- No.13- End of Niloufar.St- Alaleh.Blvd- Taavon.Blvd- ShahreZiba.Sq- Ayatollah Kashani.St, Tehran- Iran

Email:
Mahdiyeh.gh92@gmail.com

Education

- **Master of Science in Atomic & Molecular Physics** *June.2015*
  Islamic Azad University of Central Tehran Branch, *Tehran, Iran.*
  M.Sc. Thesis: **"Qualification Control of industrial composites by laser micro-plasma spectroscopy with self-absorption effect correction. "**
  (Supervisor: Prof.H. Shirvani-Mahdavi)
  (Consulting-Advisor: Prof.S.Z.Shoursheini)
  GPA: 3.375

- **B.Sc. Degree in Solid States Physics** *July.2013*
  Zanjan University, *Zanjan,, Iran.*
  B.S Project: Schaum's Outline Series of Astronomy Translated in Persian.
  (Supervisor: Prof.M.A.Maleki)

Interests: LIBS (laser-induced breakdown spectroscopy) & Laser Physics & Quantum Optics & Optics Structure & Laser-induced Plasma & Calibration Free method (calculation for determining weight percent of material) & Self Absorption Correction (MATLAB algorithm) & Calibration-based method & compilation of Internal Standard and Additional Standard methods & Stark Broadening & Instrumental Broadening & LTE (Local Thermodynamic Equilibrium) & Nano-Composite (metal Structures) & Astrophysics & Astronomy& Holography & Group research.

Publications

Articles:

1. Working on **“Calculating the eigenvalues of the quantum dot operator method and exact diagonalization method “** from 2016 till now and the article is preparing for publication.

National Research Activities

- Participate in the National math Olympiad in Tehran, Iran, 2001.
- Participate in the National math Olympiad in Tehran, Iran and thank as scientific talent, 2003.

Seminars and Workshops:

- Database Search Tools & Strategies Workshop, 2014.
- Attended at weekly seminars group Cosmology in Sharif University of technology, faculty of physics, 2009.
- 2nd Optics Workshop of University of Tehran in recognition of the International Year of Light (IYL 2015), Moiré Technique and its Applications (Lecture Notes by Prof. MT Tavassoly, Prof.Kh Hassani, Prof.K.Madanipour, Prof.M.Abolhassani(Arak University), Prof.S.Rasouli), Department of Physics, University of Tehran, Iran in collaboration with The Physical Society of Iran(PSI), ID:49,November 13,2014.
- Attended at Several Astronomy Classes from Basic to Professional Level of Astronomy in Nojum Magazine (Iranian astronomy magazine) and Sciences and Astronomy Center of Tehran which Covered Spherical Astronomy, Observational, Dynamic Astronomy etc. Since 2005.
- Achieving the prize in Zanjan (TWAN),The Astronomy National Competition of Iran
- Attended at The Word at night in September, 2012. Zanjan, Iran. (TWAN annual workshop and exhibition in Zanjan)
- Attended in All TWANs Workshops Covered All Type of Astrophotography From Nightscapes to Deep Sky Imaging and Processing Methods.
- Workshop to the direction of recognition the Messier Objects by Telescopes and Binoculars ,winter 2011, Zanjan, Iran.
- Attended at Almost One Year Field Observational-study In University of Zanjan Observatory

---

Equipment Experience:

- **Delay Generator** Tarashe.Sys trigger outport port with delay between 1.920 - 4.960 microsecond work experiences.

- **Nd: YAG Laser with 1064 nm wavelength quantel Brilliant Thorlabs with 4 Harmonic Generation, Pulse duration 6-15ns** experience (class of 4) for more than **2 years** (By Prof.H. Shirvani-Mahdavi, Dept. of physics & Photonics Research Laboratory, Islamic Azad University (Central Tehran Branch), Tehran-Iran) 2013-Now
- Experience in **Self-absorption Correction** by calculation.

- **Echelle Spectrographs for Raman and LIBS Spectroscopy** experience.
- **HR4000CG-UV-NIR**: **High Resolution Spectrometer for Laser Characterization** work experience.

- 16-inch Meade Schmidt-Cassegrain Reflecting Telescope With a Fixed Base of Concrete (The main University of Observatory Telescope)

- 8-inch Meade Schmidt-Cassegrain Reflecting Telescope With an Horizontal Posture
- 8 Inches Newtonian Telescope(Sky Watcher with equatorial and Engine EQ4)
- 8 Inches Newtonian Telescope (Oriun With The Establishment Dobson)

Research Experience

- External Standard
- Additional Standard
- Calculation Calibration-Free
- Self-Absorption Correction
- Study on Relative Intensity & Local Temperature
- Check Stark Broadening
- Write some MATLAB programs for correcting Self-Absorption
- Check different Delay Generators for Samples

Language Skills

- **English:** Good in speaking, Listening, Reading, and Writing
- **Persian:** Maternal
- **Turkish:** dominant

Computer Background

- **Programming Software:** Fortran, MATLAB, Lab VIEW, Latex
- **Modeling Software:** SprctraSuite
- **General Software:** Office collection
- **Equipment Software:** HighScore X'pert, Sigma-plot, Analysis of the spectrum with Launch SpectraSuite from Ocean Optics, Analysis Spectrum by NIST(National Institute of Standards and Technology),calculate Local Temperature from spectrum

Social Activities

- **Active member of Simultaneous Interpretation Preparatory (SIP) courses, 2015-Now.**
- **Active member of grammar classes in Simultaneous Interpretation Preparatory (SIP) courses, 2015.**
- **Participate in IELTS classes in Aug, 2018.**

Sports and Hobbies

- **Active in Observational Astronomy**
- **Amateur Astronomer**
- **Yoga**
- **Kung Fu**
- **Active in Badminton**
- **Mountain Climbing**
- **photography**
- **Cycling**
- **Dancing**
- **Cooking**

In the name of God

Date: 13 Apr 2014
NO: 101/01/240402

Certification

Awarded to

Mrs. Mahdiyeh Ghasemi

In Recognition Of The Successful Completion Of The

Database Search Tools And Strategies Workshop

Farhood Ziaie
Director Education and Graduate
Studies, NSTRI

F. Zi

Seyed Javad Ahmadi
from Head of the Nuclear Fuel Cycle
Research School

H. Sepehri

زهرا عباسعلی، مترجم رسمی انگلیسی قوه قضائیه
شماره پروانه ۴۲۰، دفتر ترجمه رسمی شماره ۴۲۰ تهران
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Email: info@tahaot.com

شماره ۳۷۴۳۰۶

ردیف دفتر ثبت

جمهوری اسلامی ایران

قوۀ قضائیه - اداره مترجمین رسمی

In the Name of God

Islamic Republic of Iran

ISLAMIC AZAD UNIVERSITY

DIPLOMA OF COMPLETION OF NON-CONTINUOUS MASTER'S DEGREE COURSE

(Holder's Photo Scanned Bearing the Embossed Seal)

This diploma shall be invalid if lacking the hologram.

(Hologram affixed)

Serial No.	: 981261
Central Organization Verification No.	: 169410110134
Date of Verification	: Nov.1,2017

On the strength of University Charter passed by Supreme Council of Cultural Revolution on Nov. 3, 1987 and Single Act enacted by the Islamic Consultative Assembly on May 4, 1988,

Whereas,

MS. MAHDIYEH GHASEMI

Daughter of MANOOCHEHR, holder of National No. 0084125519, ID Card issued in Tehran, born in 1988 has fulfilled the requirements of **Physics**, Major: **Atomic & Molecular** on Sept.14,2015 at Central Tehran Branch and is eligible to receive the **Master's Degree**; therefore, this Diploma is conferred upon her to benefit from its privileges.

- Chancellor of the University Branch: Signed
- For, President of Islamic Azad University: Signed

Certified to be a true and accurate translation of the original and the translator is competent to translate.
Tehran, date: July.29,2018

ZAHRA ABBASALI
زهرا عباسعلی
مترجم رسمی انگلیسی
قوه قضائیه – تهران
دفتر مترجمی ۴۲۰
OFFICIAL TRANSLATOR TO THE JUDICIARY, IRI Tehran-420

Department of Official Translators Affairs of the Judiciary of the Islamic Republic of Iran

Only the authenticity of the seal and signature of the Official Translator is certified. This certification does not include confirmation of the accuracy of the translation and the authenticity of the translated document. Department of Official Translators' Affairs of the Judiciary of the Islamic Republic of Iran

محمد رضایی - کارشناس
M.REZAEI
LEGALIZATION OFFICER

مبلغ ۶۰ ریال بابت تعرفه خدمات کنسولی دریافت گردید.

ISLAMIC REPUBLIC OF IRAN
MINISTRY OF FOREIGN AFFAIRS
REGISTRATION AND PERSONAL STATUS DEPARTMENT

The authenticity of the seal & signature marked (X) is certified without any consideration to the contents.

31 JUL 2018 - 700095

981261

یرفع الله الذین آمنوا منکم والذین اوتوا العلم درجات

جمهوری اسلامی ایران

دانشگاه آزاد اسلامی

دانشنامه پایان تحصیلات دوره کارشناسی ارشد ناپیوسته

به استناد اساسنامه دانشگاه مصوب ۶۶/۸/۱۲ شورای عالی انقلاب فرهنگی و ماده واحده مصوب ۶۷/۲/۱۴ مجلس شورای اسلامی

نظر به اینکه خانم مهدیه قاسمی فرزند منوچهر دارای شماره ملی ۰۰۸۴۱۲۵۵۱۹ وشناسنامه صادره از تهران متولد ۱۳۶۷

دوره تحصیلات رشته فیزیک-اتمی و مولکولی را در تاریخ ۱۳۹۴/۰۶/۲۳ در واحد تهران مرکزی به پایان رسانده و شایستگی

دریافت درجه کارشناسی ارشد را احراز نموده است، این دانشنامه به نامبرده اعطا می شود تا از امتیازات آن بهره مند گردد.

شماره تایید سازمان مرکزی

۱۶۹۴۱۰۱۱۰۱۳۴

تاریخ تایید سازمان مرکزی

۹۶/۰۸/۱۰

Certified Copy

ZAHRA ABBASALI
زهرا عباسعلی
مترجم رسمی انگلیسی
قوه قضائیه - تهران
دفتر مترجمی ۴۲۰
OFFICIAL TRANSLATOR TO THE JUDICIARY.I.R.Tehran

عباسعلی

دکتر فرهاد رهبر

از طرف رئیس دانشگاه آزاد اسلامی

دکتر ابراهیم کلانتری

دکتر محمد مهدی طهرانچی

رئیس واحد دانشگاهی

زهرا عباسعلی، مترجم رسمی انگلیسی قوه قضائیه
شماره پروانه ۴۲۰، دفتر ترجمه رسمی شماره ۴۲۰ تهران
آدرس: ضلع جنوب شرقی فلکه دوم صادقیه،ابتدای جناح، مجتمع افق، طبقه اول، واحد ۱۰۱
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Email: info@tahaot.com

شماره ۳۷۴۲۹۶
ردیف دفتر ثبت

جمهوری اسلامی ایران
قوهٔ قضائیه - ادارهٔ مترجمین رسمی

In the Name of God
Islamic Republic of Iran
Ministry of Science, Research and Technology

UNIVERSITY OF ZANJAN

Hologram Affixed

No. : F/A/52123
Date : April.7,2018

DIPLOMA OF COMPLETION OF STUDIES

(Holder's Photo Affixed Bearing the Embossed Seal)

On the strength of approval of Higher Education Development Council dated April.1991:

Ms. MAHDIYEH GHASEMI MOSHTAGHIN

Daughter of MANOOCHEHR, holder of ID Card No. 42881 issued in Tehran, born in 1988, has successfully fulfilled the requirements of Faculty of Sciences on Sept.2013; therefore, this Diploma of **Bachelor's Degree** in field of **Physics**, major: **Solid State** is conferred upon her. May God grace her with success in putting her learning into practice, following the path of piety, seeking God's gratification and serving the people.

- Academic Deputy of the University: Signed& Sealed
-President of the University: Signed & Sealed
Overleaf:
VERIFICATION: The authenticity of signatures and seals of University officials is verified.
-Director General of Internal Students Affairs: Signed
- Ministry of Science, Research & Technology: Embossed Seal
No.:23 Date: July.1,2018

Certified to be a true and accurate translation of the original and the translator is competent to translate. Tehran, date: July.29,2018

ZAHRA ABBASALI OFFICIAL TRANSLATOR TO THE JUDICIARY, I.R.I Tehran 420
زهرا عباسعلی
مترجم رسمی انگلیسی
قوه قضائیه - تهران
دفتر مترجمی ۴۲۰

Only the authenticity of the seal and signature of the Offical Translator is certified. This certification does not include confirmation of the accuracy of the translation and the authenticity of the translated document. Department of Official Translators Affairs of the Judiciary of the Islamic Republic of Iran.

محمد رضایی - کارشناس
M.REZAEI
LEGALIZATION OFFICER

مبلغ ۶۰۱ ریال بابت تعرفه
خدمات کنسولی دریافت گردید.

ISLAMIC REPUBLIC OF IRAN
MINISTRY OF FOREIGN AFFAIRS
REGISTRATION AND PERSONAL STATUS DEPARTMENT
گواهی می‌شود که امضاء و مهر علامت (X) شده
The authenticity of the seal & signature marked (X) is certified without any consideration to the contents

31 JUL 2018 - 700095

بسمه تعالی

یرفع الله الذین امنوا منکم و الذین اوتوا العلم درجات

جمهوری اسلامی ایران

وزارت علوم تحقیقات و فناوری

دانشگاه زنجان

دانشنامه پایان تحصیلات

۵۲۱۲۳/آ/ف

۱۳۹۷/۰۱/۱۸

بموجب مصوبه مورخ اردیبهشت ماه سال یکهزار و سیصد و هفتاد شورای گسترش آموزش عالی

خانم مهدیه قاسمی مشتقین فرزند منوچهر دارای شناسنامه شماره ۴۲۸۸۱ صادره از تهران متولد سال ۱۳۶۷ در تاریخ شهریور ماه سال ۱۳۹۲ دوره تحصیلات دانشکده علوم را با موفقیت به پایان رسانیده، لذا این دانشنامه با درجه کارشناسی رشته فیزیک گرایش حالت جامد به نامبرده اعطاء می شود.

توفیق نامبرده را در توأم نمودن علم با عمل و خشیت و تقوی و کسب رضای خالق و تلاش در خدمت به خلق آرزومند است.

ZAHRA ABBAS ALI زهرا عباسعلی

مترجم رسمی انگلیسی

قوه قضائیه ـ تهران

دفتر مترجمی ۴۲۰

OFFICIAL TRANSLATOR TO THE JUDICIARY, I.R.I Tehran

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رئیس دانشگاه

دکتر سید محسن نجفیان

دانشگاه زنجان

تأسیس ۱۳۵۴

معاون آموزشی دانشگاه

دکتر محمدرضا عظیمی مقدم

دانشگاه زنجان

معاونت آموزشی و تحصیلات تکمیلی

مهر وامضاء مسئولین دانشگاه
مورد تایید می باشد
جاماسب نوزری
مدیر کل امور دانشجویان داخل

ردیف ۲۳

۱۳۹۷/۴/۱۰

Certified Copy

ZAHRA ABBASALI
OFFICIAL TRANSLATOR TO THE JUDICIARY.IRI Tehran-420
زهرا عباسعلی
مترجم رسمی انگلیسی
قوه قضائیه – تهران
دفتر مترجمی ۴۲۰

زهرا عباسعلی، مترجم رسمی انگلیسی قوه قضائیه
شماره پروانه ۴۲۰، دفتر ترجمه رسمی شماره ۴۲۰ تهران
آدرس: ضلع جنوب شرقی فلکه دوم صادقیه،ابتدای جناح، مجتمع افق، طبقه اول، واحد ۱۰۱
Zahra Abbasali, Official English Translator to the Judiciary
License No.420, Translation Office No.420 – Tehran
Address: #101, 1st floor, Ofogh Building, beginning of Jenah Ave., southeast corner of Sadeghieh 2nd Sq., Tehran – Iran
Tel: +98 21 44270014 Fax: +98 21 44275625
Email: info@tahaot.com

شماره ۳۷۴۲۹۴
ردیف دفتر ثبت

جمهوری اسلامی ایران
قوهٔ قضائیه ـ اداره مترجمین رسمی

In the Name of God
Islamic Republic of Iran

ISLAMIC AZAD UNIVERSITY
CENTRAL TEHRAN BRANCH

Transcript of Academic Records
(Holder's Photo Scanned)

This is to certify that **Ms. MAHDIYEH GHASEMI**, daughter of MANOOCHEHR, holder of National No.0084125519, issued in Tehran, born in 1988, graduated in field of **Physics**, Major: **Atomic & Molecular,** in full-time academic system on Sept.14,2015 and received diploma of **Non-continuous Master's Degree** in the said field.

List of courses passed and grades gained by her during the course of studies is as follows.

Translator's Abbreviations: O= Obligatory, R= Remedial, S= Specialized, E= Elective, M= Major- based, SP= Specialized, S= Seminar, T= Thesis.

1st Semester of Academic Year 2013-2014					
Title of Course	***Type of Course***	***Theoretical Credits***	***Practical Credits***	***Grade***	***Point***
Computational Physics	O	1	1	13.00	26.00
Mathematical Physics III	R	3	-	16.00	Not effective
Advanced Quantum Mechanics I	O	3	-	17.50	52.50
Research Methodology	R	2	-	19.00	Not effective
2nd Semester of Academic Year 2013-2014					
Laser Physics	SM	3	-	15.00	45.00
Advanced Quantum Mechanics II	O	3	-	15.50	46.50
Electrodynamics I	E	4	-	15.50	62.00
Advanced Statistical Mechanics I	O	3	-	17.50	52.50
1st Semester of Academic Year 2014-2015					
Laser Spectroscopy	M	3	-	14.00	42.00
Special Subjects	S	3	-	14.00	42.00
Imam's Testaments	R	1	-	16.00	Not effective
2nd Semester of Academic Year 2014-2015					
Seminar	S	-	2	18.75	37.50
Thesis	T	-	6	18.00	108.00

ZAHRA ABBASALI OFFICIAL TRANSLATOR TO THE JUDICIARY, IRI Tehran-420
زهرا عباسعلی
مترجم رسمی انگلیسی
قوه قضائیه – تهران
دفتر مترجمی ۴۲۰

زهرا عباسعلی، مترجم رسمی انگلیسی قوه قضائیه
شماره پروانه ۴۲۰، دفتر ترجمه رسمی شماره ۴۲۰ تهران
آدرس: ضلع جنوب شرقی فلکه دوم صادقیه،ابتدای جناح، مجتمع افق، طبقه اول، واحد ۱۰۱
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southeast corner of Sadeghieh 2nd Sq., Tehran – Iran
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Email: info@tahaot.com

جمهوری اسلامی ایران
قوهٔ قضائیه ـ اداره مترجمین رسمی

شماره ۳۷۴۲۹۵
ردیف دفتر ثبت

Total Credits Passed: 32
G.P.A: 16.06 (out of 20.00)

-According to academic by-law of the university, each semester includes 16 hours of education for each theoretical credit, 32 hours for each practical credit and 48 hours of education for workshop operations.
-The evaluation standard of grades is from zero to 20. The minimum passing grade in Associate's Degree and Bachelor's Degree course is 10, in Master's Degree is 12 and in Ph.D. course is 14.
This transcript of records is issued without erasure and is registered under No.96020862 dated Jan.13,2018 in the Office of Graduates Affairs.

- Supervisor of Academic Affairs & Postgraduates Studies of Central Tehran Branch: Signed
- Supervisor of Central Tehran Branch of the Islamic Azad University: Signed & Embossed Seal

- Director General of Graduates Affairs of Islamic Azad University: Signed & Sealed

Name & Surname: **Ms. Mahdiyeh Ghasemi**

Certified to be a true and accurate translation of the original and the translator is competent to translate. Tehran, date: July.29,2018

ZAHRA ABBASALI
OFFICIAL TRANSLATOR TO THE JUDICIARY, IRI Tehran 420
زهرا عباسعلی
مترجم رسمی انگلیسی
قوه قضائیه – تهران
دفتر مترجمی ۴۲۰

Department of Official Translators Affairs of the Judiciary of the Islamic Republic of Iran
Only the authenticity of the seal and signature of the Offical Translator is certified. This certification does not include confirmation of the accuracy of the translation and the authenticity of the translated document.
Department of Official Translator's Affairs of the Judiciary of the Islamic Republic of Iran.

محمد رضایی - کارشناس
M.REZAEI
LEGALIZATION OFFICER

مبلغ ۱۲۰ ریال بابت تعرفه
خدمات کنسولی دریافت گردید.

ISLAMIC REPUBLIC OF IRAN
MINISTRY OF FOREIGN AFFAIRS
REGISTRATION AND PERSONAL STATUS DEPARTMENT
۷
The authenticity of the seal & signature marked (X) is certified without any consideration to the contents.

31 JUL 2018 - 700095

باسمه تعالی

اطلبوا العلم من المهد الی اللحد

دانشگاه آزاد اسلامی واحد تهران مرکزی

تاریخ :

شماره :

گواهی می شود خانم مهدیه قاسمی فرزند منوچهر دارای کد ملی ۰۰۸۴۱۲۵۵۱۹

صادره از تهران متولد سال ۱۳۶۷ در رشته فیزیک - اتمی و مولکولی

نظام آموزشی تمام وقت در تاریخ ۱۳۹۴/۰۶/۲۳ دانش آموخته شده است و به دریافت درجه کارشناسی ارشد ناپیوسته از رشته مذکور نایل شده است.

فهرست دروس و ریز نمرات نامبرده در طی دوره تحصیلی به شرح زیر می باشد. صفحه : ۱ از ۱

نیمسال تحصیلی	مشخصات درس				ارزشیابی		
	نام درس	نوع درس	تعداد واحد		نمره		امتیاز واحد
			نظری	عملی	به عدد	به حروف	
نیمسال اول ۹۳-۹۲	فیزیک محاسباتی	الزامی	۱	۱	۱۳	سیزده تمام	۲۶
نیمسال اول ۹۳-۹۲	ریاضی فیزیک ۳	جبرانی	۳		۱۶	شانزده تمام	بدون تاثیر
نیمسال اول ۹۳-۹۲	مکانیک کوانتومی پیشرفته (۱).	الزامی	۳		۱۷/۵۰	هفده و پنجاه صدم	۵۲/۵۰
نیمسال اول ۹۳-۹۲	روش تحقیق	جبرانی	۲		۱۹	نوزده تمام	بدون تاثیر
نیمسال دوم ۹۳-۹۲	فیزیک لیزر	تخصصی گرایشی	۳		۱۵	پانزده تمام	۴۵
نیمسال دوم ۹۳-۹۲	مکانیک کوانتومی پیشرفته (۲).	الزامی	۳		۱۵/۵۰	پانزده و پنجاه صدم	۴۶/۵۰
نیمسال دوم ۹۳-۹۲	الکترودینامیک (۱).	اختیاری	۴		۱۵/۵۰	پانزده و پنجاه صدم	۶۲
نیمسال دوم ۹۳-۹۲	مکانیک آماری پیشرفته (۱).	الزامی	۳		۱۷/۵۰	هفده و پنجاه صدم	۵۲/۵۰
نیمسال اول ۹۴-۹۳	اسپکتروسکوپی لیزری	گرایشی	۳		۱۴	چهارده تمام	۴۲
نیمسال اول ۹۴-۹۳	موضوعات ویژه	تخصصی	۳		۱۴	چهارده تمام	۴۲
نیمسال اول ۹۴-۹۳	وصیت نامه حضرت امام (ره)	جبرانی	۱		۱۶	شانزده تمام	بدون تاثیر
نیمسال دوم ۹۴-۹۳	سمینار	سمینار		۲	۱۸/۷۵	هجده و هفتاد و پنج صدم	۳۷/۵۰
نیمسال دوم ۹۴-۹۳	پایان نامه	پایان نامه		۶	۱۸	هجده تمام	۱۰۸

جمع کل واحدهای گذرانده شده : ۳۲

میانگین کل : ۱۶/۰۶

- براساس آیین نامه آموزشی دانشگاه در طول هر نیمسال تحصیلی برای هریک واحد نظری ۱۶ ساعت ، عملی ۳۲ ساعت و عملیات کارگاهی ۴۸ ساعت آموزش ارائه میشود
- معیار ارزشیابی دروس از نمره صفر تا بیست می باشد و حداقل نمره قبولی در مقاطع کاردانی و کارشناسی ۱۰ و کارشناسی ارشد ۱۲ و دکترای تخصصی ۱۴ می باشد

ZAHRA ABBASALI OFFICIAL TRANSLATOR TO THE JUDICIARY NO. 420

زهرا عباسعلی مترجم رسمی انگلیسی قوه قضائیه - تهران دفتر مترجمی ۴۲۰

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- ریزنمرات فوق بدون هرگونه خط خوردگی و خدشه اعتبار دارد و به شماره ۹۶۲۰۸۶۲ مورخ ۹۶/۱۰/۲۴ در اداره کل امور دانش آموختگان دانشگاه ثبت و تایید شده است

دکتر طهمورث شیری

سرپرست معاونت امور آموزشی و تحصیلات تکمیلی

دکتر محمدمهدی طهرانچی

سرپرست دانشگاه آزاد اسلامی واحد تهران مرکزی

محمد عابدی

مدیر کل دانش آموختگان دانشگاه

اطلبوا العلم من المهد الی اللحد

دانشگاه آزاد اسلامی

سازمان مرکزی

Hashemi, Hosein

<table>
<tr><td>Address</td><td></td><td colspan="2">Email hosein.hashemi@protonmail.ch (update 2019/02/02)</td></tr>
<tr><td colspan="2">Amalienstr. 49a
Munich, Bayern 80799
Germany</td><td colspan="2">Home Phone
Cell Phone (004989) 17647117400
Office Phone (++49 (0)89) 21804639
Skype Name Hosein.Hashemi47</td></tr>
<tr><td>Current Title / Dates</td><td colspan="3">Research assistant</td></tr>
<tr><td>Current Institution</td><td>Ludwig Maximilian University, Physics Faculty, Prof. Dvali chair,</td><td>Department</td><td>Theoretical particle physics group</td></tr>
<tr><td>Location</td><td colspan="3">Theresienstr. 39, Munich, Bayern 80333, Germany</td></tr>
<tr><td>Highest Degree</td><td>MS</td><td>Institution Ludwig Maximilian University</td><td>Date 2019/04 exp</td></tr>
<tr><td>Thesis Advisor</td><td colspan="3">Prof. Georgi Dvali</td></tr>
<tr><td>Thesis Title</td><td colspan="3">On the Topological Origin of Chiral Symmetry Breaking and Aspects of the Attractor Vacua Solution to the Hierarchy Problem</td></tr>
<tr><td>Research Interests</td><td colspan="3">Primary B3a: Dark sectors at the LHC</td></tr>
<tr><td>Secondary</td><td colspan="3">A3a: Extended Higgs sectors at the LHC; A2a: The effective electroweak Lagrangian in the light of the LHC</td></tr>
<tr><td colspan="4">Current Research Interests:
Web Pages: http://www.linkedin.com/in/hosein-hashemi</td></tr>
<tr><td>Discipline(s)</td><td colspan="3">Machine Learning; Mathematical Physics; Particle and Astroparticle Phenomenology; Experimental Neutrino Physics; Data Science; Theoretical Physics; Lattice QCD and Heavy Ion Physics; Quantum Gravity; Quantum Computing; quantum gravity/quantum cosmology; Scientific Computing; Physics</td></tr>
<tr><td>Position(s) applied</td><td colspan="3">PHD</td></tr>
<tr><td colspan="3">1. Dr. Georgi Dvali, Professor (chair) at LMU, Georgi.Dvali@physik.uni-muenchen.de (2019/02/17)</td><td></td></tr>
<tr><td colspan="3">2. Dr. Stefan Hofmann, Professor, stefan.hofmann@physik.lmu.de (2019/02/17)</td><td></td></tr>
<tr><td colspan="4"></td></tr>
<tr><td>Received Materials</td><td>PHD</td><td colspan="2">Cover Letter: file (PDF, PDF 2019/02/06)
Curriculum Vitae: file (PDF, PDF 2019/02/12)
Research Statement: file (PDF, PDF 2019/02/06)
Copies of grades transcripts: file (PDF, PDF 2019/02/06)</td></tr>
</table>

Hosein Hashemi

hosein.hashemi@protonmail.ch ++49(89)17647117400 Munich linkedin.com/in/hosein-hashemi

To

The CRC Admission Committee

07 February, 2019

My name is Hosein Hashemi, and I am a master student at the Ludwig Maximilian University of Munich. My master thesis is on the Topological origin of Chiral Symmetry Breaking and the "Attractor Vacua" solution to the Hierarchy Problem under the supervision of Prof. Gia Dvali. As a student currently finishing my master of physics, I am highly interested in starting a PhD within The Collaborative Research Center "Particle Physics Phenomenology after the Higgs Discovery".

The realization that particle physics is my true passion was an important milestone in my scientific journey. This field of physics explains the creation and annihilation of almost everything in nature with a beautiful structure and satisfies my insatiable appetite for discovering the unknown. Hence, I began to broaden my knowledge in this field and related subjects during my master program. I started with basic courses on QFT, QED, QCD, GR and Group Theory along with Advanced Particle Physics. From the beginning of my studies, I was always looking for open problems in mathematics and physics, especially the ones in between. Hence, to get ready to understand them, I also attended courses such as Algebraic QFT and Mathematical Gauge Theory. Within my 2nd semester, I got introduced to many modern research topics in the interplay between particle phenomenology and theory at ICTP International Summer School on Particle Physics. Since then I decided to continue my career within the adventurous path of exploring the unknown in the framework of BSM. During the two projects I have done for my master thesis, I learned a lot about the Hierarchy problem and almost all of its proposed solutions, Higgs physics, Weak Gravity Conjecture, Effective field theories, Confinement mechanisms, Topological defects, Instanton induced effects, the math and physics behind Anomalies, Green-Schwarz mechanism, Strong CP problem and it solutions, Axion Physics and Dark matter, p-form gauge theories, and Dualities. Moreover, being in a very hard-working and strong research group and presenting every stage of my master thesis in front of them along with attending several summer schools and workshops made me entirely ready to begin a PhD research program. Team-working, doing independent research, looking at the problems from various perspectives and thinking outside the box, and computational abilities are the essential skills I learned during my master thesis.

My goal is to follow my dreams and pursue academic studies to receive my PhD and eventually become a full-time researcher to help the Physics community and also give back to society by spreading science. Within this path, I want to understand the fundamentals of nature and the unknown sectors of physics and mathematics. Also, I am eager to increase the depth of my knowledge over the open problems in particle physics and eventually contribute to solving them which has been my dream ever since I embarked on my journey in Physics. All in all, I can describe myself to have a learner personality who is constantly looking for new challenges. I find myself a risk- lover and adventurous person with a very flexible perspective on different projects and topics to work on for the knowledge I learn within the path. Following my interest and working within the CRC will definitely give me an excellent opportunity to interact with, and learn from the brilliant professional academics in a multi-national environment to expand my knowledge and enhance my abilities. Thus, I view the CRC PhD fellowship in theoretical particle physics with its appealing education program as the ideal continuation of my studies. In particular, the PhD projects are exceptionally intriguing to me for investigating the physics beyond the standard model which is exactly what I enjoy to do during a PhD program. Therefore, I would highly value the privilege of a successful application.

Sincerely,
Hosein Hashemi

Hosein Hashemi

hosein.hashemi@protonmail.ch
++49(89)17647117400
Munich

I am interested in using modern mathematical and machine learning tools along with new physical ideas in model building and solving open problems in particle physics. I love to work on both BSM phenomenology and theory based on LHC physics for their challenges due to the scarcity of analytical methods and the intriguing results ahead. Thus, my research interests are Effective field theories, Axion physics, The physics of Dark matter, New approaches to Naturalness problems such as Strong CP and Hierarchy problem, New CP violation mechanisms, Baryogenesis, Neutrino Physics, Extended Higgs physics, Top-quark physics, Jet physics, Renormalisation group methods, Heavy ions and quark-gluon plasma, Hadron physics and confinement mechanisms.

EDUCATION

Master in Physics
Ludwig-Maximilians-Universität München, Munich

10/2016 – Present *1.18*

Courses
- Quantum Field Theory (1.0).
- Instantons and Black Holes (1.0).
- Scattering Amplitudes in Gauge Theories (1.3).
- Seminar: Particle Physics and the Early Universe (1.3)
- Beyond the Standard Model Physics (exam not taken)
- QCD and Standard Model (1.0).
- QED (1.0).
- Advanced Particle Physics (1.0).
- General Relativity (exam not taken)
- Advanced Quantum Mechanics (2.0).

Bachelor in Science
Urmia University, Urmia

02/2012 – 02/2016 *1.9*

Awards
- Ranked 33rd in Iran Graduate University Entrance Examination (Concours) among 6000 students, 2016.
- Graduated Summa Cum Laude, 2016.
- 2nd rank at Iran Physicists' Tournament, 2016.
- 1st rank at National Competition on Aerospace System Design (VTOL UAV design), 2012.

High School
National Organization for Development of Exceptional Talents (NODET)

2008 – 2011 *1.5*

Awards
- 4th Rank at National Khwarizmi Youth competition with "Triple Blade UAV", 2010.

MASTER THESIS

On the Topological Origin of Chiral Symmetry Breaking and Aspects of the Attractor Vacua Solution to the Hierarchy Problem (11/2017 – 11/2018)

- The goal of this thesis is to describe the topological structure of both QCD and Higgs vacuum. Since the pioneering work of 't Hooft on anomaly matching, it is known that chiral symmetry breaking and confinement are correlated to each other from a fundamental point of view. Here, we investigate how deep their connection is, and see if we can describe dynamical breaking of chiral symmetry without confinement in a p-form language. As a result, we try to shed light on the dynamical breaking of global symmetries in non-confining theories like gravity. Within the second part of the thesis, we examine the "Attractor vacua" solution to the hierarchy problem. In this solution, the hierarchy problem gets promoted from a problem of UV- stability of the Higgs mass, into the problem of a super-selection rule among infinite vacua scanned by the Higgs mass. Here, by mapping the original problem into a quantum mechanical scattering problem, we study the non-trivial effects on the Higgs VEV in the presence of a domain wall localized mass term.

SCHOOLS

11th Odense Winter School on Theoretical Physics (11/2018)
CP3-Origins
- Formal Developments in Quantum Field Theory

Arnold Sommerfeld School (10/2018)
The Arnold Sommerfeld Center for Theoretical Physics
- Black Holes and Quantum Information

The 24th "Saalburg" Summer School (09/2018)
Wilhelm and Else Heraeus Foundation
- Foundation and New methods in Theoretical Physics

International Summer School on Particle Physics (06/2017)
Abdus Salam International Centre for Theoretical Physics (ICTP)

TECHNICAL SKILLS

Programming Python, Julia

Applications Sagemath, Mathematica

TEACHING EXPERIENCE

Mathematical Physics II
Shahid Beheshti University

09/2015 – 01/2016 *Tehran*

Tasks/Achievements
- Teaching Assistant

Contact: *Dr. M. Ali-Akbari*

Mathematical Physics III
Shahid Beheshti University

02/2016 – 06/2016 *Tehran*

Tasks/Achievements
- Teaching Assistant

Contact: *Dr. M. Ali-Akbari*

TEST SCORES

TOEFL ibt (11/2015 – 11/2017)
Reading: 27, Listening:29, Speaking:27, Writing: 22

LANGUAGES

Persian	●●●●●
English	●●●●●
German	●●○○○

PERSONAL INTERESTS

Chess · Swimming · Calisthenics · Judo · Post-Rock Music · Reading Fantasy Novels · Board Games · Life on Other Planets · Astronautics · Psychology

OTHER ACHIEVEMENTS

National Judo championship (2008)
Rank 3rd among 27 competitors in 73kg

National Chess competition (2004)
Rank 11th among 78 chess players under 12 years of age

REFERENCES

Prof. Dr. Georgi Dvali
"Superviser"
Contact: *georgi.dvali@physik.uni-muenchen.de – +49 89 2180-4549*

Prof. Dr. Stefan Hofmann
"Mentor"
Contact: *stefan.hofmann@physik.lmu.de – +49 89 2180-4110*

Hosein Hashemi

hosein.hashemi@protonmail.ch ++49(89)17647117400 Munich linkedin.com/in/hosein-hashemi

To

The CRC Admission Committee,

February 07, 2019

I love to dedicate my time to unravel difficult and unsolved problems using modern mathematical and machine learning tools along with new physical ideas in model building and solving open problems in BSM physics. I love to work on theoretical particle physics and phenomenology for their challenges due to the scarcity of analytical tools in order to reach a higher precision in experiments and explore the unknown theoretical sectors beyond the Standard Model. For instance, understanding of the Mass gap and confinement mechanism in 3 and 4 dimensions, and proving that an infinite volume limit exists thereon, is my true passion. Moreover, Working on the Hierarchy problem so far gave me a strong curiosity and excitement about working on the BSM physics such as Naturalness problems, physics of Dark matter, Axion Physics, Higgs extensions, SUSY breaking mechanisms, CP violation, Neutrino Physics and UV completion due to their vast area for model building and adventure. Finding a both theoretically and phenomenologically viable solution to the Large Electroweak Hierarchy Problem and examining the hidden extension of the Higgs sector is indeed of my deep interest. Furthermore, when I was in the ICTP summer school, I was introduced to the Physics of Dark matter, and its phenomenological implications. It was then I became fond of exploring the Dark Sectors. Thereafter, I continued to increase my knowledge of this subject by studying Prof. Weiner's PITP lectures and Heidelberg's lecture notes on DM. That is why I feel emboldened to pursue these topics in greater depth in a PhD program. Also, topics on Effective field theories, Top-quark physics, Jet Physics, QCD phase transitions, Renormalisation group methods, Heavy ions and quark-gluon plasma, Hadron physics and confinement mechanisms are extremely intriguing for me.

Sincerely,
Hosein Hashemi

LMU LUDWIG-MAXIMILIANS-UNIVERSITÄT MÜNCHEN

PHYSICS

Hashemi Eshkiki, Gholamhosein
born 23 March 1993 in Rasht
Student ID: 11620971

Munich, 23 August 2018

Program: Physics
Degree: Master of Science (M.Sc.)

Transcript of Records in accordance with the examination regulations for the Master program in Physics at Ludwig-Maximilians-Universität München of 30 September 2009

	List of Credit Courses	Term	Grade	ECTS
10200	**Advanced Theoretical Physics**		**2.00**	**9**
10201	Quantum Mechanics II (Brunner)	WS 17/18	2.0	9
20100	**Modern Physics**		**1.00**	**9**
20101	Quantum Field Theory (Ferro)	SS 2017	1.0	9
20200	**Specialisation**		**1.07**	**12**
20201	Seminar: Particle Physics and the Early Universe (Schaile)	WS 17/18	1.3	3
20202	QCD and Standard Model (Helling)	SS 2017	1.0	9
20300	**Research Methods of Modern Physics**		**1.00**	**9**
20301	Quantum Field Theory (Quantum Electrodynamics) (Buchalla)	WS 16/17	1.0	9
20400	**Fundamental Research**		**1.30**	**9**
20401	Introduction in Scattering Amplitudes in Gauge Theories (Ferro)	WS 17/18	1.3	9
30100	**Practical Phase Part 1**	WS 17/18	**BE**	**15**
30200	**Practical Phase Part 2**	SS 2018	**BE**	**15**
30300	**Final Module**			
	Sum of ECTS Credits			**78**
Additional courses not counted for the master exam:				
	Instantons/Black Holes (Mayr)	SS 2018	1.0	9
Sum of ECTS Credits				**9**

End of Transcript

(P)=compulsory module, (WP)=compulsory optional module, BE=passed

Grading scheme:
Grades on each piece of work are indicated as: 1 = very good; 2 = good; 3 = satisfactory; 4 = sufficient; 5 = not sufficient. To guarantee a higher degree of differentiation, grades may be decreased or increased by 0.3. Grades of 0.7, 4.3, 4.7 and 5.3 are not possible.
The final grade is indicated as: up to and including 1.50 = "very good"; from 1.51 up to and including 2.50 = "good"; from 2.51 up to and including 3.50 = "satisfactory" and from 3.51 up to and including 4.00 = "sufficient".

M. Fulgieri

Marion Fulgieri
Examination Office of Physics

PRUFUNGSAMT PHYSIK
LUDWIG-MAXIMILIANS-UNIVERSITÄT
SCHELLINGSTRASSE 4
80799 MÜNCHEN

LUDWIG-MAXIMILIANS-UNIVERSITÄT MÜNCHEN

ZEUGNIS

FÜR MASTERSTUDIENGÄNGE DER FAKULTÄT FÜR PHYSIK

Der/Die Studierende des Studiengangs ____________________

Herr/Frau Gholam Hosein Hashemi Eshkiki

aus München Matrikelnr.: 11620971

geboren am ____________ in ____________

hat im ■ Sommer-/ ☐ Wintersemester 2018

die folgende Lehrveranstaltung erfolgreich besucht:

Titel (deutsch): ____________________

Titel (englisch): Advanced Particle Physics

Dozent: Prof. Dr. Dorothee Schaile

Anzahl der Semesterwochenstunden/ECTS-Punkte: 6 / 9

Note: 1.0

Datum der Prüfung: 12.07.2018

Art der Lehrveranstaltung:
■ Vorlesung mit Übung ☐ Praktikum
☐ Vorlesung ☐ Seminar
☐ Schlüsselqualifikation

München, den 31.7.2018

D. Schaile
Unterschrift des Dozenten

LUDWIG-MAXIMILIANS-UNIVERSITÄT MÜNCHEN

He, Shi-Ping

Address		**Email** 1468944713@qq.com (update 2018/11/11)	
Beijing, Beijing China		**Home Phone** **Office Phone**	
Current Institution	Peking University	**Department**	School of Physics
Location	Beijing, Beijing , China		
Highest Degree	Ph.D	**Institution**	**Date**
Thesis Advisor	Shou-hua Zhu		
Research Interests	**Primary** Particle Physics		
Secondary	Physics beyond the SM; Higgs Physics		
Discipline(s)	Physics		
Position(s) applied	PHD		
1. Shou-Hua Zhu, School of Physics, Peking University, Beijing, China, shzhu@pku.edu.cn (2018/10/23)			file (PDF, PDF, 2018/11/05)
2. Qing-Hong Cao, School of Physics, Peking University, Beijing, China, qinghongcao@pku.edu.cn (2018/10/23)			file (PDF, PDF, 2018/11/10)
3. Kingman Cheung, Department of Physics, National Tsing Hua University, Hsinchu 300, Taiwan, cheung@phys.nthu.edu.tw (2018/10/23)			file (PDF, PDF, 2018/11/06)
Received Materials	**PHD**	**Cover Letter:** file (PDF, PDF 2018/11/04) **Curriculum Vitae:** file (PDF, PDF 2018/11/04) **Research Statement:** file (PDF, PDF 2018/11/04)	

Cover Letter of Shi-Ping He

School of Physics, Peking University, Beijing, China

E-mail: sphe@pku.edu.cn

Date: Oct. 15, 2018

Dear Professor,

I would like to apply for the postdoctoral position in your institute. I am a Chinese PhD student majoring in high energy physics at Peking University (PKU). It is expected that I will receive the doctorate around July, 2019.

I am interested in physics beyond the SM (BSM), especially Higgs related theoretical and phenomenological studies. Muon $g-2$ and R_K, R_D anomalies have drawn much attention of the community with the progress of corresponding experiments, which also attract my curiosity.

During my PhD years, I focus my attention mainly on two BSM models: Higgs singlet model (HSM) and simplest little Higgs model (SLH). In the HSM, I finished the related analytic calculations and numerical results under the guidance of advisor Shou-hua Zhu. For the SLH, we completed several works. I derived the η components in other goldstones at all order of $\frac{v}{f}$, worked out the perturbative unitarity constraints with Yang Zhou independently, got the Lagrangian in mass eigenstates under the discussion with other authors, derived the particle decay width formulas with Ying-nan Mao indenpendently, plotted the production cross section and decay graphs with Po-Yan Tseng independently. Besides, I cross-checked most of the details.

I have benefit a lot from previous researches. I can use Mathematica to do some calculations and plot graphs. I have also learnt some high energy physics related softwares: FeynRules, FeynCalc, LoopTools, MadGraph. Besides, I have read some bibliographies in other fields (dark matter, neutrino, cosmology...). I have attended many national and international conferences and given a talk in SI2018. Up to now, I have published four papers. I was awarded PKU president scholarship in 2017 and national scholarship in 2018.

I am interested in the research topics of your institute. It will be my great honour to join you. I will treasure the opportunity and spare great effort in research if I can receive the offer.

Yours sincerely,

Shi-Ping He

Curriculum Vitae

Shi-Ping He

November 4, 2018

Personal information

First Name: Shi-Ping **Family Name:** He

Gender: Male **Nationality:** Chinese

Current Institution: School of Physics, Peking University, Beijing, China

E-mail: sphe@pku.edu.cn **Phone:** +86 18811785276 **Postcode:** 100871

Address: No.5 Yiheyuan Road Haidian District, Beijing, P.R.China

My personal information can also be searched via inspirehep website: http://inspirehep.net/author/profile/S.P.He.1.

Education career

BSc (Physics), Wuhan University (WHU), 2010-2014

PhD (Theoretical Physics), Peking University (PKU), 2014-2019

PhD Advisor, Prof. Shou-hua Zhu.

Research interest

Physics beyond the SM (BSM), especially Higgs related theoretical and phenomenological studies. Muon $g-2$ and R_K, R_D anomalies.

Publication list

[1] **Shi-Ping He**, Shou-hua Zhu. One-Loop Radiative Correction to the Triple Higgs Coupling in the Higgs Singlet Model. Phys.Lett. B764 (2017) 31-37, arXiv: 1607.04497.

[2] **Shi-Ping He**, Ying-nan Mao, Chen Zhang, Shou-hua Zhu. $ZH\eta$ vertex in the simplest little Higgs model. Phys.Rev. D97 (2018) no.7, 075005, arXiv: 1709.08929.

[3] Kingman Cheung, **Shi-Ping He**, Ying-nan Mao, Chen Zhang, Yang Zhou. Simplest little Higgs model revisited: Hidden mass relation, unitarity, and naturalness. Phys.Rev. D97 (2018) no.11, 115001, arXiv: 1801.10066.

[4] Kingman Cheung, **Shi-Ping He**, Ying-nan Mao, Po-Yan Tseng, Chen Zhang. Phenomenology of a little Higgs pseudoaxion. Phys.Rev. D98 (2018) no.7, 075023, arXiv:1809.03809.

Skills and Hobbies

I know how to use the Mathematica (do some calculations and plot graphs). I have learnt some high energy physics related softwares: FeynRules, FeynCalc, LoopTools, MadGraph. In my spare time, I like to do some outer sports.

Conferences attended

I have attended several national and international conferences:
a. 21th International Summer Institute on Phenomenology of Elementary Particles and Cosmology (SI2015, August 2015, Yan-Xi Lake),
b. The fifth Annual Large Hadron Collider Physics conference (LHCP2017, May 2017, Shanghai Jiao Tong University),
c. The 28th International Symposium on Lepton Photon Interactions at High Energies (LP2017, August 2017, Sun Yat-Sen University),
d. 21st Mini-workshop on the frontier of LHC (April 2018, Nanjing),

e. 24th International Summer Institute on Phenomenology of Elementary Particle Physics and Cosmology (SI2018, August 2018, Tianjin).

I give a talk 'Simplest Little Higgs Revisited: the $ZH\eta$ vertex' in SI2018
(see https://indico.ihep.ac.cn/event/7780/material/slides/28.pdf)

Awards

PKU president scholarship in 2017 and national scholarship in 2018

List of references

Dr. Shou-hua Zhu (Advisor)

Academic title: Professor E-mail: shzhu@pku.edu.cn

Institution: School of Physics, Peking University, Beijing, China

Dr. Qing-Hong Cao

Academic title: Professor E-mail: qinghongcao@pku.edu.cn

Institution: School of Physics, Peking University, Beijing, China

Dr. Kingman Cheung

Academic title: Professor E-mail: cheung@phys.nthu.edu.tw

Institution: Department of Physics, National Tsing Hua University, Hsinchu 300, Taiwan

Research Statement

Shi-Ping He

November 4, 2018

Research interest

As we all know, standard model (SM) has been verified by enormous experiments from low to high energy scales. Many unsolved problems in SM (gravity, naturalness, dark matter, baryon asymmetry, neutrino mass and so on) have inspired the community to search for physics beyond the SM (BSM). The discovery of Higgs boson may give us some footprints to these suspense.

I am interested in BSM physics, especially Higgs related theoretical and phenomenological studies. Muon $g-2$ and R_K, R_D anomalies have drawn much attention of the community with the progress of corresponding experiments, which also attract my curiosity.

Summary of completed works

One-Loop Radiative Correction to the hhh in the Higgs Singlet Model

In Ref [1], we studied the triple Higgs coupling in the Higgs singlet model (SM extended by a pure gauge singlet). We found that it can receive sizable radiative correction at one-loop. hZZ coupling is a complementarity owing to the high precision. Then this model may be tested at future high energy colliders by hhh, hZZ precision measurement. In this work, I finished the related analytic calculations and numerical results under the guidance of advisor Shou-hua Zhu.

$ZH\eta$ vertex in the simplest little Higgs model

In Ref [2], we found there is something wrong with $ZH\eta$ vertex in simplest little Higgs model (SLH) in previous literatures, because of the gauge invariance violation for $ff \to \eta H$

scattering amplitude using their Feynman rules. After the scalar kinetic terms are canonically normalized, mass terms are diagonalized, scalar vector two-point functions are removed, we got the consisted $ZH\eta$ interactions, which is just the topic of my talk given in SI2018 (see [6]). In this work, I derived the η components in other goldstones at all order of $\frac{v}{f}$. Besides, I cross-checked most of the calculation details.

Simplest little Higgs model revisited: Hidden mass relation, unitarity, and naturalness

In Ref [3], we re-analysed the scalar potential in SLH through $\overline{MS}$ renormalization scheme in Landau gauge, then the unphysical cutoff Λ is removed. A mass relation related to m_η, f, m_T, t_β was obtained. We also re-considered the naturalness argument, which favours $m_\eta \sim 500\text{GeV}, m_T \sim 3\text{TeV}$. In this work, I worked out the perturbative unitarity constraints with Yang Zhou independently. Besides, I cross-checked most of the calculation details.

Phenomenology of a little Higgs pseudo-Axion

In Ref [4], we performed an exhaustive phenomenology of η in SLH. Main production channels and decay modes are investigated. We found that detection of η at 14TeV (HL-)LHC is challenging, thus the 27TeV HE-LHC and 100TeV FCC-hh or SppC are motivated to capture such a CP-odd scalar. In this work, I got the Lagrangian in mass eigenstates under the discussion with other authors, derived the particle decay width formulas with Ying-nan Mao indenpendently, plotted the production cross section and decay graphs with Po-Yan Tseng independently.

Note added:

For more information, please see inspirehep website http://inspirehep.net/author/profile/S.P.He.1.

I have trained a lot and mastered some skills from these studies. Then the experience will lay the foundation of next researches.

I have attended many national and international conferences and given a talk in SI 2018 (see [6]).

Future research plan

Higgs precision measurements

Since the discovery of Higgs boson, the precision measurements of Higgs have become a very urgent project. It can help us understand the electro-weak symmetry breaking mechanism (EWSB) and even serve as a door to new physics (NP). $h \to ZZ, WW, \gamma\gamma, b\bar{b}, \tau\tau$ and $t\bar{t}h$ production have been observed. $h \to \gamma Z, \mu\mu$ and hh production are still not discovered. Precision measurement of $hb\bar{b}$ remains challenging, which may be improved through artificial intelligence (AI). I am interested in the anomalous $hb\bar{b}, hhh$ coupling study from experimental and theoretical perspectives.

CP property of the Higgs

There is no fundamental scalar before the discovery of Higgs. Then CP study of this scalar will give us further knowledge of the nature. Although the possibility of SM-like Higgs to be a pure CP-odd state is excluded, there is still some room for the scalar to be a CP-mixed state. Many works have appeared, for example: measuring the CP property from $h \to \tau\tau(\tau \to \nu_\tau \rho), h \to ZZ \to 4\ell$. CP violation related to the Higgs may give us another way of understanding the baryogenesis (BG). It will be also interesting to construct new processes, observables and techniques to measure CP nature of the Higgs.

Muon $g-2$ and R_K, R_D anomalies

These low energy anomalies have been longstanding puzzles in particle physics. Investigations of these areas are becoming more and more important with the development of Muon $g-2$ and B-factories experiments, thus it may infer some clues to low energy NP as a complementary direction of LHC. These problems are also within my future research interest.

References

[1] **Shi-Ping He**, Shou-hua Zhu. One-Loop Radiative Correction to the Triple Higgs Coupling in the Higgs Singlet Model. Phys.Lett. B764 (2017) 31-37, arXiv: 1607.04497.

[2] **Shi-Ping He**, Ying-nan Mao, Chen Zhang, Shou-hua Zhu. $ZH\eta$ vertex in the simplest little Higgs model. Phys.Rev. D97 (2018) no.7, 075005, arXiv: 1709.08929.

[3] Kingman Cheung, **Shi-Ping He**, Ying-nan Mao, Chen Zhang, Yang Zhou. Simplest little Higgs model revisited: Hidden mass relation, unitarity, and naturalness. Phys.Rev. D97 (2018) no.11, 115001, arXiv: 1801.10066.

[4] Kingman Cheung, **Shi-Ping He**, Ying-nan Mao, Po-Yan Tseng, Chen Zhang. Phenomenology of a little Higgs pseudoaxion. Phys.Rev. D98 (2018) no.7, 075023, arXiv:1809.03809.

[5] **Shi-Ping He**, Ying-nan Mao, Chen Zhang, Shou-hua Zhu. $ZH\eta$-vertex: Effective Field Theory Analysis and the Behavior in the Simplest Little Higgs Model.

[6] https://indico.ihep.ac.cn/event/7780/material/slides/28.pdf.

PEKING
UNIVERSITY

北京大學

To whom it may concern

I am writing you to recommend Mr. Shi-ping He for the application of the postdoctoral position in your distinguished institute. Shi-ping is expected to get his PhD in 2019 and I am his Ph.D thesis advisor. Since he became my student more than 4 years ago, I had the appropriate angle to know him. In a word, I strongly recommend Shi-ping without any reservation.

After finished the required graduate courses in Institute of Theoretical Physics, the first academic stuff he impressed me is about the study on Higgs properties in the Singlet Model. Shi-ping worked almost independently, from the motivation, analytical calculation, numerical calculation and the paper drafting. I would expect such excellent performance in his latter stage. Finally this paper has been published in PLB.

The next project is about the Z-H-eta vertex study in the simplest little Higgs model. This project is evolved from the question: what kind of effective Lagrangian one can writes in a model independently way, if there is one extra light Higgs boson as in the Lee-Model. Shi-ping did all calculations independently in order to cross-check the results. This paper has been published in PRD.

For all projects, Shi-ping showed his ability to raise the question, motivate the idea and solve the difficult technical issues. Based on the collaboration, the merits of him can be summarized as following

- Independence
- Self-motivated
- Hard-working
- Easy to collaborate with
- Excellent personality

Given opportunity, Shi-ping will become more mature and confident to be a young high energy physicist. I strongly recommend him without any reservation. If you have any question, please don't hesitate to contact me via e-mail.

Yours sincerely

Shou-hua Zhu
Professor in theoretical Physics, Peking University
E-mail: shzhu@pku.edu.cn Tel：86-10-62761156

PEKING UNIVERSITY

QING-HONG CAO
Institute of Theoretical Physics
School of Physics, Peking University
Beijing, 100871, CHINA
Phone: (086) 10-62762606
E-mail: qinghongcao@pku.edu.cn

To Whom It May Concern,

I am writing to support Mr. Shi-Ping He for applying postdoc position in your group. Mr. He is a fifth-year graduate student in High Energy Theory group at Peking University. He has a solid background on quantum field theory and the phenomenology of particle physics. I am writing this letter to acquaint you with his academic performance.

I have known Shi-Ping since 2014. Together with Prof. Shou-Hua Zhu (Mr. He's thesis advisor), I organize a weekly meeting to discuss the recent progress in high energy physics. I had a lot of discussions with Shi-Ping in journal clubs. It is fair to say that I know Shi-Ping very well. Shi-Ping has great interest in physics beyond the SM (BSM), especially Higgs related theoretical and phenomenological studies. He is curious about the latest developments in particle physics.

Shi-Ping is very independent. I learned from his collaborator that, in his first paper of "one-loop corrections to triplet Higgs boson coupling in the Higgs singlet model", Shi-Ping is responsible for getting this project started and he played a central role in keeping it going. It is nice to see young student takes the initiative to team up to complete the analysis on his own. During the work Shi-Ping showed his good skill at analytical calculation and programming.

Later on Shi-Ping is interested in the so-called simplest Little Higgs model. He and his collaborators found a correct way to deal with the $ZH\eta$ vertex and studied the phenomenology of little Higgs pseudoaxion. Through the work Shi-Ping mastered all the relevant issues and tools (FeynRules, FeynCalc, MadSuites) in collider physics.

Shi-Ping is modest and easygoing. I witnessed the growth of Shi-Ping during the past years. He impresses me by his independence and strong drive to work. Shi-Ping has, I believe, all the qualities of a very promising researcher in high-energy theory and he can contribute in a positive and relevant way to any group interested in phenomenology of particle physics. I very strongly support his application for a postdoc position at your institution.

Sincerely,

Qing-Hong Cao

QING-HONG CAO
Professor of Physics

國立清華大學物理學系
DEPARTMENT OF PHYSICS, National Tsing Hua University
No.101, Sec.2, Kuang Fu Rd., Hsinchu, Taiwan 30043, R.O.C
TEL: 886-(0)3-5742511 FAX: 886-(0)3-5723052 Web site: www.phys.nthu.edu.tw

Email: kingman.cheung@cern.ch
Phone: 03-5731276

November 7, 2018

Dear Selection Committee,

I recommend Dr. Shi-Ping He for a research position in your institute.

I came to know Shi-Ping through a postdoc, Dr. Chen Zhang, in my institute. They were friends back in the Peking University under the same adviser. Although we have not met each other, I feel that he is a very sincere person when he first asked me to write a letter for him.

Dr. He will receive his Ph.D from the Peking University in 2019 under the guidance of Professor Shou-hua Zhu. I am sure Prof. Zhu will write more on his personality and progress during his Ph.D study. Here I only describe his contributions to the two works that we collaborated on. Dr. Chen Zhang came to the NCTS in September 2017. Since then Chen, Shi-Ping, and I have been working on the subject of Little Higgs models, especially, the fine-tuning problem in the Simplest Little Higgs model (SLH) and the phenomenology of the η meson in the model.

Simplest little Higgs model revisited: Hidden mass relation, unitarity, and naturalness published in Phys. Rev. D97 (2018) 115001. The main focus of this work is on deriving a mass relation between the pseudoaxion mass m_η and the heavy top mass m_T. Imposing partial-wave unitarity an upper bound on f is obtained, and together with the mass relation one can map out the viable parameter space in $f, \tan\beta, m_T$. We also propose a strategy of analyzing the fine-tuning problem consistent with continuum effective field theory and apply it to the simplest little Higgs models. Shi-Ping played an important role in this work. He and Chen worked out all the formulas in the paper. They checked against each other's results. What I can say they both can do very technical works.

Phenomenology of a Little Higgs Pseudo-Axion, published in Phys. Rev. D98 (2018) 075023. In the previous work, the mass of the pseudoaxion is bounded and can be abundantly produced at the LHC. So in this work we pursue the phenomenology of the little Higgs pseudoaxion in the anomaly-free SLH model. We show that for natural region in the parameter space, the SLH pseudo-axion is top-philic, decaying almost exclusively to a pair of top quarks. The direct and indirect production of such a pseudo-axion at the 14TeV (HL-)LHC turns out to suffer from either large backgrounds or small rates, making its detection quite challenging. We also extended to pp colliders with higher energy and luminosity, such as the 27TeV HE-LHC, or even the 100TeV FCC-hh or SppC, is therefore motivated to capture the trace of such a pNGB. In this work, Shi-Ping was doing most of the numerical work. He and

Dr. Tseng (another collaborator, my former student) checked against each other's numerical results. Shi-Ping is quite familiar with Madgraph and other simulation tools.

Overall, Dr. Shi-Ping He can do both tedious algebra and numerical works. He will be a very valuable addition to any research group in particle physics. I recommendation him strongly.

Yours Sincerely,

Kingman Cheung

Kingman Cheung
Tsing Hua Chair Professor
Fellow of American Physical Society

Hidayat, Alam Ahmad

Address		**Email** alamahmadh@gmail.com (update 2019/02/13)	
Kp. Kaum, RT4, RW2, Desa Jayagiri, Kec. Lembang Kab. Bandung Barat, West Java Bandung, Jawa Barat 40391 Indonesia		**Home Phone** **Cell Phone** (+62) 82128721828 **Office Phone**	
Current Title / Dates	Fresh Graduate		
Current Institution		**Department**	
Location	, N/A , Indonesia		
Highest Degree	MSc	**Institution** Helmholtz-Institut für Strahlen- und Kernphysik, University of Bonn	**Date** 2018/11
Thesis Advisor	PD. Dr. Andreas Wirzba		
Thesis Title	Bayesian Study of the Pion Charge Radius		
Research Interests	**Primary** Particle and Astroparticle physics phenomenology		
Secondary	Theoretical Cosmology		
Discipline(s)			
Position(s) applied	PHD		
1. Prof. Dr. Bastian Kubis, Helmholtz-Institut für Strahlen- und Kernphysik, Universität Bonn, kubis@hiskp.uni-bonn.de (2019/02/07)			file (PDF, PDF, 2019/02/08)
2. Dr. Christoph Hanhart, Forschungszentrum Jülich Institute for Nuclear Physics, c.hanhart@fz-juelich.de (2019/02/07)			file (PDF, PDF, 2019/02/08)
Received Materials	**PHD**	**Cover Letter:** file (PDF, PDF 2019/02/13) **Curriculum Vitae:** file (PDF, PDF 2019/02/13) **Research Statement:** file (PDF, PDF 2019/02/13) **Copies of grades transcripts:** file (PDF, PDF 2019/02/13)	

February 14, 2019

Collaborative Research Center TRR 257
"Particle Physics Phenomenology after the Higgs discovery”
Germany

To the Search Committee,

I am writing to apply for the PhD position in theoretical particle physics within The Collaborative Research Center “Particle Physics Phenomenology after the Higgs discovery". I recently graduated with a master's of science degree in physics at University of Bonn with a specialization in theoretical hadron physics. I am confident that the skills and knowledge I acquired during my previous study is sufficient to embark on a research trajectory in phenomenology of particle physics. I currently develop fascination towards one of the available topics concerning the searches of new physics at LHC by adopting our understanding of vector-boson scattering and multi-boson production. Additionally, I am also excited to welcome another open opportunity in investigating the process with colour-singlet single-particle final states for the determination of parton distribution functions.

My master's thesis, entitled “Bayesian Study of the Pion Charge Radius”, has become the pivotal opportunity in gaining experience to work on a interdisciplinary research for the first time. Not only does the research deal with the theoretical aspect of dispersion theory, but it also incorporates a statistical analysis based on Bayesian method to extract information about the updated value of the pion charge radius.

Apart from the skills and knowledge I acquired during the phase of my master's thesis research, I have attended the relevant coursework on both theoretical and experimental aspects of particle physics at colliders and accelerators. I also participated in one-month research internship in dispersion theory research group under guidance of Professor Dr. Bastian Kubis and his PhD students. The research is a preliminary study of the hadronic contribution of the anomalous magnetic of muon. In addition, I actively took part in Hadron Physics Summer School held by Forschungzentrum Juelich and the participating universities such as University of Bonn.

Throughout my college years, I have been committed to improve my academic career by having achieved some awards, especially by obtaining prestigious scholarships awarded by Indonesia government during studying for bachelor's degree in Indonesia and master's degree in Germany. Therefore, I am confident that I will be able to venture into a competent academic and research trajectory with the support from the collaborative research center to encourage me to involve in relevant research and doctoral training. Moreover, I believe that joining this PhD program enables me to build a broad network of research institutions for particle physics.

I also enclose my curriculum vitae, statements of research interests, and two letters from relevant professional references under separate files. Thank you very much for your consideration to review my application. I look forward to hearing from you.

Sincerely,
Alam Ahmad Hidayat

CURRICULUM VITAE

Personal Information

Name	Alam Ahmad Hidayat
Current address	Gang Kaum, Desa Jayagiri RT 04 RW 02 40391 Lembang District, West Bandung Regency Indonesia
Telephone	+6282128721828
Email	alamahmadh@gmail.com
Nationality	Indonesian
Date of Birth	October, 20 1992
Gender	Male

Education

Dates	**2016 – 2018**
Name and type of organization providing education	Bonn-Cologne Graduate School of Physics and Astronomy, Universität Bonn
Language of Instruction	English
Principal Subject/occupational skills covered	Master’s Thesis Topic : “*Bayesian Study of the Pion Charge Radius*”
Expected Awarded degree	Master of Science in Physics (M.Sc)
Level in national classification	Final Grade : 1.9–good (gut) based on Germany Grading Scheme
Graduation date	7 November 2018
Dates	**2010 – 2014**
Name and type of organization providing education	Institut Teknologi Bandung (ITB).
Language of Instruction	Mostly Bahasa Indonesia
Principal Subject/occupational skills covered	Bachelor’s Thesis Title “*The Penrose Inequality in Higher Dimensional Spherically Symmetric Spacetimes*”
Awarded degree	Sarjana Sains (S.Si) equivalent to Bachelor of Science (B.Sc) in Physics
Level in national classification	GPA 3.61 out of 4.00– High distinction (Cum Laude)
Graduation date	October, 18 2014
Dates	**2007 – 2010**
Name and type of organization providing education	SMAN 1 Lembang (Public High School Number 1 Lembang)
Level in national classification	Total National Examination Score : 52.55 out of 60.00
Graduation date	April, 27 2010

Employment Experiences

Dates	**2017**
Name and address of employer	Helmholtz-Institut für Strahlen- und Kernphysik, Universität Bonn
Type of business or sector	Academic
Occupation or position held	Research Intern
Responsibilities	Active participation in Prof. Bastian Kubis research group to undertake a small-scale research project of one month duration in summer semester break. The topic deals with an analytical and numerical calculation of hadronic contribution in the theoretical prediction of the anomalous magnetic of the muon using dispersion relation.
Dates	**2015 – 2016**
Name and address of employer	Laboratory of Theoretical Physics, Faculty of Mathematics and Natural Sciences, Institut Teknologi Bandung, Bandung-Indonesia
Type of business or sector	Academic
Occupation or position held	Research assistant
Responsibilities	• Active involvement in theoretical physics research concerning the improvement of previous work from undergraduate final project: resolve the conjecture of the Penrose inequality for more general case by employing method called Jang Equation and inverse mean curvature flow. • Making progress report as well as presentation of the research each week.
Dates	**April 2015 – 2016**
Name and address of employer	Bintang Pelajar, Bandung-Indonesia
Type of business or sector	Academic Tutoring Services
Occupation or position held	Physics tutor
Responsibilities	Helping high school students to grasp the core concepts of elementary physics in more effective ways and guiding them to improve relevant skills in solving various physics problems.
Dates	**January 2013 – June 2014**
Name and address of employer	Physics Program Study, Faculty of Mathematics and Natural Sciences, Institut Teknologi Bandung, Bandung-Indonesia.
Type of Business or sector	Academic
Occupation or position held	Grader and Tutorial Assistant (Fundamental Physics I & II courses)
Responsibilities	• Helping lecturer to correct homework and quizzes done by freshmen who took Fundamental Physics courses. • Guiding the freshmen in gaining understanding about physics topics given by lecturer and solving difficult physics problems by giving tutorials.
Dates	**September 2011 – December 2011**
Name and address of employer	Fundamental Physics Laboratory, Faculty of Mathematics and Natural Sciences, Institut Teknologi Bandung.
Type of business or sector	Academic
Occupation or position held	Laboratory Assistant

Responsibilities	Guiding freshmen who took fundamental physics course to perform some basic experiments on mechanics and electromagnetism and giving them score according to their performance and lab report.
Workshops	
Dates	24 September 2018 – 28 September 2018
Name of Event	Hadron Physics Summer School Juelich 2018
Place	Juelich, Germany
Dates	13 March 2017 – 17 March 2017
Name of Event	Bonn-Cologne Graduate School of Physics and Astronomy (BCGS) Intensive Week on Topological Insulators
Place	Bonn, Germany
Organization Experience and Community Involvement	
Dates	**2016 – Today**
Name of organization/community	FORMAL LPDP Jerman
Position held	Member
Dates	**2014 – 2016**
Name of organization/community	Theoretical Physics Research Group ITB
Position held	Research assistant
Dates	**2011 – 2014**
Name of organization/community	Himpunan Mahasiswa Fisika ITB (Society of Physics Student ITB)
Position held	Member
Dates	**2014 – 2016**
Name of organization/community	Keluarga Pelopor (Community of West Java Government scholarship recipient)
Position held	Member of academic division
Technical Skills	Python (intermediate) Mathematica (intermediate) C++ (basic) Microsoft office (Word, Excel, Powerpoint)
Language Proficiencies	
Mother's tongue	**Bahasa Indonesia**
Other languages	**English** : IELTS 6.00, TOEFL ITP 557, CEFR B2 (result in 2015 has not yet been renewed) **German** : Basic Vocabularies

Honors and Awards

Date **2016 – 2018**
Recipient of Indonesian Education Scholarship (BPI) to pursue master degree.
- Prestigious national scholarship funded by Indonesian government and managed by LPDP (Indonesia Endowment Fund for Education).

Date **2010 - 2014**
Recipient of Pelopor Scholarship during four-year undergraduate study.
- Full-ride scholarship awarded by West Java government for outstanding high school students residing in West Java province who got admitted to Institut Teknologi Bandung.

Research interests

Phenomenology of Particle physics, Theoretical Hadron Physics, Astroparticle Physics, Theoretical Cosmology, Bayesian Statistics

Scientific Publications

1. Title : ***Higher Dimensional Penrose Inequality in Spherically Symmetric Spacetimes***
   Authors : **Alam Ahmad Hidayat**, Bobby Eka Gunara, Fiki Taufik Akbar
   Published in Chinese Journal Physics, June 2016.

2. Title : ***The Penrose Inequality in Spherically Symmetric Spacetimes***
   Authors : **Alam Ahmad Hidayat**, Bobby Eka Gunara, Fiki Taufik Akbar
   Published in International Conference on Mathematics and Natural Sciences (ICMNS) 2014 Proceeding.

3. Title : ***Simulasi gerak tali bermassa dengan menggunakan persamaan Lagrange terkopel berbasis bahasa C++***
   Title (in English) : ***C++ Programming Simulation of the Dynamics of Heavy Hanging Rope Using Coupled Lagrange Equations***
   Authors : Freddy Giovanni Setiawan, **Alam Ahmad Hidayat**, Ryan Sentosa, Erlandy Dwinanto.
   Published in Seminar Kontribusi Fisika 2012 Proceeding.

Relevant Non- Academic Experience

1. Active participation in religious events in Indonesia muslim community in Bonn
   2016 – 2018

2. Actively contribute to strengthen "communication bridge" among Indonesian students holding LPDP scholarship in Germany (FORMAL Jerman) via annual community events and cultural activities held in some Germany cities.
   2016 – Today

3. Involved in the fundraising team to support for "Seminar Olimpiade Astronomi Tingkat SMA" event held in ITB as part of final project in compulsory course in Astronomical Institution Management.
   2014

4. Active collaboration in organizing the annual HIMAFI graduation prom to commemorate the contribution of HIMAFI graduates.
   2011 - 2012

References

1. Prof. Dr. Bastian Kubis
   Helmholtz-Institut für Strahlen- und Kernphysik, Universität Bonn
   Email : kubis@hiskp.uni-bonn.de

2. Prof. Dr. Christoph Hanhart
   Forschungszentrum Jülich Institute for Nuclear Physics
   Email : c.hanhart@fz-juelich.de

STATEMENT OF RESEARCH INTEREST

Alam Ahmad Hidayat

I have been awarded master's of science degree in physics at University of Bonn with a specialization in theoretical hadron physics. During my master study, I involved in an independent research project that is quantifying the value of the pion charge radius that can provide information about hadron interactions at low energies. I employed a numerical Bayesian analysis to a statistical model designated to explain the recent experimental data for the pion form factor in the timelike region and hence obtain a more accurate value of the radius.

I decided to conduct a master's thesis research in this direction under supervision of two thesis supervisors, PD Dr. Andreas Wirzba and Professor Dr. Bastian Kubis. The work attempts to extract the pion charge radius from a parametrization of the above data by utilizing a dispersion relation as a consequence of the universality of final-state interactions. Moreover, the computation of the dispersion integral is performed using the pion-pion partial wave phase based on the dispersive analysis that is available from the Madrid group. I then wrote a python program to perform a Bayesian method to establish a posterior distribution function (pdf) in which all of the information about the parameters, including the pion charge radius, is contained. The pdf is sampled via a Markov Chain Monte Carlo (MCMC) algorithm called *emcee* that is a novel development of an affine invariant sampling algorithm, which in turn enters the statistical analysis. Apart from the parameter inference, I also performed Bayesian model selection to determine the number of parameters needed in the model to explain the data sets better via Bayesian model complexity.

I have been formally familiar with the basic of theoretical and experimental particle physics by attending the relevant coursework. Prior to the master's thesis project, I also participated in a one-month research internship in Professor Kubis research group in the end of summer semester 2017. The topic deals with a calculation of hadronic contributions in a phenomenological prediction to improve the value of anomalous magnetic of the muon using the same approach from the dispersion theory. The internship helped me to build skills in mathematica and python programming due to the necessity to perform numerical computation and statistical analysis on the experimental pion form factor data sets.

I find that the current projects of the CRC framework is appealing to me due to the emphasis of one of the research topics on developing the existing methodology to understand the vector-boson scattering for measurements and searches for new physics in the LHC. I envision my future research within the CRC team to carry out analytical and numerical computations to endow the necessary knowledge and predictions about the interactions of the vector-bosons. There is also a possible opportunity to engage in a relevant skill training in simulation and data analysis to anticipate the experimental result from the LHC and investigate it on the basis of the theoretical computation of the processes. In addition, I enjoy to take part in improving the precision of event measurements in the LHC by taking into account the accurate description of a parton shower in which possible quantum interference effects take place. I will also strongly consider to pursue research on the implementation of the parton shower analysis to the measured events at the collider. Considering the participating institutions's excellent track records of research on phenomenology of elementary particles, working within the framework of the CRC would be a great opportunity for me to embark on interdisciplinary research career in this direction.

Rheinische Friedrich-Wilhelms-Universität Bonn

Mathematisch-Naturwissenschaftliche Fakultät

CERTIFICATE

Alam Ahmad Hidayat

born on October 20th, 1992 in Bandung (Indonesia)

has successfully passed the examinations for the degree
Master of Science in Physics
on November 7th, 2018

with the overall grade **good (1.9)**

Academic Records:

Module				CP	Grade
Advanced Laboratory Course				**7**	**satisfactory (2.7)**
- physics601: Advanced Laboratory Course					
summer semester 2017	ECTS:	7	Grade: 2.7		
Elective Courses Theoretical Physics				**7**	**satisfactory (3.0)**
- physics606: Advanced Quantum Theory					
winter semester 2016/2017	ECTS:	7	Grade: 3.0		
Specialization				**24**	**good (2.5)**
- physics611: Particle Physics					
winter semester 2016/2017	ECTS:	6	Grade: 2.0		
- physics615: Theoretical Particle Physics					
winter semester 2016/2017	ECTS:	7	Grade: 3.7		
- physics632: Physics of Hadrons					
summer semester 2017	ECTS:	6	Grade: 2.7		
- physics633: High Energy Collider Physics					
summer semester 2017	ECTS:	6	Grade: 1.7		
Seminar				**4**	**good (2.0)**
- Seminar on Theoretical Hadron Physics					
summer semester 2017	ECTS:	4	Grade: 2.0		

Elective Advanced Lectures			**18 good (2.4)**
- physics711: Particle Astrophysics and Cosmology			
winter semester 2016/2017	ECTS: 6	Grade: 2.3	
- physics737: Intensive Week: Advanced Topics in Photonics and Quantum Optics: BCGS Intensive week on Topological Insulators			
winter semester 2016/2017	ECTS: 4	Grade: 2.3	
- physics755: Quantum Field Theory			
summer semester 2017	ECTS: 7	Grade: 3.0	
- physics799: Internships in the Research Groups			
winter semester 2016/2017	ECTS: 4	Grade: 2.0	
Scientific Exploration of the Master Thesis Topic			**15 very good (1.3)**
- physics910: Scientific Exploration			
summer semester 2018	ECTS: 15	Grade: 1.3	
Methods and Project Planning			**15 very good (1.3)**
- physics920: Methods and Project Planning			
summer semester 2018	ECTS: 15	Grade: 1.3	
Master Thesis			**30 very good (1.5)**
- Master Thesis			
winter semester 2018/2019	ECTS: 30	Grade: 1.5	

Subject of the Master Thesis: "Bayesian Study of the Pion Charge Radius"

Bonn, December 7th, 2018

Head of the Examining Board
in Physics and Astronomy

signed

Prof. Dr. Hartmut Schmieden

Notes:
ECTS: work load of module according to the European Credit Transfer and Accumulation System
CP (Credit Points according to the examination regulations): weight of the module in the overall grade

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This English translation of the German original document is certified to be complete and correct.

Bonn, December 7th, 2018

Prof. Dr. Hartmut Schmieden

Rheinische Friedrich-Wilhelms-Universität Bonn

Mathematisch-Naturwissenschaftliche Fakultät

PRÜFUNGSZEUGNIS

Alam Ahmad Hidayat

geboren am 20. Oktober 1992 in Bandung (Indonesien)

hat die Masterprüfung im Studiengang
Physik

am 7. November 2018

mit der Gesamtnote **gut (1,9)** bestanden.

Es wurden folgende Prüfungsleistungen erbracht:

Modul				LP	Note
Advanced Laboratory Course				**7**	**befriedigend (2,7)**
- physics601: Advanced Laboratory Course					
Sommersemester 2017	ECTS:	7	Note: 2,7		
Elective Courses Theoretical Physics				**7**	**befriedigend (3,0)**
- physics606: Advanced Quantum Theory					
Wintersemester 2016/2017	ECTS:	7	Note: 3,0		
Specialization				**24**	**gut (2,5)**
- physics611: Particle Physics					
Wintersemester 2016/2017	ECTS:	6	Note: 2,0		
- physics615: Theoretical Particle Physics					
Wintersemester 2016/2017	ECTS:	7	Note: 3,7		
- physics632: Physics of Hadrons					
Sommersemester 2017	ECTS:	6	Note: 2,7		
- physics633: High Energy Collider Physics					
Sommersemester 2017	ECTS:	6	Note: 1,7		
Seminar				**4**	**gut (2,0)**
- Seminar on Theoretical Hadron Physics					
Sommersemester 2017	ECTS:	4	Note: 2,0		

Elective Advanced Lectures			**18 gut (2,4)**
- physics711: Particle Astrophysics and Cosmology			
Wintersemester 2016/2017	ECTS: 6	Note: 2,3	
- physics737: Intensive Week: Advanced Topics in Photonics and Quantum Optics: BCGS Intensive week on Topological Insulators			
Wintersemester 2016/2017	ECTS: 4	Note: 2,3	
- physics755: Quantum Field Theory			
Sommersemester 2017	ECTS: 7	Note: 3,0	
- physics799: Internships in the Research Groups			
Wintersemester 2016/2017	ECTS: 4	Note: 2,0	
Scientific Exploration of the Master Thesis Topic			**15 sehr gut (1,3)**
- physics910: Scientific Exploration			
Sommersemester 2018	ECTS: 15	Note: 1,3	
Methods and Project Planning			**15 sehr gut (1,3)**
- physics920: Methods and Project Planning			
Sommersemester 2018	ECTS: 15	Note: 1,3	
Master Thesis			**30 sehr gut (1,5)**
- Master Thesis			
Wintersemester 2018/2019	ECTS: 30	Note: 1,5	

Thema der Masterarbeit: "Bayesian Study of the Pion Charge Radius"

Bonn, den 7. Dezember 2018

Der Vorsitzende des
Prüfungsausschusses Physik/Astronomie

Prof. Dr. Hartmut Schmieden

Erläuterung:
ECTS: Arbeitsaufwand des Modulteils nach European Credit Transfer and Accumulation System
LP (Leistungspunkte nach Prüfungsordnung): Gewicht des Moduls für die Gesamtnote

INSTITUT TEKNOLOGI BANDUNG
FAKULTAS MATEMATIKA DAN ILMU PENGETAHUAN ALAM

Jalan Ganesha 10 Bandung 40132 Telp. (022) 2515032 Fax. (022) 2502360

ACADEMIC TRANSCRIPT

No: 102020/I1.C01/PP/X/TRS/2014

Name	:	Alam Ahmad Hidayat
Student ID Number	:	10210025
Place, Date of Birth	:	Lembang, October 20, 1992
Admission Year	:	2010
Faculty/School	:	Faculty of Mathematics and Natural Sciences
Study Program	:	Bachelor of Physics

Semester 1

Code	Course	Crd.	Grade
MA1101-08	Calculus I	4	AB
FI1101-08	Elementary Physics IA	4	A
KI1101-08	Basic Chemistry I A	3	A
KU1101-08	Conceptual Science	2	A
KU1001-08	Sports	2	A
KU1011-08	Indonesian Language: Scientific Writing	2	BC
KU1180-08	Introduction to Mathematics and Natural Sciences	2	A

Semester 2

Code	Course	Crd.	Grade
MA1201-08	Calculus II	4	AB
FI1201-08	Elementary Physics IIA	4	AB
KI1201-08	Basic Chemistry II A	3	A
KU1201-08	Natural and Universe Systems	2	AB
KU1072-08	Introduction to Information Technology B	2	A
KU1021-08	English: Critical Reading Skills	2	B

Semester 3

Code	Course	Crd.	Grade
FI2101-08	Mechanics	3	AB
FI2102-08	Mathematical Physics I	4	BC
FI2103-08	Theory of Special Relativity	3	A
FI2104-08	Electronics	4	BC
FI2105-08	Statistical Data Analysis	3	C
KU2061-08	Islam: Religion and Ethics	2	A

Semester 4

Code	Course	Crd.	Grade
FI2201-08	Electricity and Magnetism	4	A
FI2202-08	Mathematical Physics II	4	A
FI2203-08	Thermodynamics	3	B
FI2204-08	Instrumentation System	3	B
FI2001-08	Study of Physics Literature	2	A
KU2071-08	Pancasila and Civic Education	2	A

Semester 5

Code	Course	Crd.	Grade
FI3151-13	Dosimetry and Radiation Protection	3	A
FI3101-08	Waves	4	BC
FI3102-08	Computational Physics	4	AB
FI3103-08	Experimental Physics I	2	A
FI3104-08	Quantum Physics I	4	A

Semester 6

Code	Course	Crd.	Grade
AS3002-13	Astronomical Institution Management	2	A
AS3201-08	Gravitation and Cosmology A	3	A
AS3201-13	Introduction to Cosmology	3	A
FI3214-13	Group Theory and Symmetry in Physics	3	A
FI3221-13	Electromagnetic Interaction in Matter	3	B
FI3201-08	Quantum Physics II	3	A
FI3202-08	Statistical Physics	4	A
FI3203-08	Experimental Physics II	2	AB
FI3204-08	Advanced Mechanics	3	AB

Semester 7

Code	Course	Crd.	Grade
TL4103-08	Management for Environmental Engineering	3	BC
FI4096-13	Independent Study	2	A
FI4115-13	Relativistic Quantum Mechanics	3	A
FI4091-13	Final Project I	3	A
FI4002-08	Nuclear Physics	4	A

Semester 8

Code	Course	Crd.	Grade
TL2105-08	Environmental Health	3	AB
FI4251-08	Physics of Radiology	3	A
FI5002-13	Statistical Mechanics	3	A
FI5003-13	Quantum Mechanics	3	AB
FI4201-13	Solid State Physics	3	A
FI4092-13	Final Project II	3	A
FI4093-13	Final Project Seminar	1	AB

Note: A (4) = Outstanding, AB (3.5) = Excellent, B (3) = Very Good, BC (2.5) = Good, C (2) = Satisfactory, D (1) = Sufficient

Credit Hours	:	150	Grade Point Average	:	3.61
Completion Date	:	July 04, 2014	Judicium	:	Cum Laude (distinction)
Final Project Title	:	Penrose Inequality for Spherically Symmetric Spacetimes.			

Published in : Bandung
Date : October 18, 2014

Head of the Physics Undergraduate Program

Widayani Ph.D
NIP 196012231990012001

Dean

Prof.Dr.rer.nat. Umar Fauzi
NIP 196405041989031002

Printed on: 16-10-2014 12:45:19

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UNIVERSITÄT BONN
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Friedrich-Wilhelms-
Universität Bonn

Helmholtz-Institut
für Strahlen- und
Kernphysik

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Prof. Dr. Bastian Kubis

Abteilung Theorie

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To whom it may concern

Bonn, 4. Januar 2019

Letter of recommendation for Alam Ahmad Hidayat

Dear Colleagues,

with this letter of recommendation, I would like to strongly support the application by Alam Ahmad Hidayat, former Master student in Physics at the University of Bonn, Germany, for a position in your PhD program.

I am a professor in the theory division of the *Helmholtz-Institut für Strahlen- und Kernphysik* at Bonn University, Germany, working myself mainly on the phenomenology of the strong interactions in particle physics at low-to-medium energies, with methods from effective field theories and dispersion relations.

Alam came to Bonn University in October 2016, joining the Bonn–Cologne Graduate School of Physics and Astronomy (BCGS) for the Master program in physics. I learnt to know him as a student in my Advanced Quantum Theory course (WT 2016/17), the only obligatory theoretical course for all physics Master students in Bonn (covering scattering theory, the quantum mechanical path integral, relativistic quantum mechanics, and second quantisation). He passed the first exam with a grade 3.0 (best grade: 1.0, minimum to pass: 4.0), which still put him in the better 50% of all 101 exam participants. In the following summer term 2017, Alam similarly passed the written examination of my course in Quantum Field Theory (the course culminates, at the end of the term, in one-loop calculations in Quantum Electrodynamics) with a grade 3.0. Both results demonstrated convincingly that he indeed had all the skills required to keep up with the highly demanding course program in theoretical physics.

When Alam approached me for a working group internship (a graded module in the Master program lasting about 6 weeks), I was happy to accept him and gave him the task to estimate the leading hadronic contribution to the anomalous magnetic moment of the muon. This is a currently hotly debated quantity in elementary particle physics, as it seems to show some tension between theoretical predictions and experimental measurements, hinting therefore at not-yet-understood physics beyond the *Standard Model*. The hadronic contribution gives the main uncertainty in the theoretical prediction and is dominated by charged-pion loop effects. Alam had to understand a theoretical parametrisation of the pion charge form factor and perform a fit of certain parameters therein to experimental data, in order to subsequently calculate the resulting quantum loop correction that he could compare to values from the literature. He performed this task successfully and documented his results convincingly in a written summary, which I graded with 2.0 („gut“).

Beginning in the winter term 2017/18, Alam could continue related scientific work as his 12-months Master thesis project under the supervision of my colleague PD Dr. Andreas Wirzba (Forschungszentrum Jülich), to which I was the second adviser. The aim was a statistically valid, high-precision extraction of the pion's charge radius, a measure of the spatial extent of this composed, non-point-like hadron that can be linked to the derivative of its form factor at vanishing momentum transfer. The main difficulty was that the theoretical parametrisation adapted to data depends, as one of its essential ingredients, on the pion–pion scattering phase shift, which itself contains some uncertainty, requiring the use of Bayesian statistics. In addition, the number of theoretical parameters is not *a priori* fixed, such that model selection based on information and complexity criteria needed to be studied. The numerical integrations required to marginalise over all input parameters were performed using Markov Chain Monte Carlo. Alam has therefore worked on a very demanding subject that required the use of techniques that are far from standard, and usually not taught in the courses of the Master curriculum in physics. The level on which he familiarised himself with the techniques and details of Bayesian statistics was extraordinary and very impressive; as I could convince myself during his Master colloquium as well as in discussions throughout the year, he fully mastered all the relevant concepts and argued about them with ease. This alone made his thesis, written in good English, a very commendable work of merit, that I graded with the mark 1.7 [„gut (plus)“], while his primary adviser, taking into account in particular the strong independence of his research, awarded him a 1.3 [„sehr gut (minus)“]. We are still considering how to turn his results into an article that can be published in a peer-reviewed journal.

On a more personal level, while still a little shy and introvert, Alam is a very open, friendly, and curious young man, who integrated himself into a research group in a completely new cultural environment seamlessly. His intention to continue his graduate studies, albeit with a slightly shifted topical emphasis, in Central Europe, further demonstrates his ability to adapt, I have no doubts that he will continue to be a successful graduate student.

To summarise: Alam Ahmad Hidayat is a dedicated, hard-working student, who managed to fit into a demanding graduate program in physics at Bonn University without problems, and has since shown a clear upward trend in his grades, earning him a good Master of Science degree. In particular his extended work for his Master thesis clearly demonstrates his ability to pursue independent research, and there is no doubt that he will also successfully pursue a PhD degree subsequently. I therefore strongly recommend that you consider Alam for your graduate program.

With best regards,

B. Kubis

Prof. Dr. Bastian Kubis

JÜLICH
Forschungszentrum

Prof. Dr. Christoph Hanhart
Institut für Kernphysik
Forschungszentrum Jülich
D–52425 Jülich

Tel.: (02461) 61-5137
Fax: (02461) 61-3930
e-mail: c.hanhart@fz-juelich.de

Jülich, February 8th, 2019

Letter of Reference for Alam Ahmad Hidayat

The first time I had contact with Alam was in the Winter Term 2016/2017 when he took part in my lecture on Advanced Quantum Mechanics. In the following Summer Term he gave a talk in our seminar on Theoretical Hadron Physics. In both cases he performed well, but not outstanding.

Most closely Alam and I got in contact, however, when I co-supervised him (together with Andreas Wirzba, who was the formal supervisor) in the research project of his master studies. Given our earlier contacts (see above) I did not expect Alam to perform very strongly, however, in the course of the research project I got very positively surprised: While he began very slowly and reluctant his performance improved significantly in the course of the project and Alam began to not only develop own ideas but also to implement them himself. Moreover, his performance in the numerical aspects of the projects improved as well a lot as time went by and because of this Alams research provided a couple of very non-trivial insights that will allow us to better control the uncertainty of very fundamental quantity in particle physics — the vector radius of the pion.

In his thesis work Alam had to investigate in a statistically sound way how well the mentioned radius of the pion can be extracted from a theoretical analysis of various experimental data sets. The theoretical treatment comes with a sizable number of parameters. Various of those are constrained by earlier studies but not with very high accuracy. Other parameters were unconstrained. The pion radius then emerged from an analytic continuation of the parameterisations of the pion vector form factor extracted from data for $e^+e^- \to \pi^+\pi^-$ to the point with total energy equal to zero. The radius is then given by the slope of the form factor at the mentioned kinematical point. Therefore the project called for two important steps: On the one hand a Baysian marginalization for the expression of the radius had to be performed. This involved the numerical evaluation of a strongly peaked integrand in a high dimensional parameter space. Alam solved this by employing a Monte Carlo integration technique. He also ran various checks for numerical stability. On the other hand a method had to be developed to identify which ansatz is statistically best motivated to be used for the parameterisation of the from factor. Here Alam had to run various tests employing different information criteria.

In both parts — the numerical treatment of the problem as well as its statistical aspect

— Alams master thesis project was very demanding and carried him way beyond what is traditionally taught in the University classes. Alam clearly accumulated deep knowledge about the numerical handling of complicated problems as well as the statistically sound interpretation of the results. During his research phase Alam showed a steep learning curve and his performance very much exceeded my expectations. From my point of view he is now well prepared to start a PhD project in a field that requires involved numerical/statistical studies. Moreover, I am sure that Alam has a lot of potential for future development.

Prof. Christoph Hanhart

Li, Shao-Ping

<table>
<tr><td>Address</td><td></td><td colspan="2">Email ShowpingLee@mails.ccnu.edu.cn (update 2019/01/02)</td></tr>
<tr><td colspan="2">152 Luoyu Rd
Wuhan, Hubei 430079
China</td><td colspan="2">Home Phone
Cell Phone (86) 15538087619
Office Phone</td></tr>
<tr><td>Current Title / Dates</td><td colspan="3">MS student, September/2016-June/2019</td></tr>
<tr><td>Current Institution</td><td>Central China Normal University</td><td>Department</td><td>College of Physical Science and Technology</td></tr>
<tr><td>Location</td><td colspan="3">152 Luoyu Rd, Wuhan, Hubei 430079, China</td></tr>
<tr><td>Highest Degree</td><td>MS</td><td>Institution Central China Normal University</td><td>Date 2019/06 exp</td></tr>
<tr><td>Thesis Advisor</td><td colspan="3">Xin-Qiang Li</td></tr>
<tr><td>Research Interests</td><td colspan="3">Primary Phenomenology of New Physics beyond the Standard Model</td></tr>
<tr><td>Secondary</td><td colspan="3">Neutrino Physics and Dark Matter; Particle Physics in the Early Universe</td></tr>
<tr><td colspan="4">Current Research Interests: 1.Model Building of Theories of New Physics 2.Neutrino Physics & Dark Matter 3.Anomalies in Low-Energy Physics</td></tr>
<tr><td>Discipline(s)</td><td colspan="3">Electroweak Particle Physics; Physics; Theoretical Physics</td></tr>
<tr><td>Position(s) applied</td><td colspan="3">PHD</td></tr>
<tr><td colspan="3">1. Xin-Qiang Li, Institute of Particle Physics and Key Laboratory of Quark and Lepton Physics (MOE), Central China Normal University, Wuhan, Hubei 430079, China, xqli@mail.ccnu.edu.cn (2019/01/01)</td><td>file (PDF, PDF, 2019/01/02)</td></tr>
<tr><td colspan="3">2. Ya-dong Yang, Institute of Particle Physics and Key Laboratory of Quark and Lepton Physics (MOE), Central China Normal University, Wuhan, Hubei 430079, China, yangyd@mail.ccnu.edu.cn (2019/01/02)</td><td>file (PDF, PDF, 2019/01/24)</td></tr>
<tr><td colspan="4"></td></tr>
<tr><td>Received Materials</td><td>PHD</td><td colspan="2">Cover Letter: file (PDF, PDF 2019/01/02)
Curriculum Vitae: file (PDF, PDF 2019/01/02)
Research Statement: file (PDF, PDF 2019/01/02)
Copies of grades transcripts: file (PDF, PDF 2019/01/02)</td></tr>
</table>

January 2, 2019

No. 152 Luoyu Road, Hongshan District
Central China Normal University
Wuhan, 430079, China
Email: showpinglee@mails.ccnu.edu.cn

To Whom It May Concern,

I am writing to apply for the Ph.D. positions in theoretical particle physics Collaborative Research Center TRR 257, Karlsruhe Institute of Technology. I plan to receive my master degree in Particle Physics and Nuclear Physics from Central China Normal University in June 2019.

My current interests in theoretical particle physics include model buildings of new physics beyond the standard model and the associated phenomenology investigations, particularly in flavor physics focusing on neutrino physics, semi-leptonic B-meson decays. I will also extend my research to include dark matter candidates and particle physics in the early Universe.

In my study of master in physics, I am focusing on finding a unified model to address problems which the standard model cannot solve, including lepton-flavor-universality violation observed in semi-leptonic B-meson decays, the excess of the anomalous magnetic moment of muon, the neutrino mass generation and dark matter candidate. These haunting issues have driven me to construct a scenario that can address some of them simultaneously, which is well-organized in the published paper: **JHEP 09 (2018)149**, together with another paper submitted to Phys.Rev.D (**arXiv:1808.02424**). For more details, I would like to invite you to have a look at my C.V and research statement.

I would like to indicate three projects the school provides, they are: A3a-Extended Higgs sectors at the LHC (especially the research topic 1. Precision studies of the electroweak vacuum), B3a-Dark sectors at the LHC (especially the research topic 2. Models: Beyond WIMPs) and C3b-New Physics models for flavour observables (which is the project I show the most interest and incentive). I would also like to indicate that I am very interested in the searching areas of Jun.-Prof. Felix Kahlhoefer and Prof. Ulrich Nierste as I have a well-trained foundation in these areas.

Enclosed is my curriculum vitae, a research statement, and a copy of grade transcript. Please let me know if there are any other materials or information that will assist you in processing my application.

Thank you for your consideration. I look forward to hearing from you.

Sincerely,

Shao-Ping Li

Curriculum Vitae

Personal Data

Name:	Shao-Ping Li
Gender:	Male
Date of Birth:	Oct. 17^{th}, 1992
Address:	Central China Normal University, Wuhan, Hubei 430079, China
Phone:	+86 155 3808 7619
email:	showpinglee@mails.ccnu.edu.cn

Education

Sept. 2016–current	Master of Particle Physics: Central China Normal University, Wuhan, Hubei, China.
Sept. 2012–Jun. 2016	Bachelor of Theoretical Physics: Zhengzhou University, Zhengzhou, Henan, China.

Scholarships & Awards

Sept. 2016	The First-class Scholarship (Central China Normal University)
Sept. 2017	The Second-class Scholarship (Central China Normal University)
Sept. 2018	The Second-class Scholarship (Central China Normal University)
Oct. 2018	The National Fellowship

Languages

Chinese:	Mothertongue
English:	IELTS 6.5

Computer Skills

System:	Windows, Linux-ubuntu
Language:	Mathematica
Professional packages:	FeynRules, SARAH, SPheno, FeynArts, FeynCalc, Package-X, MadGraph5

Research Interests

- Model Building of Theories of New Physics
- Neutrino Physics
- Dark Matter
- Anomalies in Low-Energy Physics
- Particle Physics in the Early Universe

Research Experience

★ *Title*: **$R_{D^{(*)}}$, $R_{K^{(*)}}$ and neutrino mass in the 2HDM-III with right-handed neutrinos**
Journal: JHEP 09(2018) 149
arXiv: 1807.08530
Time Periods: Aug. 2017– July 2018

Main Conclusions: based on a two-Higgs-doublet model of type III, with which the low-scale seesaw mechanism is embedded, it was found that the $R_{D^{(*)}}$, $R_{K^{(*)}}$ anomalies observed in the lepton-flavor universality test of B-meson physics can be addressed simultaneously, and two sub-eV light neutrino states are predicted with an inverted mass hierarchy.

★ *Title*: **Muon $g-2$ in a $U(1)$-symmetric Two-Higgs-Doublet Model**
Status: submitted to Phys. Rev. D
arXiv: 1808.02424
Time Periods: Feb. 2018– Aug. 2018
Main Conclusions: based on the previous work: JHEP 09(2018) 149, it is found that the long-standing excess of the anomalous magnetic moment of muon can be explained by large two-loop Barr-Zee contributions.

Master Thesis

★ *Title*: **A Unified 2HDM Solving B-meson anomalies, $(g-2)_\mu$, Neutrino Mass and Dark Matter**
Status: under preparation
Time Periods: Sept. 2018– May 2019
Abstract: based on our previous work, we consider the a unified framework where right-handed neutrinos are introduced in a $U(1)$-symmetric two-Higgs-doublet model to address the anomalies observed in $R_{D^{(*)}}$, $R_{K^{(*)}}$ and $(g-2)_\mu$, together with the explanation of neutrino mass problem and dark matter candidate. The parameter space will be scrutinized under severe constraints from existing data.

Research Statement

I am greatly interested in new physics (NP) beyond the standard model (SM) and have been concentrating on NP phenomenology in my master study, including neutrino mass problem, semi-leptonic decays of heavy B-meson, as well as flavor symmetry in explaining flavor mixing and mass hierarchies. My researches stem from the following considerations.

There exist some theoretical puzzles that the SM cannot explain and some experimental anomalies which deviate from the SM prediction with significant confidence. These include: *flavor puzzles*—the fermion mass hierarchies among generations, neutrino mass and mixing; *dark matter* & *dark energy*—the observation of the abundance of dark matter and dark energy; *matter-antimatter asymmetry*—the observed matter-antimatter asymmetry in the Universe; *anomalies*—experimental observations that deviate from the SM prediction, such as the lepton-flavor universality violation in the B-meson physics, *e.g.*, the $R_{D^{(*)}}$ excess and the $R_{K^{(*)}}$ deficit, and the long-standing excess of the anomalous magnetic moment of muon($(g-2)_\mu$).

I am focusing on constructing a unified NP model, which is the theme of my investigation project in my master study and will also extend to my doctoral study. However, I should highlight that it would be a non-trivial task to explain all the puzzles and anomalies under a simple framework. Even so, I am keeping pondering whether Nature has a simple structure which can be derived from a succinct field configuration embedded with uniquely gauged and/or global symmetry (by uniquely, I mean that the irreducible representations of the fields can be uniquely determined).

Based on the incentives and the motivations stemming from a simultaneous explanation for $R_{D^{(*)}}$, $R_{K^{(*)}}$, $(g-2)_\mu$ and neutrino mass, my advisor, cooperator and I constructed a scenario by embedding right-handed neutrinos into two-Higgs-doublet model and successfully explain the problems simultaneously, which was well-organized in JHEP 09 (2018) 149, together with another paper submitted to Phys. Rev. D (arXiv:1808.02424). To be more explicit, we imposed a $U(1)$ symmetry in the full Lagrangian, allowing flavor-changing neutral currents (FCNCs) to arise in the up-quark sector only, then the $R_{D^{(*)}}$ excess can be explained due to the FCNCs and charged Higgs boson mediator. Regarding the $R_{K^{(*)}}$ deficit, the introduced right-handed neutrinos give significant contributions to the effective operators C_9 and C_{10} via box diagrams, leading to the solution in the direction of $C_9 = -C_{10}$ in the muon channel. Moreover, $(g-2)_\mu$ can be also addressed due to the significant up-quark FCNCs contribution via two-loop Barr-Zee diagrams.

However, we have not considered dark matter candidate. Prospectively, we are to consider keV sterile neutrino warm dark matter (see, *e.g.* JCAP 01 (2017) 025) within our constructed framework, which is under consideration. Besides, more thorough investigations on the flavor observables particularly in heavy B-meson rare decays and LHC constraints are also to be considered.

Master of Physics in Central China Normal University
Transcript

DEPARTMENT: College of Physical Science and Technology

MAJOR: Particle Physics and Nuclear Physics

NAME: Shao-Ping Li

TUTOR: Xin-Qiang Li

COURSE	Class Hours	Credits	Grade/100	COURSE	Class Hours	Credits	Grade/100
Chinese Social Theory and Practice	32	2	83	Symmetry and Group	48	3	95
Dialectics of Nature	18	1	84	Gauged Field Theory	48	3	96
First Foreign Language (English)	72	3	85	Particle Physics-Theory and Phenomenology	48	3	94
Computational Physics	48	3	66	Quantum Statistics	48	3	80
Advanced Quantum Mechanics	48	3	91	High-Energy-Physic-Experimental Methodology	48	3	75
Quantum Field Theory	48	3	77	Particle Physics	48	3	100
Practice Course	-	4	94.5	GPA: 3.46			

Authentication

Department (Seal)	胡响明 华中师范大学物理科学与技术学院 Data:
Graduate School (Seal)	成绩属实 Data: 华中师范大学研究生院 成绩专用章

Institute of Particle Physics
Central China Normal University
152 Luoyu Rd, Wuhan, 430079, China,

Xin-Qiang Li
Email: xqli@mail.ccnu.edu.cn

Recommendation Letter

To whom it may concern,

January 1, 2019

As Mr. Shao-Ping Li's supervisor, I am very glad to write this recommendation letter, in support of his application for the Ph.D program in your group.

Shao-Ping joined my group in September 2016, and works with me mainly on projects focused on heavy flavor physics and phenomenology of new physics beyond the Standard Model, particularly in neutrino physics. He has attended several graduate courses designed necessarily for theoretical particle physics, including Advanced Quantum Mechanism, Quantum Field Theory, Group Theory, as well as Gauge Field Theory. He finished these courses with high scores (over averaged 95%) and got the corresponding credits needed for a master student. Actually, he has already built and understood most of the necessary foundations at an adequate level when he was an undergraduate as he, as far as I know, has great interests in the field of theoretical particle physics.

Shao-Ping shows great talent in theoretical particle physics not only because of his pure and strong ambition but also due to his diligence. He is a well-disciplined student who is always focusing on the research during the working time and is very active to discuss interesting academic questions with me and other members of our group. Driven by the ambitions in this field, he usually finishes the tasks I give to him effectively and, for most of the time, he extends the tasks with new and interesting ideas.

Thanks to his active performance, Shao-Ping has finished two interesting papers, one published already in JHEP 09(2018) 149 and another subsequent paper submitted to Phys. Rev. D (arXiv:1808.02424) during his second year of the master study. Both papers are well-motivated and -organized in the investigation of new physics beyond the Standard Model. He is committed himself to unifying a new physics model minimally and naturally to address the problems which the Standard Model cannot resolve during his mater study and I am convinced that he will continue to find more reasonable solutions in his Ph.D study.

Besides the above academic aspects, I should also highlight that Shao-Ping is very good at English, both in reading and in writing. He has also given several academic talks about his works in English in different workshops.

There is no doubt that he is the most outstanding one among the master students enrolled in the same year in my group. I am convinced that Shao-Ping is a well-qualified candidate for this program. It would be very appreciable if he could be given such a chance.

Sincerely yours,

Prof. Xin-Qiang Li Xin-Qiang Li

Institute of Particle Physics
Central China Normal University

Institute of Particle Physics,
Central China Normal University
Wuhan, Hubei 430079
P. R. China
email: yangyd@mail.ccnu.edu.cn

23 January, 2019

Dear Professors,

It is my great pleasure to recommend Mr.Shao-Ping Li to you for a doctoral graduate student position.

I have known him since the annual interview for new graduate students in May, 2016. Among the more than 40 candidates, the review team evaluated him as the first. After three semesters graduate courses, he chose our particle physics group. I am so happy about his choice. During our collaboration, I have been impressed very much by his enthusiasm for physics, abilities to master very complicated calculations and patience during the calculations. Since then, we have established very close collaborations and friendship, which I have enjoyed so much.

I would like to say that he is a very active young researcher working on heavy flavor physics. So far, our collaboration has resulted in two papers in one year, one has been published in JHEP, and the another one has been accepted by Physics Rev. D. His contribution is dominant.

In the spring of 2018, he came to my office with a draft which addressed the anomalies $R_{D^{(*)}}$, $R_{K^{(*)}}$ and neutrino mass in the 2HDM-III, and ask me to read it. He surprised me very much, since I did not think a second year master student could do that, even might not knew the three problems clearly.

As you know, the three problems are the tough challenges to particle physics, and it is very hard to solve the three problems in one new physics model.

S.Iguro and K. Tobe have shown that the $R_{D^{(*)}}$ anomalies could be accommodated in a general two Higgs doublet model [NPB925(2017)560], however, the same scenario could not address the known $R_{K^{(*)}}$ anomaly since the model would give universal coefficients of the Flavor Changing Neutral processes $b \to s\ell^+\ell^-$ for all lepton flavors. Mr.Li considered a unified model with a low scale type-I seesaw mechanism embedded into the 2HDM-III, and found the three problems could be resolved simultaneously.

His draft is well written and comprehensive. The paper has been published in JHEP1809(2018)149.

This work has exhibited his talent in physics, which might convince us to evaluate him a promising physicist. I believe that he would achieve much more important physics results under your Ph.D program training.

He is truly a modest and intelligent man. Collaboration with him is always pleasant and fruitful.

Therefore, I strongly recommend Mr. Shao-Ping Li X to you for a doctoral graduate student position.

Best regards,

Sincerely yours,

Ya-Dong Yang
Professor of Physics

Lindner, Andreas Maximilian

Address		**Email** and.lindner@physik.uni-muenchen.de (update 2019/02/08)	
Wertheimerstraße 98 Muenchen, Bayern 81243 Germany		**Home Phone** **Office Phone** (++49) 89 2180-4555	

Current Title / Dates	Master Student		
Current Institution	LMU Munich	**Department**	Physics Department
Location	Geschwister-Scholl-Platz 1, Muenchen, Bayern 80539, Germany		
Highest Degree	MS	**Institution** LMU Munich	**Date** 2019/04 exp
Thesis Advisor	Gerhard Buchalla		
Thesis Title	The Higgs Electroweak Chiral Lagrangian - Renormalization and Application to Composite Higgs		
Research Interests	**Primary** Particle Physics		
Secondary			
Current Research Interests: *Higgs phenomenology, hadron physics*			
Discipline(s)	Particle and Astroparticle Phenomenology; High Energy Physics; Physics		
Position(s) applied	PHD		
1. Gerhard Buchalla, LMU Munich, gerhard.buchalla@physik.uni-muenchen.de (2019/02/15)			
Received Materials	**PHD**	**Cover Letter:** file (PDF, PDF 2019/02/15) **Curriculum Vitae:** file (PDF, PDF 2019/02/15) **Research Statement:** file (PDF, PDF 2019/02/15) **Copies of grades transcripts:** file (PDF, PDF 2019/02/15)	

Andreas Maximilian Lindner
and.lindner@physik.uni-muenchen.de
Wertheimerstraße 98, D-81243 Muenchen

Prof. Kirill Melnikov
Institut für Theoretische Teilchenphysik
Campus Süd
Karlsruher Institut für Technologie (KIT)
D-76128 Karlsruhe

Dear supervisors,

I am writing to apply for a Ph.D. position in the Collaborative Research Center TRR257 "Particle Physics Phenomenology after the Higgs discovery". I am Master Student in the theoretical phenomenological particle physics group of Prof. Gerhard Buchalla at LMU Munich. My colleague Khoirul Muzakka, who is also applying, first told me about the collaboration. He found it after an internet research and immediately approached me. Shortly afterwards it was announced at our chair.

My transcript of records shows that I have specialized to particle physics and done well in the lectures. It is in the first place theoretical particle physics that I am interested in. I appropriated profound knowledge in the underlying concepts of quantum mechanics and quantum field theory (and special lectures in QED and QCD). But besides the theoretical lectures it was important to me to get insights into experimental techniques and methods in the experimental lectures on advanced particle physics and heavy quark physics I attended. To get an outlook I also visited a course on models beyond the Standard Model.
I am no one-track specialist, though. I also attended a course on general relativity and I very much enjoyed teaching two semesters as tutor for thermodynamics and statistical physics.
In my master thesis we work on Higgs effective field theory. We enlarged the Higgs-electroweak chiral Lagrangian by an additional scalar singlet and studied one-loop renormalization and phenomenological consequences. You find a short description of it in my research statement.

Throughout my time at university I have been studying independently. Therefore, the project with Khoirul was also a good lesson on collaborative work for me. I enjoyed the lively discussions at an time of the day (and night) in the office or via the internet. The exchange of ideas and the splitting of work turned out to be very fruitful.

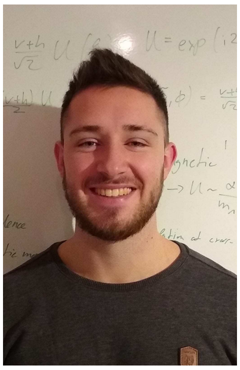
Your research center with theoretical projects near phenomenology and experiment is an ideal place covering my research interests. In detail, I would like to be considered for the projects A1b, C2a and C2b, see my research statement.

Thank you for considering my application.

Sincerely,

Andreas Lindner

Andreas Maximilian Lindner



Master student of physics with special interest in high energy physics.

Personal Info

Born:	September 17th, 1994 in Graefelfing, Germany
Address:	Wertheimerstraße 98, 81243 Muenchen, Germany
E-mail:	and.lindner@physik.uni-muenchen.de

Education

2013	Abitur, Max-Planck-Gynmasium, Munich with honors from the DPG for excellent achievements in physics
2013-2016	Bachelor of Science in Physics, LMU Munich
2016-2019	Master of Science in Physics, LMU Munich presumably to be graduated in April (transcript complete with exception of Master thesis)

Skills

Languages:	German (native speaker), English (very good command)
Soft:	basic C++, Mathematica, LaTeX

Research Statement by Andreas Maximilian Lindner

Master Thesis

In my master thesis we work on Higgs effective field theory. We enlarged the Higgs-electroweak chiral Lagrangian by an additional scalar singlet. This is the simplest extension that still may serve to cure some problems like dark matter and baryogenesis. We extracted the one-loop diverences which arise from the Higgs-sector (we did this for a generalized sector with three Goldstones and N scalar singlet fields) via the background field method and matched the general Lagrangian to the Composite Higgs model with SO(6)/SO(5) coset structure. Assuming the one singlet to be heavy, we integrate it out and analyze the new parameters the model predicts for the remaining Higgs's couplings.

Desired Ph.D. Projects

I would like to be considered for the projects **A1b**, **C2a** and **C2b**.

My work on Higgs effective field theory makes me a good candidate for the project A1b. The discovered scalar being the simple idea of the SM Higgs seems also to me very puzzling. Since the measurements of the Higgs couplings are not that precise yet, the scope in this field is still wide. I like to pursue the way of it behaving *nearly* as in the SM and catch the deviations in an effective description with precision through higher order corrections in any of the Higgs couplings and processes.

Since flavor physics arose my interest in some lectures and I even was invited to the *Flavor-Lunch*[1] it would thrill me to dive into the theoretical details of the processes. In this context I would like to increase theoretical predictions by precision calculations. The projects C2a and C2b sounded most appealing to me in that area.
Obtaining more accurate theoretical values for CKM matrix elements with modern methods is an attractive contemporary task. Measurements of CKM matrix elements are research topics that tackle the SM at its roots.
Rare decays are of special interest to me because of the larger relative effect new physics would have on them. Also semileptonic decays which are addressed in the project are a hot topic these days. Lepton universality violation was addressed several times by experimentalists in the Flavor-Lunch and also once in a seminar on theoretical particle physics at LMU.

[1] An almost weekly meeting of LMU and TU researchers at Garching where mostly experimentalists and some theorists present their research results and ideas, hosted by Prof. Thomas Kuhr. A bit off-topic, I gave a Higgs talk there.

LMU LUDWIG-MAXIMILIANS-UNIVERSITÄT MÜNCHEN

PHYSICS

Lindner, Andreas Maximilian
born 17 September 1994 in Gräfelfing
Student ID: 10959588

Munich, 16 January 2019

Program: Physics
Degree: Master of Science (M.Sc.)

Transcript of Records in accordance with the examination regulations for the Master program in Physics at Ludwig-Maximilians-Universität München of 30 September 2009

	List of Credit Courses	Term	Grade	ECTS
10100	**Advanced Experimental Physics**		**1.00**	**9**
10101	Advanced Particle Physics (Schaile)	SS 2018	1.00	9
10200	**Advanced Theoretical Physics**		**1.00**	**9**
10201	Quantum Mechanics II (Brunner)	WS 16/17	1.0	9
10300	**Qualification**		**BE**	**3**
10301	Object orientet Programming in CC++ for Physicists (recognized from the Bachelor Degree Program in Physics (LMU))	SS 2016	BE	3
20100	**Modern Physics**		**1.10**	**9**
20101	Heavy Quark Physics (Kuhr/McCarthy)	SS 2018	1.0	6
20102	Quantum Electrodynamics (Buchalla)	WS 17/18	1.3	3
20200	**Specialisation**		**1.22**	**12**
20201	Seminar: Electrodynamics (recognized from the Bachelor Degree Program in Physics (LMU))	WS 15/16	1.0	3
20202	QCD and the Standard Modell (Helling)	SS 2017	1.3	9
20300	**Research Methods of Modern Physics**		**1.00**	**9**
20301	Physics beyond the Standard (Dvali)	SS 2017	1.0	9
20400	**Fundamental Research**		**1.00**	**9**
20401	Quantum Field Theory (Ferro)	SS 2017	1.0	9
30100	**Practical Phase Part 1**	SS 2018	BE	15
30200	**Practical Phase Part 2**	SS 2018	BE	15
	Sum of ECTS Credits			**90**

End of Transcript

(P)=compulsory module, (WP)=compulsory optional module, BE=passed

Grading scheme:
Grades on each piece of work are indicated as: 1 = very good; 2 = good; 3 = satisfactory; 4 = sufficient; 5 = not sufficient. To guarantee a higher degree of differentiation, grades may be decreased or increased by 0.3. Grades of 0.7, 4.3, 4.7 and 5.3 are not possible.
The final grade is indicated as: up to and including 1.50 = "very good"; from 1.51 up to and including 2.50 = "good"; from 2.51 up to and including 3.50 = "satisfactory" and from 3.51 up to and including 4.00 = "sufficient".

M. Fulgieri

Marion Fulgieri
Examination Office of Physics

PRUFUNGSAMT PHYSIK
LUDWIG-MAXIMILIANS-UNIVERSITÄT
SCHELLINGSTRASSE 4
80799 MÜNCHEN

LMU LUDWIG-MAXIMILIANS-UNIVERSITÄT MÜNCHEN | PHYSIK

Lindner, Andreas Maximilian
geb. am 17. September 1994 in Gräfelfing
Matrikelnr. 10959588

München, den 16. Januar 2019

Studiengang: Physik
Abschluss: Master of Science (M.Sc.)

Transcript of Records gemäß Prüfungs- und Studienordnung der Ludwig-Maximilians-Universität München für den Masterstudiengang Physik vom 30.09.2009

	Studienbegleitende Prüfungsleistungen	Semester	Bewertung	ECTS
10100	**Fortgeschrittene Experimentalphysik**		**1,00**	**9**
10101	Teilchenphysik für Masterstudenten (Schaile)	SS 2018	1,00	9
10200	**Fortgeschrittene Theoretische Physik**		**1,00**	**9**
10201	Quantenmechanik II (Brunner)	WS 16/17	1,0	9
10300	**Qualifikation**		**BE**	**3**
10301	Objektorientiertes Programmieren in C++ für Physiker (anerkannt aus dem Bachelor Studium Physik (LMU))	SS 2016	BE	3
20100	**Moderne Physik**		**1,10**	**9**
20101	Physik der schweren Quarks (Kuhr/McCarthy)	SS 2018	1,0	6
20102	Quantenelektrodynamik (Buchalla)	WS 17/18	1,3	3
20200	**Spezialisierung**		**1,22**	**12**
20201	Seminar: Elektrodynamik (anerkannt aus dem Bachelor Studium Physik (LMU))	WS 15/16	1,0	3
20202	QCD und das Standard Modell (Helling)	SS 2017	1,3	9
20300	**Forschungsmethoden der modernen Physik**		**1,00**	**9**
20301	Physik jenseits des Standards (Dvali)	SS 2017	1,0	9
20400	**Grundlagenforschung**		**1,00**	**9**
20401	Quantenfeldtheorie (Ferro)	SS 2017	1,0	9
30100	**Praktische Phase Teil 1**	SS 2018	BE	15
30200	**Praktische Phase Teil 2**	SS 2018	BE	15
	Summe ECTS-Punkte			**90**

Ende der Auflistung

(P)=Pflichtmodul, (WP)=Wahlpflichtmodul, *= anerkannte Leistung, BE=bestanden

Notengebungsart:
Die Leistungen in den einzelnen Prüfungsgebieten werden bezeichnet mit 1 = sehr gut; 2 = gut; 3 = befriedigend; 4 = ausreichend; 5 = nicht ausreichend. Zur differenzierteren Bewertung der Leistung können die Notenziffern um 0,3 erniedrigt oder erhöht werden. Die Bewertungen 0,7, 4,3, 4,7 und 5,3 sind ausgeschlossen.
Die Endnote und Gesamtnoten aus Einzelbewertungen lauten: bis einschließlich 1,50 = „sehr gut"; von 1,51 bis einschließlich 2,50 = „gut"; von 2,51 bis einschließlich 3,50 = „befriedigend" und von 3,51 bis einschließlich 4,00 = „ausreichend".

M. Fulgieri
Marion Fulgieri
Prüfungsamt Physik

PRUFUNGSAMT PHYSIK
LUDWIG-MAXIMILIANS-UNIVERSITÄT
SCHELLINGSTRASSE 4
80799 MÜNCHEN

Loukas, Orestis

Address		**Email** orelouks@gmail.com (update 2017/11/30)	
Vereinsweg 7 Bern, Bern 3012 Switzerland		**Home Phone** **Office Phone**	
Current Title / Dates	PhD Candidate		
Current Institution	Institute for Theoretical Physics, University of Bern	**Department**	Albert Einstein Center for Fundamental Physics (AEC)
Location	Sidlerstrasse 5, Bern, Bern 3012, Switzerland		
Highest Degree	Ph.D.	**Institution** University of Bern	**Date** 2018/08
Thesis Advisor	Prof. Dr. Susanne Reffert		
Thesis Title	Large Charge Perturbation Theory (temporary)		
Research Interests	**Primary** Theoretical High Energy Physics		
Secondary	Mathematical Physics; String Theory		
Current Research Interests: *High energy theory, mathematical physics, String Theory, effective field theories, AdS/CFT* **Web Pages:** http://inspirehep.net/author/profile/O.Loukas.1			
Discipline(s)	High-Energy Theory; Mathematical Physics		
Position(s) applied	PHD		
Also Consider For	**Temporary:** Postdoc 2 Year 1 Year		
1. Prof. Dr. Luis Alvarez-Gaume, CERN and Simons Center for Geometry and Physics, luis.alvarez-gaume@cern.ch (2017/11/04)			file (PDF, PDF, 2017/11/04)
2. Prof. Dr. Dieter Luest, ASC, LMU and MPI Munich, dieter.luest@lmu.de (2017/11/01)			file (PDF, PDF, 2017/11/01)
3. Prof. Dr. Susanne Reffert, AEC and ITP, University of Bern, sreffert@itp.unibe.ch (2017/10/31)			file (PDF, PDF, 2017/11/01)
4. Priv.-Doz. Dr. Stefan Groot Nibbelink, School of Engineering and Applied Sciences, Rotterdam University of Applied Sciences, groos@hr.nl (2017/10/31)			file (PDF, PDF, 2017/11/01)
Received	**PHD**	**Cover Letter:** file (PDF, PDF 2017/11/23) **Curriculum Vitae:** file (PDF, PDF 2019/02/09) **Research Statement:** file (PDF, PDF 2017/11/23)	

Materials		**Copies of grades transcripts:** file (PDF, PDF 2019/02/09)

Cover Letter

Orestis Loukas

Summary of experience

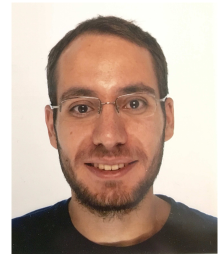
I am a **doctoral student** at the University of Bern in the third and final year of my PhD program (the thesis defense is expected to take place during summer 2018) with **roughly four years of research experience in the theoretical field of high energy physics**. I completed my undergraduate studies (Bachelor and Master) at the University of Munich. By studying at the University of Munich, a key-player in the European academic network, I had the opportunity to be confronted from an early stage with the challenges and merits of an active and competitive research environment around the chair of Prof. Dieter Lüst. The subsequent time at the University of Bern within a young but stimulating research group led by Prof. Susanne Reffert expanded my research interests offering insight into further European academic systems. Under multiple occasions, I had the chance to interact with both local faculty members as well as maintain external collaborations with colleagues from different countries and different backgrounds, which has further enhanced my academic awareness. In addition, I possess **three years of teaching experience** by tutoring various undergraduate courses.

Research interests

My current research interests are within the field of high energy physics, mathematical physics and string theory. The main emphasis lies on the implementation of symmetry principles and mathematical insight to a given problem in order to understand concrete physical systems and produce phenomenologically interesting predictions. Along those lines, in my future postdoctoral position I would like to conduct research in key areas like string theory and M-theory with a particular emphasis on string model building and stringy supersymmetry breaking mechanisms. At the same time, I would like to explore the effective theory which governs the sectors of strongly coupled quantum field theories at large quantum number(s). This exploration serves as a bridge to other areas of theoretical physics such as the conformal bootstrap, or the AdS/CFT correspondence. It also incorporates potential applications in condensed matter physics together with lattice simulations. Such future research directions are outlined in my attached research statement.

Curriculum Vitae

Orestis Loukas



Name and Surname	Orestis Loukas
Date and place of birth	05/02/1992, Thessaloniki, Greece
Current address	Vereinsweg 7, CH-3012, Bern
Telephone	+ 41 79 450 39 95
e-mail	orelouks@gmail.com
LinkedIn	www.linkedin.com/in/OrestisLoukas/

Educational background

PhD studies

2015–2018 PhD studies (advisor: Prof. Dr. Susanne Reffert) at the
Institute for Theoretical Physics (ITP) and the
Albert Einstein Center for Fundamental Physics (AEC),
at the **University of Bern**, Switzerland
Supported by the Swiss National Science Foundation (SNSF)

Visiting Scientist at the
European Organization for Nuclear Research (CERN)

2018 PhD *in Physics* with *summa cum laude*, grade 6 (excellent)
Thesis Title: *Perturbation Theory at Large Charge*

Postdoctoral Fellowship offer at the ULB University in Brussels

(Under)graduate studies

2010–2015 **Excellence scholarship** by the
German Academic Exchange Service (DAAD)
in the five-year-full-study program (Bachelor & Master)
"Schulen Partner der Zukunft"

2013–2015 *Master of Science in Physics* with grade 1.1 (excellent) at the
Arnold Sommerfeld Center for Theoretical Physics (ASC),
Ludwig-Maximilian University of Munich (LMU), Germany

2013 **Master Thesis** (advisor: Priv.-Doz. Dr. Stefan Groot Nibbelink)
grade 1.0 (excellent)
Thesis Title:
(Non)-supersymmetric model building with heterotic strings

2010–2013	*Bachelor of Science in Physics* with grade 1.6 (very good) at the **Ludwig-Maximilian University of Munich**
2013	**Bachelor Thesis** (advisor: Priv.-Doz. Dr. Stefan Groot Nibbelink) grade 1.0 (excellent) Thesis Title: *Heterotic Model Building on $\mathbb{Z}_8$ orbifolds*

Secondary Education

2004-2010	Study at the German Secondary School of Thessaloniki, **Deutsche Schule von Thessaloniki** (DST)
2010	**Abiturzeugnis**; Overall grade 1.1 (excellent) Graduation certificate (**Apolytirion**) from Secondary School; Overall grade 19.7 (excellent)

Languages

English	**IELTS** Exam; Overall Score 8.5 (excellent)
German	**DSD Stufe II** together with **Abitur** certificate; grade 1.1 (excellent)
Greek	Mother tongue

Computer skills

Programming	C, C++, Python, Java, Shell Scripting, LaTeX,
Math suites	Mathematica, MatLab
Office suite	Word, PowerPoint, Excel, Access
Operating systems	Linux, Windows, Mac OS X
Hardware	General knowledge of computer hardware and network infrastructure

Teaching experience in academia

as an assistant at ASC, LMU Munich

2013	*Mathematik für Physiker III* for Bachelor by Prof. Dr. Detlef Dürr
2014–2015	*String Theory* for Master by Priv.-Doz. Dr. Stefan Groot Nibbelink
	Quantum Field Theory for Master by Prof. Dr. Stefan Hofmann
2015	*Theoretische Mechanik* for Bachelor by Prof. Dr. Jan von Delft
	Atomic & Molecular physics for Bachelor by Prof. Dr. Harald Weinfurter

as an assistant at ITP, AEC Bern

2016	*Rechenmethoden* for Bachelor by Prof. Dr. Christoph Greub
2016–2017	*Statistische Thermodynamik I* for Bachelor by Priv.-Doz. Dr. Urs Wenger
2017	*Quantenmechanik II* for Bachelor by Prof. Dr. Uwe-Jens Wiese
2017–2018	*Statistische Thermodynamik II* for Bachelor by Prof. Dr. Susanne Reffert

Teaching and working experience

2018 **Mathematics, Physics and Informatics tutoring**
for high school and (technical) university students;
employed by *Teachy*, *Flying teachers* and *Lernstudio Heureka*
teachy.ch, www.flyingteachers.ch, www.lernstudioheureka.ch
and as a freelance tutor under tutor24.ch/en/tutors/841626
and with http://yashina-tutors.ch

Administrative experience

2016–2018 Member of the administrative body ("Institutsrat") of the Institute for Theoretical Physics at the University of Bern representing PhD students

Interdisciplinary work and public outreach

2017 Presentation of the university work and research to the public at the University of Bern: "Nacht der Forschung" (Night of science)
Contribution: Poster on *Extra dimensions and String Theory*

2014–2015 Interdisciplinary seminar in Physics, Mathematics and Philosophy at LMU Munich: "The Ontology of Physics"

2012 Interdisciplinary seminar in Physics and Philosophy at LMU Munich: "Das Ende von Allem" (The End of Everything)
Contribution: Talk with title *Cosmological models in String Theory*

Schools

2018 **Educational workshop on tutor training** in *Teachy*, Bern

2015–2017 ITP graduate program, Institute for Theoretical Physics, Bern

2017 ICTP Spring School on "Superstring Theory and Related Topics", Italy

2016 CERN Winter School on "Supergravity, Strings, and Gauge Theory"

2015 Amsterdam-Brussels-Geneva-Paris **Solvay Doctoral School** on "Quantum Field Theory, Strings and Gravity"

Seminars, Workshops and Conferences

talk given

2018 Journal Club at ITP, Bern
Title: *Holography, Hydrodynamics and Large Charge*

2017 Theory Seminar at SISSA, Trieste
and at École polytechnique and École normale supérieure, Paris

as well as “Fields and Strings” seminar at LMU, Munich
and Research Seminar at the Humboldt University of Berlin
Title: *Accessing the CFT spectrum at large charge*

Journal Club at CERN
Title: *Two approaches for theories at finite charge densities*

Ascona international conference on
“String Theory and Quantum Gravity”, Monte Verita, Switzerland
Title: *Compensating strong coupling with large charge*

Poster session at the occasion of the site visit by the **SwissMAP review panel** in Geneva, Switzerland (poster presentation)
Title: *Compensating strong coupling with large charge*

Group seminar at the ITP, University of Bern: “Strings and Fields”
Title: *RG flows and the a-theorem*

2016 AEC graduate student seminar, University of Bern
Title: *Compensating strong coupling with large charge*

DESY Theory Workshop, “Rethinking Quantum Gravity”, Hamburg
Title: *Large Charge Perturbation Theory*

SwissMAP General Meeting in Engelberg, Switzerland
Title: *Large Charge Perturbation Theory*

Lunch Seminar at the ITP, University of Bern
Title: *Large Charge Theory at finite temperature*

2015 **XXVII Workshop - Beyond the Standard Model**,
Physikzentrum Bad Honnef, Bonn, Germany
Title: *Non-supersymmetric heterotic model building*

Graduate seminar at LMU Munich: on “Particle Physics & Cosmology”
Title: *Models with (large) extra dimensions*

2014 String Theory group seminar at ASC, LMU Munich
Title: *Non-supersymmetric heterotic model building*

attended or member of the local organization

2017 SwissMap General Meeting in Grindelwald, Switzerland

2016 String Pheno conference in Ioannina, Greece
Workshop on “Supersymmetric theories and dualities”, Bern

2014 “The String Theory Universe” cost-workshop in Mainz, Germany
Bethe Forum on “Non-geometry and model building”, Bonn

References

Prof. Dr. Luis Álvarez-Gaumé
Simons Center for Geometry and Physics,
State University of New York
Stony Brook, NY-11794-3636, USA
✉ Luis.Alvarez-Gaume@cern.ch

Prof. Dr. Stefan Groot Nibbelink
School of Engineering and Applied Sciences,
Rotterdam University of Applied Sciences,
G.J. de Jonghweg 4 - 6, 3015 Rotterdam, Netherlands
✉ groos@hr.nl

Dr. Konstantinos Siampos
Theory Department – CERN,
CH-1211 Geneva 23, Switzerland
✉ konstantinos.siampos@cern.ch

Further Links

inSPIRE-HEP	inspirehep.net/author/profile/O.Loukas.1?ln=en academic profile in High Energy Physics
Research Gate	www.researchgate.net/profile/Orestis_Loukas
ASC - LMU Munich	www.theorie.physik.uni-muenchen.de/MATH/ members/former_mem/former_asc/loukas_orestis/
ITP and	www.reffert.itp.unibe.ch/
AEC - University of Bern	www.einstein.unibe.ch/research/ graduate_student_seminars/fall_semester_2016/
Ascona Conference	conf.itp.phys.ethz.ch/string17/talks/Loukas.pdf
Humboldt-University Berlin	qft.physik.hu-berlin.de/next-seminars/vorname-name/

Motivationsschreiben

Ich bin ein **Physiker** aus Thessaloniki, Griechenland, der hier in der Schweiz seit drei Jahren studiert und arbeitet. Vor Kürze habe ich mein Doktorat an der Universität Bern auf dem Gebiet der mathematischen und theoretischen Physik erfolgreich abgeschlossen. Bevor hatte ich Bachelor Physik und Master Physik mit Schwerpunkt Mathematik an der Ludwig-Maximilians-Universität München unter Förderung im Exzellenzprogramm des Deutschen Akademischen Austauschdienstes (DAAD) studiert.

Ausser der akademischen Forschung umfasst meine bisherige Job- und Unterrichtserfahrung hauptsächlich das **Assistieren bei der Organisation und Betreuung von akademischen Lehrveranstaltungen**. Sowohl während des Masterstudiums als auch im Rahmen meiner Promotion hatte ich die Möglichkeit als Tutor in verschiedenen Fächern Übungsstunden zu betreuen und bei verschiedenen Vorlesungen als Assistent tätig zu sein. Dabei hat das allgemeine Feedback immer gut ausgesehen. Insbesondere haben viele Studierende mein Engagement und Enthusiasmus für das jeweilige Lehrmodul explizit in ihrer Evaluation erwähnt. Zusätzlich hatte ich mehrmals besonders Bachelorstudenten individuell betreuet und in ihrem Studienweg unterstützt (Coaching). Diese Lehrerfahrungen haben mir verschiedene Ideen vermittelt, wie man abstraktere Konzepte der Naturwissenschaften auf einfachere Art und Weise erklären kann und wie man eine einprägsame Unterrichtsform findet, die die Kandidaten für ihre Semesterprüfungen effizient vorbereitet.

Selbstverständlich ist mein Hauptfach **Physik**. Weil mein Forschungsschwerpunkt in den letzten vier Jahren Hochenergiephysik und mathematische Physik war, fühle ich mich auch mit abstrakteren **mathematischen Konzepten** sehr vertraut. Im Rahmen besonders meiner Masterarbeit habe ich mich intensiv mit dem Programmieren befasst, indem ich Routinen in C, C++ und Python für unsere Forschung aufgebaut und co-entwickelt habe. Daher wäre ich auch in der Lage mich professionell mit **Programmiersprachen und Computeranwendungen** zu befassen.

Die Fachkenntnisse in den erwähnten Bereichen besitze ich sowohl auf **Deutsch** als auch auf **Englisch**. Selber habe ich gleichzeitig das deutsche Abitur und die griechischen Reifeprüfungen abgelegt und beide mit exzellenten Noten bestanden. Dementsprechend habe ich Schwerpunktfächer im Abitur wie Mathematik und Physik auch auf Deutsch gehabt. Zudem fanden alle Bachelorvorlesungen, die ich an der LMU besucht habe, auf Deutsch statt.

Bezüglich meiner Weiterentwicklung in der Berufswelt interessiere ich mich einerseits für die Anwendung des theoretischen Wissens, das mir während meines Studiums vermittelt wurde, beispielsweise im Bereich vom **Data Management**; auch in Verbindung mit **Machine Learning** und der Entwicklung und **Simulation** von innovativen Modellen. Für das bessere Gestalten des jeweiligen Projektes, aber auch zur Vertiefung meiner Kommunikationsfähigkeiten spielt die **Interdisziplinarität** sowie die Wechselwirkung mit anderen Gruppen aus relevanten Bereichen im Betrieb eine entscheidende Rolle. Meine Lernbereitschaft spiegelt sich sowohl in den sehr guten Noten meiner Zeugnisse als auch in meinem bisherigen Anteil an der aktiven wissenschaftlichen Forschung wider. Insbesondere zeigt sich meine **Teamfähigkeit** durch meine Veröffentlichungen in anerkannten Fachzeitschriften als Mitglied von internationalen Kollaborationen.

Andererseits gefällt mir das **Unterrichten besonders von jungen Erwachsenen** sehr. Gerade betreue ich als Nachhilfelehrer schon drei Studenten an der Berner Fachhochschule in den Fächern Physik (Optik und Elektrotechnik) und Algebra sowie sechs Studierenden an der Universität Bern in den Fächern Physik, Quantenchemie, Statistik und Mathematik (Analysis und lineare Algebra). Ich bin davon überzeugt, dass ich sowohl durch mein **tieferes Verständnis der theoretischeren Grundlagen** als auch durch meine **Erfahrung in der Betreuung von Studierenden** (Hinweise, Coaching, Übungserien und Lösungsansätze aufstellen, Korrektur von abgegebenen Arbeiten) dabei helfen könnte, dass der Unterricht an einer (Fach)hochschule auf eine noch einprägsamere und effizientere Art und Weise gestaltet würde.

Beigefügte Unterlagen

- Auszeichnungen
  - Attestation 8 of Associated Membership of the Personnel (Visiting Scientist) of the European Organization for Nuclear Research (CERN)
  - Stipendienurkunde 9 und Bestätigung 10
  - Offer letter for a Postdoctoral Fellowship by the research group in mathematical physics of fundamental interactions at the Université Libre de Bruxelles 11
  - Urkunde für die erfolgreiche Teilnahme an der griechischen Mathematik-Olympiade 12
- Zeugnisse
  - Schein zur Erlangung des Doktortitels 13 und Transcript of Records 14
  - Masterurkunde 15, Masterzeugnis 16 und Transcript of Records 17
  - Bachelorzeugnis 18 und Transcript of Records 20
  - Abiturzeugnis 21
  - griechisches Apolytirion 24 und griechische Reifeprüfung 25
    für die Bedeutung der relevanten Notenskala siehe z.B.
    https://de.wikipedia.org/wiki/Schulnote#Griechenland
  - FCE 26 und IELTS 27 Zeugnisse
    https://www.ielts.org/about-the-test/how-ielts-is-scored

European Organization for Nuclear Research
Organisation européenne pour la recherche nucléaire

CERN
HR Department
CH-1211 Geneva 23

Tel. direct: +41 22 767 3854
Tel. general: +41 22 766 6111
Email: attestation-request@cern.ch

Your reference:
Our reference: Attestation / pid 785370

Geneva, 11.11.2018

ATTESTATION

This is to certify that Mr. Orestis LOUKAS, born on 05.02.1992, of Greek nationality, is an Associated Member of the Personnel (Visiting Scientist) of the European Organization for Nuclear Research (CERN) from 30.11.2015 to 13.11.2018.

CERN Département HR

Head,
Human Resources Department

This attestation has been extracted automatically from the CERN Human Resources database.

DAAD Deutscher Akademischer Austausch Dienst
German Academic Exchange Service

STIPENDIENURKUNDE

Der Deutsche Akademische Austauschdienst ist eine gemeinsame Einrichtung der deutschen Hochschulen.
Er fördert mit öffentlichen Mitteln die internationale akademische Zusammenarbeit, insbesondere den Austausch von Studierenden und Wissenschaftlern.
Die Stipendien des DAAD werden auf der Grundlage von Auswahlentscheidungen unabhängiger wissenschaftlicher Kommissionen vergeben.

Im Rahmen seiner Programme verleiht der Deutsche Akademische Austauschdienst

Orestis Loukas

ein Stipendium zur wissenschaftlichen Aus- und Fortbildung in Deutschland.

Ich beglückwünsche Sie zu diesem Stipendium und wünsche Ihnen einen erfolgreichen Aufenthalt in Deutschland. Ich hoffe, dass Sie neben Ihren fachlichen Aufgaben auch die Gelegenheit wahrnehmen werden, unser Land, seine Menschen und seine Kultur näher kennenzulernen. Ich würde mich freuen, wenn Sie auch nach Rückkehr in Ihr Heimatland weiterhin die Verbindung mit Ihren deutschen Partnern und dem DAAD aufrechterhalten würden.

Bonn, den 10.06.2010

Deutscher Akademischer Austauschdienst DAAD

Prof. Dr. Dr. h.c. Max G. Huber
Vizepräsident des Deutschen Akademischen Austauschdienstes

Diese Urkunde ist nur wirksam in Verbindung mit der Stipendienzusage des zuständigen DAAD-Referats.

DAAD Deutscher Akademischer Austausch Dienst
German Academic Exchange Service

Referat Auslandsschulen, Praktika und
Hochschulsommerkurse - ST41

DAAD • Postfach 200404 • D-53 134 Bonn

Herrn
Orestis Loukas
Albert Einstein Center for Fundamental Physics
Institute for Theoretical Physics
University of Bern

Ansprechpartnerin: Gabriele Parmentier
Telefon: (0228) 882-565
Fax: (0228) 882-9565
E-Mail: parmentier@daad.de
Ihre Nachricht vom:
Unser Zeichen: ST41-Pa

Datum: 24. Februar 2016

Bescheinigung

Hiermit bescheinigen wir, dass Herr Orestis Loukas, geb. am 05.02.1992 vom 1.10.2010 bis 30.09.2015 Stipendiat im Stipendienprogramm für Absolventen deutscher Auslandsschulen beim Deutschen Akademischen Austauschdienst war. Herr Orestis Loukas wurde gefördert zum Studium an der LMU München zum Bachelor und Master.

Der DAAD ist die weltweit größte Förderorganisation für den internationalen Austausch von Studierenden und Wissenschaftlern

Mit freundlichen Grüßen

Deutscher Akademischer Austauschdienst e.V.
Bonn
65

Gabriele Parmentier
Teamleiterin Stipendienprogramm Deutsche Auslandsschulen
Referat Auslandsschulen, Praktika und Hochschulsommerkurse – ST 41

Offer in Brussels

Reply Reply All Forward Archive Delete Quick Post

Offer in Brussels

Job Application

From: Marc Henneaux
To: orestis.loukas@cern.ch
Cc: Riccardo Argurio, Glenn Barnich, Andres Collinucci, Geoffrey Compere, Stephane Detournay, Frank Ferrari

31/01/2018, 07:11
CERN account - Inbox

Dear Orestis,

We are happy to offer you a postdoctoral position in our group at the Université Libre de Bruxelles for two years starting in the Fall of 2018, extendable. Our policy is to systematically renew postdoctoral positions for one additional year (so a total of 3 years).

The permanent scientists in our group are Riccardo Argurio, Glenn Barnich, Andrés Collinucci, Geoffrey Compère, Stéphane Detournay and Frank Ferrari, besides myself. We have currently 15 postdocs and 12 graduate students. We have rather generous travel and invitation money. In addition, we have close connections with the International Solvay Institutes
http://www.solvayinstitutes.be/

We also interact with the theory groups at the VUB (Ben Craps, Alberto Mariotti, Alexandre Sevrin, Ben Craps) and at the KUL (Nicolay Bobev, Thomas Hertog, Antoine Van Proeyen, Thomas Van Riet) with whom we have weekly seminars.

The exact amount of the postdoctoral grant depends on various factors (age ...) and can be discussed if you are interested in the offer. You might perhaps contact one of our current postdocs for more information on living in Brussels:
http://www.ulb.ac.be/sciences/ptm/pmif/people.html

I hope you will accept our offer. We would appreciate an answer as soon as possible and in any case no later than February 12, 2018. In particular, if you accept an offer elsewhere, please let us know immediately. In the meantime, do not hesitate to contact anyone of us if you have any question.

Best regards,

Marc Henneaux

Quick reply...

DEUTSCHE SCHULE THESSALONIKI

URKUNDE

Orestis Loukas, 9B

wird im Schuljahr 2006/2007 für

die erfolgreiche Teilnahme an den

Mathematikwettbewerben Thales und Euklid

geehrt.

Wir bedanken uns und
gratulieren zu der hervorragenden Leistung.

Thessaloniki, am 11.5.2007

Deutsche Schule Thessaloniki
Der Direktor

Rolf-Victor Siedenhans

DIPLOM

UNIVERSITÄT
BERN

The Faculty of Science
awards

Orestis Loukas

from Greece, born on February 05, 1992

the degree of

PhD of Science in Physics

University of Bern

with the Latin honors **summa cum laude**.

Thesis
Perturbation Theory at Large Charge

Bern, September 14, 2018

Chr. Leumann

Prof. Dr. Christian Leumann, Rector
University of Bern

Zoltan Balogh

Prof. Dr. Zoltan Balogh, Dean
Faculty of Science

Transcript of Records

PhD of Science in Physics

PhD of Science in Physics

Subject	Lecturer	Date	Grade x ECTS	ECTS	Grade
Dissertation					
Perturbation Theory at Large Charge	Reffert, Hellerman	31.08.2018	-	-	6.00
Defense					
Defense	Wiese, Reffert, Hellerman	14.09.2018	-	-	5.66
Relevant for grade calculation:			**23.660:**	**4.00 =**	**5.91**
Credits to be taken into account:				***0.00***	

In the calculation of the final grade, the grade of the thesis is triply weighted and the grade of the thesis defense is singly weighted. The resulting grade has been truncated to 2 decimal places.

Overall Grade	**6.00**

The resulting grade is shown using the standard rating scale.

Latin honors	**summa cum laude**

7. Beurkundung des Diploma Supplement / Certification of the Diploma Supplement

7.1 Datum / Date
14. September 2018 / September 14, 2018

7.2 Unterschrift(en) / Signature(s)

Zoltan Balogh
Prof. Dr. Zoltan Balogh, Dean
Faculty of Science

7.3 Dekan(e)/Dekanin(nen) / Dean(s)
Prof. Dr. Zoltan Balogh, Dean, Faculty of Science

7.4 Stempel / Seal

UNIVERSITÄT
BERN
Faculty of Science

LUDWIG - MAXIMILIANS - UNIVERSITÄT MÜNCHEN

MASTER DIPLOMA

THE STUDENT OF PHYSICS

Orestis Loukas

BORN ON FEBRUARY 05, 1992 IN THESSALONIKI

HAS FULFILLED THE REQUIREMENTS FOR THE MASTER'S PROGRAM IN

PHYSICS

IN ACCORDANCE WITH THE EXAMINATION AND STUDY REGULATIONS
OF SEPTEMBER 30, 2009 AT LUDWIG-MAXIMILIANS-UNIVERSITÄT MÜNCHEN
AND HAS ACHIEVED THE FOLLOWING GRADE:

-- very good --

HAVING FULFILLED THE PRESCRIBED REQUIREMENTS HE IS HEREBY
CONFERRED THE DEGREE

MASTER OF SCIENCE

MÜNCHEN, SEPTEMBER 15, 2015

CHAIRMAN
OF THE EXAMINATION COMMITTEE

....
Prof. Dr. O. Biebel

DEAN OF THE FACULTY OF PHYSICS
LUDWIG-MAXIMILIANS-UNIVERSITÄT MÜNCHEN

....
Prof. Dr. R. Bender

LUDWIG - MAXIMILIANS - UNIVERSITÄT MÜNCHEN

MASTER EXAMINATION IN PHYSICS

MASTER - CERTIFICATE

THE STUDENT OF PHYSICS

Orestis Loukas

BORN ON FEBRUARY O5, 1992 IN THESSALONIKI

HAS FULFILLED THE REQUIREMENTS FOR THE MASTER'S PROGRAM IN PHYSICS IN ACCORDANCE WITH THE EXAMINATION AND STUDY REGULATIONS OF SEPTEMBER 30, 2009 AT LUDWIG-MAXIMILIANS-UNIVERSITÄT MÜNCHEN AND HAS ACHIEVED THE FOLLOWING GRADE:

-- very good (1.10) --

THE TOPIC OF MASTER THESIS WAS:

"(Non-) supersymmetric model building with heterotic strings".

THE MASTER THESIS WAS GRADED **1.0.**

THE FULL LIST OF COURSES AND THE GRADES ATTAINED IN EACH COURSE AS WELL AS THE ACQUIRED ECTS-CREDITS ARE TO BE FOUND IN THE ATTACHED TRANSCRIPT OF RECORDS DATED SEPTEMBER 15, 2015.

MÜNCHEN, SEPTEMBER 15, 2015

CHAIRMAN OF THE
EXAMINATION COMMITTEE

Prof. Dr. O. Biebel

GRADES: VERY GOOD (1.00 – 1.50), GOOD (1.51 – 2.50), SATISFACTORY (2.51 – 3.50), SUFFICIENT (3.51 – 4.00)

Munich, 15 September 2015

Loukas, Orestis
born 05 February 1992 in Thessaloniki
Student ID: 10368365

Program: Physics
Degree: Master of Science (M.Sc.)
Master Certificate dated 15 September 2015

Transcript of Records in accordance with the examination regulations for the Master program in Physics at Ludwig-Maximilians-Universität München of 30 September 2009

List of Credit Courses		Term	Grade	ECTS
10100	**Advanced Experimental Physics**		**1.00**	**9**
10103	Advanced Particle Physics (Schaile)	SS 2015	1.00	9
10200	**Advanced Theoretical Physics**		**1.00**	**9**
10202	Advanced Theoretical Physics (Pollet)	WS 13/14	1.0	9
10300	**Qualification**		**BE**	**3**
10301	Java for Physicists (Duckeck, Elmsheuser)	WS 14/15	BE	3
20100	**Modern Physics**		**1.00**	**9**
20101	Stringtheory I (Lüst)	WS 13/14	1.0	9
20200	**Specialisation**		**1.07**	**12**
20201	Seminar: Particle Physics and the Early Universe (Schaile)	WS 14/15	1.3	3
20202	Supersymmetry (Mayr)	SS 2014	1.0	9
20300	**Research Methods of Modern Physics**		**1.30**	**9**
20301	Stringtheory II (Brenner)	SS 2014	1.3	9
20400	**Fundamental Research**		**2.00**	**9**
20401	Quantum Electrodynamics (Buchalla)	WS 13/14	2.0	9
30100	**Practical Phase Part 1**			
30101	(Non-) supersymmetric model building with heterotic strings (Groot-Nibbelink)	SS 2014	BE	15
30200	**Practical Phase Part 2**			
30201	(Non-) supersymmetric model building with heterotic strings (Groot-Nibbelink)	WS 14/15	1.0	15
30300	**Final Module**			
30301	(Non-) supersymmetric model building with heterotic strings (Groot-Nibbelink)	SS 2015	1.0	30
	Sum of ECTS Credits			**120**

All requirements for the Master's program in Physics were fulfilled on 15 September 2015 with final grade of 1.10 (very good).

End of Transcript

(P)=compulsory module, (WP)=compulsory optional module, BE=passed

Grading scheme:
Grades on each piece of work are indicated as: 1 = very good; 2 = good; 3 = satisfactory; 4 = sufficient; 5 = not sufficient. To guarantee a higher degree of differentiation, grades may be decreased or increased by 0.3. Grades of 0.7, 4.3, 4.7 and 5.3 are not possible.
The final grade is indicated as: up to and including 1.50 = "very good"; from 1.51 up to and including 2.50 = "good"; from 2.51 up to and including 3.50 = "satisfactory" and from 3.51 up to and including 4.00 = "sufficient".

LUDWIG-MAXIMILIANS-UNIVERSITÄT MÜNCHEN 73

PD Dr. Martin Kerscher
Examination Office of Physics

LUDWIG - MAXIMILIANS - UNIVERSITÄT MÜNCHEN

BACHELORPRÜFUNG IN PHYSIK

BACHELOR - ZEUGNIS

DER STUDENT DER PHYSIK

Orestis Loukas

GEBOREN AM 05. FEBRUAR 1992 IN THESSALONIKI

HAT DIE BACHELORPRÜFUNG FÜR DEN STUDIENGANG PHYSIK AN
DER LUDWIG-MAXIMILIANS-UNIVERSITÄT MÜNCHEN GEMÄß DER
STUDIEN- UND PRÜFUNGSORDNUNG VOM 31. JANUAR 2007 MIT DER NOTE

-- gut -- (1,65)

BESTANDEN.

DAS THEMA DER BACHELORARBEIT LAUTETE:

"Heterotische Modellkonstruktion auf Z8-I Orbifold".

DIE BACHELORARBEIT WURDE MIT DER NOTE **1,0** BEWERTET.

DIE WEITEREN NOTEN UND DIE ZUGEHÖRIGEN ECTS-PUNKTE
SIND IM TRANSCRIPT OF RECORDS VOM 04. JULI 2013 AUFGELISTET.

MÜNCHEN, DEN 04. JULI 2013

DER VORSITZENDE
DES PRÜFUNGSAUSSCHUSSES PHYSIK

Prof. Dr. O. Biebel

LUDWIG-MAXIMILIANS-UNIVERSITÄT MÜNCHEN

NOTENSTUFEN: SEHR GUT (1,00 - 1,50), GUT (1,51 - 2,50), BEFRIEDIGEND (2,51 - 3,50), AUSREICHEND (3,51 - 4,00)

LMU

LUDWIG-MAXIMILIANS-UNIVERSITÄT MÜNCHEN

BACHELOR PHYSIK

Loukas, Orestis
geb. am 05. Februar 1992 in Thessaloniki
Matrikelnr. 10368365

München, den 04. Juli 2013

Studiengang: Physik
Abschluss: Bachelor

Transcript of Records gemäß Prüfungsordnung der Ludwig-Maximilians-Universität München für den Bachelorstudiengang Physik vom 31. Januar 2007

	Studienbegleitende Prüfungsleistungen	Semester	Note	ECTS
10100	**Modul E1: Mechanik**		**2,7**	**9**
10101	E1.1 Vorlesung Mechanik	WS 10/11		6
10102	E1.2 Übung zur Vorlesung Mechanik	WS 10/11		3
10191	Modulprüfung *(Gaub)*	WS 10/11	2,7	
10200	**Modul R: Rechenmethoden der theoretischen Physik**		**BE**	**9**
10201	R.1 Vorlesung Rechenmethoden der theoretischen Physik	WS 10/11		6
10202	R.2 Übung zur Vorlesung Rechenmethoden der theoretischen Physik	WS 10/11		3
10291	Modulprüfung *(Groot Nibbelink)*	WS 10/11	BE	
10300	**Modul P 1-2: Grundpraktikum**		**BE**	**6**
10301	P1-2.1 Grundpraktikum 1 *(Giersch)*	WS 10/11	BE	3
10302	P1-2.2 Grundpraktikum 2 (SS) *(Giersch)*	SS 2011	BE	3
10400	**Modul M1: Analysis und Lineare Algebra I**		**BE**	**9**
10401	M1.1 Vorlesung Analysis und Lineare Algebra I *(Dürr)*	WS 10/11	BE	6
10402	M1.2 Übung zur Vorlesung Analysis und Lineare Algebra I *(Dürr)*	WS 10/11	BE	3
10500	**Modul E2: Wärme und Elektromagnetismus**		**1,0**	**9**
10501	E2.1 Vorlesung Wärme und Elektromagnetismus	SS 2011		6
10502	E2.2 Übung zur Vorlesung Wärme und Elektromagnetismus	SS 2011		3
10591	Modulprüfung *(Kersting)*	SS 2011	1,0	
10600	**Modul T1: Theoretische Mechanik**		**2,0**	**9**
10601	T1.1 Vorlesung Theoretische Mechanik	SS 2011		6
10602	T1.2 Übung zur Vorlesung Theoretische Mechanik	SS 2011		3
10691	Modulprüfung *(Mukhanov)*	SS 2011	2,0	
10700	**Modul M2: Analysis und Lineare Algebra II**		**BE**	**9**
10701	M2.1 Vorlesung Analysis und Lineare Algebra II *(Zenk)*	SS 2011	BE	6
10702	M2.2 Übung zur Vorlesung Analysis und Lineare Algebra II *(Zenk)*	SS 2011	BE	3
10800	**Modul E3: Elektromagnetische Wellen und Optik**		**1,0**	**9**
10801	E3.1 Vorlesung Elektromagnetische Wellen und Optik	WS 11/12		6
10802	E3.2 Übung zur Vorlesung Elektromagnetische Wellen und Optik	WS 11/12		3
10891	Modulprüfung *(Zinth)*	WS 11/12	1,0	
10900	**Modul T2: Quantenmechanik**		**1,0**	**9**
10901	T2.1 Vorlesung Quantenmechanik	WS 11/12		6
10902	T2.2 Übung zur Vorlesung Quantenmechanik	WS 11/12		3
10991	Modulprüfung *(Hofmann)*	WS 11/12	1,0	
11000	**Modul P 3/I: Fortgeschrittenenpraktikum I**		**BE**	**6**
11001	P3.1 Fortgeschrittenenpraktikum I, Teil A *(Giersch)*	WS 11/12	BE	3
11002	P3.2 Fortgeschrittenenpraktikum I, Teil B *(Giersch)*	SS 2012	BE	3
11100	**Modul M3: Analysis III**		**BE**	**9**
11101	M3.1 Vorlesung Analysis III *(Dürr)*	WS 11/12	BE	6
11102	M3.2 Übung zur Vorlesung Analysis III *(Dürr)*	WS 11/12	BE	3
11200	**Modul E4: Atom- und Molekülphysik**		**1,7**	**9**
11201	E4.1 Vorlesung Atom- und Molekülphysik	SS 2012		6
11202	E4.2 Übung zur Vorlesung Atom- und Molekülphysik	SS 2012		3
11291	Modulprüfung *(Bloch)*	SS 2012	1,7	
11300	**Modul T3: Elektrodynamik**		**2,3**	**9**
11301	T3.1 Vorlesung Elektrodynamik	SS 2012		6
11302	T3.2 Übung zur Vorlesung Elektrodynamik	SS 2012		3
11391	Modulprüfung *(Schollwöck)*	SS 2012	2,3	

Studienbegleitende Prüfungsleistungen		Semester	Note	ECTS
11400	**Modul M4: Numerik**		**BE**	**6**
11401	M4.1 Vorlesung Numerik *(Kerscher)*	SS 2012	BE	4
11402	M4.2 Übung zur Vorlesung Numerik *(Kerscher)*	SS 2012	BE	2
11500	**Modul SQ: Schlüsselqualifikation**		**BE**	**3**
11501	SQ.1 Schlüsselqualifikation 1 *Einführung in die Griechische Philosophie Stufe III*	WS 11/12	BE	2
11502	SQ.2 Schlüsselqualifikation 2 *Einführung in die Griechische Philosophie Stufe III*	WS 11/12	BE	1
11600	**Modul E5: Kern- und Teilchenphysik**		**2,0**	**6**
11601	E5.1 Vorlesung Kern- und Teilchenphysik	WS 12/13		4
11602	E5.2 Übung zur Vorlesung Kern- und Teilchenphysik	WS 12/13		2
11691	Modulprüfung *(Schieck)*	WS 12/13	2,0	
11700	**Modul E6: Festkörperphysik**		**3,7**	**6**
11701	E6.1 Vorlesung zu Festkörperphysik	WS 12/13		4
11702	E6.2 Übung zur Vorlesung Festkörperphysik	WS 12/13		2
11791	Modulprüfung *(Kleineberg)*	WS 12/13	3,7	
11800	**Modul T4: Statistische Physik**		**2,7**	**9**
11801	T4.1 Vorlesung Statistische Physik	WS 12/13		6
11802	T 4.2 Übung zur Vorlesung Statistische Physik	WS 12/13		3
11891	Modulprüfung *(Sachs)*	WS 12/13	2,7	
11900	**Modul V/I: Vertiefungsbereich**		**1,05**	**18**
11901	V.1 Fortgeschrittenenpraktikum II *(Benoit)*	WS 12/13	1,3	3
11902	V.2 Physikalisches Seminar *Das Ende von Allem (Lesch)*	SS 2012	1,0	3
20100	**V.3A Astronomie und Astrophysik, Kosmologie**		**1,00**	**6**
20101	V.3A1 Vorlesung aus dem Bereich der Astronomie und Astrophysik, Kosmologie	WS 12/13		4
20102	V.3A2 Übung zur Vorlesung aus dem Bereich der Astronomie und Astrophysik, Kosmologie	WS 12/13		2
20103	Modulteilprüfung *Extragalaktische Astronomie (Lesch)*	WS 12/13	1,0	
21100	**V.3A Astronomie und Astrophysik, Kosmologie**		**1,00**	**6**
21101	V.3A1 Vorlesung aus dem Bereich der Astronomie und Astrophysik, Kosmologie	SS 2012		4
21102	V.3A2 Übung zur Vorlesung aus dem Bereich der Astronomie und Astrophysik, Kosmologie	SS 2012		2
21103	Modulteilprüfung *Sterne und Planeten (Lesch)*	SS 2012	1,0	
24000	**Modul AP: Abschlußprüfung *(Groot Nibbelink)***	**SS 2013**	**1,0**	**9**
24100	Modul BA: Bachelorarbeit *"Heterotische Modellkonstruktion auf Z8-I Orbifold" (Groot Nibbelink)*	SS 2013	1,0	12
Summe der Leistungspunkte				**180**

Die Bachelorprüfung im Studiengang Physik wurde erfolgreich am 04.07.2013 mit der Endnote 1,65 abgelegt.

Ende der Auflistung

Die Leistungen in den einzelnen Prüfungsgebieten werden bezeichnet mit 1 = sehr gut; 2 = gut; 3 = befriedigend; 4 = ausreichend; 5 = nicht ausreichend. Zur differenzierteren Bewertung der Leistung können die Notenziffern um 0,3 erniedrigt oder erhöht werden. Die Bewertungen 0,7, 4,3, 4,7 und 5,3 sind ausgeschlossen.
Die Gesamtnote lautet: bis einschließlich 1,5 = "sehr gut"; von 1,51 bis einschließlich 2,5 = "gut"; von 2,51 bis einschließlich 3,5 = "befriedigend" und von 3,51 bis einschließlich 4,0 = "ausreichend". BE=bestanden, *=anerkannte Leistung

Bernhard Emmer
Leiter Prüfungsamt
Physik

LUDWIG-MAXIMILIANS-UNIVERSITÄT MÜNCHEN

04. Juli 2013

DEUTSCHE SCHULE THESSALONIKI

ZEUGNIS

über den Erwerb der

ALLGEMEINEN DEUTSCHEN HOCHSCHULZUGANGSBERECHTIGUNG

durch Teilnahme an der Ergänzungsprüfung
zum Abschlusszeugnis des Lykeions (Apolytirion)

Orestis Loukas

geboren am **05.02.1992** in **Thessaloniki**

hat das griechische Lykeion absolviert und durch Teilnahme an der Ergänzungsprüfung in Verbindung mit dem griechischen Apolytirion die allgemeine deutsche Hochschulzugangsberechtigung erworben.

Dem Zeugnis liegt die Ordnung der Ergänzungsprüfung für Absolventen der griechischen Abteilung der Deutschen Schule Thessaloniki (Beschluss der Kultusministerkonferenz vom 17.01.1985 in der Fassung vom 09.03.2005) zu Grunde

Orestis Loukas

geboren am 05.02.1992 in Thessaloniki

griechischer Staatsangehörigkeit

ist im Schuljahr 2004/05 in die Klasse 7 der Deutschen Schule Thessaloniki eingetreten.

Er/Sie hat im Schuljahr 2009/10 die Jahrgangsstufe 12 erfolgreich absolviert und das Abschlusszeugnis des Lykeion erworben.

Am 22.04.2010 hat er/sie die Ergänzungsprüfung zur Erlangung einer allgemeinen deutschen Hochschulzugangsberechtigung abgelegt.

Nach den Leistungen im Unterricht der Abschlussklassen und den Leistungen in den Teilprüfungen werden folgende Noten[1] erteilt:

Note im Fach Deutsch:	**19.55**
Note im Fach Englisch:	**20,00**
Note im Fach Mathematik (Ergänzungsfach):	**20,00**

DEUTSCHE SCHULE THESSALONIKI 1927 1956

Für die Richtigkeit der Abschrift/Fotokopie.
Thessaloniki, den 2.7.2010

[1] Notenstufen: 20 – 19 sehr gut, 18 – 16 gut, 15 – 13 befriedigend, 12 – 10 ausreichend

Dieses Zeugnis berechtigt in Verbindung mit dem Apolytirion der Deutschen Schule Thessaloniki, das eine Mindestnote von 10 ausweist, zum Studium an einer Hochschule in der Bundesrepublik Deutschland.

Aus den Schul- und Prüfungsleistungen errechnet sich für die deutsche Hochschulzugangsberechtigung folgende

Gesamtnote: **1,1**

Thessaloniki, den 22.04.2010

Der/Die Beauftragte der Ständigen Konferenz der Kultusminister der Länder in der Bundesrepublik Deutschland

Schäfer

Der/Die Leiter/in der Schule

Der Generalkonsul der Bundesrepublik Deutschland in Thessaloniki

Der/Die Vertreter/in des Schulvereinsvorstandes

GENERALKONSULAT DER BUNDESREPUBLIK DEUTSCHLAND THESSALONIKI 1

(Dienstsiegel)

DEUTSCHE SCHULE THESSALONIKI 1927 1956

(Dienstsiegel)

(Emblem)
DEUTSCHE SCHULE THESSALONIKI
PRIVATES ALLGEMEINES LYZEUM

Schuljahr 2009-2010

ABSCHLUSSZEUGNIS

NUMMERN: DES PROTOKOLLS	: **670-06/07/2010**	DES SCHÜLERREGISTERS	: **643**
DES MÄNNERREGISTERS	: **946/1992**	DES GEMEINDEREGISTERS	: **130397/3**
DER GEMEINDE ODER STADT	: **THESSALONIKI**	VERWALTUNGSBEZIRK	: **THESSALONIKI**
STAATSANGEHÖRIGKEIT	: **GRIECHISCH**	RELIGION	: **Christlich Orthodox**
		GEBURTSJAHR	: **1992**

Der Schüler **LOUKAS ORESTIS,** Sohn des **ANGELOS** und der **MARIA,** geb. **CHALKIA,** hat im Schuljahr **2009-2010** die Fächer **der dritten (3.) Klasse des Allgemeinen Lyzeums** (Fachbereich: TECHNOLOGIE, Studiengang: INFORMATIK und DIENSTLEISTUNGEN) besucht, und nachdem er entsprechend der in Kraft befindlichen Bestimmungen geprüft worden war, wurde er vom Lehrerverband **(Urkunde 18/06.07.2010)** des ABSCHLUSSZEUGNISSES mit der allgemeinen Note **„sehr gut“ NEUNZEHN und SIEBEN ZEHNTEL (19,7)** und mit Betragen **„AUSGEZEICHNET“** für würdig befunden.

Durchschnittsabschlussnote der 3. Klasse: "sehr gut" NEUNZEHN und SIEBEN ZEHNTEL (19,7) ….."

Seine ausführliche Benotung in den Fächern der 3. Klasse ist:

ALLGEMEINE BILDUNG

- *Religion*
- NEUNZEHN und FÜNF ZEHNTEL (19,5)
- *Altgriechische Sprache und Literatur* (20)
- *ZWANZIG*
- *Neugriechische Literatur* (20)
- ZWANZIG
- *Neugriechische Sprache* (18,5)
- ACHTZEHN und FÜNF ZEHNTEL
- *Neuere Geschichte* (20)
- ZWANZIG
- *Mathematik und Statistik* (19,9)
- NEUNZEHN und NEUN ZEHNTEL
- *Physik* (20)
- ZWANZIG
- *Biologie* (19,8)
- NEUNZEHN und ACHT ZEHNTEL
- *Sozialkunde* (20)
- ZWANZIG
- *Englisch* (19,5)
- NEUNZEHN und FÜNF ZEHNTEL
- *DEUTSCH* (19)
- NEUNZEHN

STUDIENGANGFÄCHER

- *Mathematik* (20)
- ZWANZIG
- *Physik* (20)
- ZWANZIG
- *Grundsätze der Organisation und Führung von Unternehmen und Dienstleistungen* (19)
- NEUNZEHN
  Entwicklung von Anwendungen in der Programmierungsumgebung (19,9)
  NEUNZEHN und NEUN ZEHNTEL

FÄCHER FREIER AUSWAHL

- *Computeranwendungen*
- *ZWANZIG*

(*20*)

(Rundstempel, Stempel und Unterschrift)
GENAUE ABSCHRIFT
08.07.2010

Das vorliegende Schreiben hat die Gültigkeit eines ABSCHLUSSZEUGNISSES EINES STAATLICHEN ALLGEMEINEN LYZEUMS (G 682/1977)

Thessaloniki, den 07.07.2010

Reg. Dir. des pr. u. sek Bildungsbereichs
DIR. DES SEK. BILD. OST THESSALONIKI
Beglaubigt
Thessaloniki, den ………..
DER VORSITZENDE der
DIR. DES SEK. BILD. OST THESSALONIKI
(Unterschrift)
Theodoulos L. Tapanidis
Mathematiker

Die Rektorin
(Unterschrift)
Nikoletta Simou

Der Rektor des Instituts
(Unterschrift)
Rolf-Victor Siedenhans

Die Lehrer
(4 Unterschriften)

Der Verfasser des Titels
(Unterschrift)
Nikolaos Liolios
(Rundstempel)

Genaue Übersetzung der beglaubigten Abschrift aus der griechischen in die deutsche Sprache.
Thessaloniki, den 09/07/2010
DER ÜBERSETZER

GRIECHISCHE REPUBLIK
DIR. DES SEK. BILD. OST THESSALONIKI
301
DEUTSCHE SCHULE THESSALONIKI
PRIVATES ALLGEMEINES LYZEUM
Registriernummer des Lyzeums: 1990912
Km. 9 Thessaloniki-Thermi, 55102 Thessaloniki
Telefon: 475900 – 475901 – 475902
Fax: 476232

Schuljahr 2009-2010
Thessaloniki: 06.07.2010
Protokoll-Nr.: 727-06/07/2010

BESCHEINIGUNG

(Paragraph 13, Artikel 1, Gesetz 2525/1997, wie mit Paragraph. 1 des Artikels 1 des Gesetzes Nr. 2909/2001 vervollständigt wurde)

Es wird bescheinigt, dass **LOUKAS ORESTIS,** Sohn des **ANGELOS** und der **MARIA,** mit der Registriernummer 10052400, Eigentümer des Abschlusszeugnisses- oder diploms mit Nr. **670-06/07/2010**, das von der **DEUTSCHEN SCHULE THESSALONIKI** ausgestellt wurde, an den schriftlichern Prüfungen der unten stehenden Fächer im Fachbereich **TECHNOLOGIE** (Studiengang: **INFORMATIK und DIENSTLEISTUNGEN) der dritten (3.) Klasse des Allgemeinen Lyzeums** teilgenommen, die auf nationaler Ebene im Schuljahr **2009-2010** durchgeführt wurden.

Seine mündlichen und schriftlichen Leistungen und die Abschlussnoten für jedes Fach sind:

	MÜNDLICHE NOTE	SCHRIFTLICHE NOTE	ABSCHLUSSNOTE
A. FÄCHER ALLGEMEINER BILDUNG			
1. Neugriechische Sprache	(18,9)	(16,9)	(17,5)
2. Mathematik und Statistik	(20)	(19,8)	(19,9)
B. FÄCHER DES FACHBEREICHS			
1.Mathematik	(20)	(20)	(20)
2. Physik	(20)	(20)	(20)
3. Grundsätze der Organisation und Führung von Unternehmen und Dienstleistungen	(20)	(18)	(18,6)
4. Entwicklung von Anwendungen in der Programmierungsumgebung	(20)	(19,7)	(19,8)

ALLGEMEINE ~~ABSCHLUSS~~NOTE «NEUNZEHN und DREISSIG HUNDERTSTEL» (19,30)
Zugangs-

(Rundstempel)
Die Rektorin des Lyzeums
Unterschrift
Nikoletta Simou

Genaue Übersetzung der beglaubigten Abschrift aus der griechischen in die deutsche Sprache.
Thessaloniki, den 13/07/2010
DER ÜBERSETZER

PANHELLENIC ASSOCIATION OF TRANSLATORS
MEMBER OF INTERNATIONAL FED. OF TRANSLATORS
SAVAS A. PAVLIDIS
TRANSLATOR
P.A.T.

UNIVERSITY *of* CAMBRIDGE
ESOL Examinations

English for Speakers of Other Languages

Level 1 Certificate in English (ESOL)*

This is to certify that

ORESTIS ANGELOU LOUKAS

has been awarded

Grade A

in the

First Certificate in English

Council of Europe Level B2

Date of Examination	**DECEMBER 2006**
Place of Entry	**THESSALONIKI**
Reference Number	**06CGR0260204**
Accreditation Number	**100/2032/9**

*This level refers to the UK National Qualifications Framework

Michael Milanovic
Chief Executive

Date of Issue 12/02/07

Certificate Number 0017259134

INTERNATIONAL ENGLISH LANGUAGE TESTING SYSTEM

ACADEMIC

Test Report Form

NOTE *Admission to undergraduate and post graduate courses should be based on the ACADEMIC Reading and Writing Modules. GENERAL TRAINING Reading and Writing Modules are **not** designed to test the full range of language skills required for academic purposes. It is recommended that the candidate's language ability as indicated in this Test Report Form be re-assessed **after two years** from the date of the test.*

Centre Number	GR026	Date	13/OCT/2012	Candidate Number	301723

Candidate Details

Family Name	LOUKAS
First Name	ORESTIS
Candidate ID	356423

Date of Birth	05/02/1992	Sex (M/F)	M	Scheme Code	Private Candidate
Country or Region of Origin	GREECE	First Language	GREEK		
Repeating IELTS (Y/N)	N	Previous Test Date		Previous Test Centre	

Test Results

Listening	Reading	Writing	Speaking	Overall Band Score
9.0	9.0	8.0	7.5	8.5

Administrator Comments

Centre stamp

BRITISH COUNCIL
THESSALONIKI

Validation stamp

VALIDATION STAMP
IELTS
CAMBRIDGE ESOL/BRITISH COUNCIL/IDP:IA

Writing Examiner Number	990478	Administrator's Signature	Αθανασίου
Speaking Examiner Number	997945	Date	24/10/2012
Test Report Form Number	12GR301723LOUO026A		

BRITISH COUNCIL   idp IELTS AUSTRALIA   UNIVERSITY *of* CAMBRIDGE ESOL Examinations

The validity of this IELTS Test Report Form can be verified online by recognising organisations at http://ielts.ucles.org.uk

Research Statement

Orestis Loukas

In my future postdoctoral position I would like to conduct research in the following areas (Of course, I am open to any related suggestion which extends and/or goes beyond the points mentioned here.):

Research suggestion I: Accessing the CFT spectrum at large global charge

I am interested in studying strongly coupled theories in three or higher dimensions. Of particular interest are conformal field theories, as they appear in numerous applications in modern physics from string theory and quantum gravity to the theory of phase transitions and condensed matter physics. The main objective is to *systematically* gain *analytic* access to such strongly coupled sectors.

To this end, the large-charge techniques first implemented in [1] to analyze the low-energy dynamics of IR fixed points of the RG flow can be used. Considering first non-supersymmetric theories, where the order parameter of the critical theory is described by a scalar operator in the fundamental or adjoint representation of the global symmetry group, in the sectors where the associated global charge is large, leads to unexpected simplifications and highly interesting results. In particular, it allows the perturbative computation of the full CFT spectrum with controlling parameter $1/Q \ll 1$. The outcome of our perturbative analysis has been verified via Monte-Carlo simulations on the lattice [2]. It is meaningful to pursue further this path, considering larger (and hence richer) global symmetry groups, as more simulations are on their way (private communication with the authors), especially for $\mathbb{CP}^N$ theories, which are broadly studied in condensed matter physics, as well.

On the other hand, it is my intention to use a similar reasoning in the supersymmetric setting. For instance, by taking an R-symmetry charge to be large [3] a relation was motivated between the unbroken phase of superconformal $\mathcal{N} = 2$ theories in 3D and the low-energy effective action governing the moduli space of vacua. Comparing with exact results from supersymmetric localization, one establishes again the validity of large-charge perturbation theory. Along similar lines, a fruitful application will be to consider next the holographic duals of some of those CFTs where large-charge perturbation theory is meaningful. One natural candidate would be to look at superconformal field theories related to ABJM theory. This will enable us to compare the large-charge prediction with the dual computation on the gravity side, which should serve as yet another important crosscheck of our construction.

Connecting the two approaches, by going to larger global symmetry groups and by using holographic principles, one would hope to investigate the relation of large-charge to large-N expansion. This could sed some light on the emergent universality of large-charge predictions leading generally to a more model-independent formulation of large-charge perturbation theory.

There are many more aspects which remain to be understood about the sectors of theories at large global charge. Last but not least, to be mentioned is the relation of large-charge to large-spin expansion or the possibility to develop similar perturbative techniques by fixing some purely fermionic current. Finally, one has to acknowledge the very recent [4] formulation of higher dimensional CFTs at large global charge in terms of conformal bootstrap and the interesting interplay it opens between bootstrap and our analytic techniques.

Research suggestion II:
Phenomenologically viable models from string theory

It is often stated that string theory predicts target-space supersymmetry (SUSY). However, evidence from LHC suggests that SUSY is either entirely not realized in nature or broken at very high energies. In fact, as it has been known [5] from the early days there are consistent (i.e. anomaly-free and tachyon-free) superstring theories without target-space SUSY, to begin with. Another reasoning to reconcile with experimental evidence follows the implementation of some stringy mechanism which spontaneously breaks SUSY. In either case, the hope is that the consistency conditions of string theory will help us keep the non-supersymmetric model under control compared to ordinary QFT.

At the forefront are two questions. One deals with the spectrum predicted by our non-supersymmetric model. The most challenging question though, concerns the Casimir energy of our stringy vacuum, i.e. the value of the cosmological constant. The presence of an exact CFT description is a natural setting to attack the latter serious issue. To this end, we consider non-supersymmetric asymemtric and/or non-Abelian orbifold geometries to compactify the internal space of (mainly) heterotic string theory to obtain a more systematic, less model-dependent way to ensure the vanishing of the 4D one-loop (which gives the leading contribution in string perturbation theory) cosmological constant. This is very fundamental, not only due to phenomenological reasons, but also to ensure the stability of string perturbation theory itself around the non-supersymmetric vacuum (at least to leading orders).

Nowadays, we have the power of various mathematical classifications (e.g. [6]) of more and more admissible manifolds in conjecture with new insights developed for non-Abelian and asymmetric orbifolds [7]. Also, the advances in computer efficiency make exhaustive searches for the appropriate type of compactification manifolds a viable task. It is thus reasonable to push forward this idea and look for huge classes of 4D string models suported by some orbifold geometry with the desired property to allow for non-supersymmetric string model building with a vanishing one-loop cosmological constant.

[1] S. Hellerman, D. Orlando, S. Reffert, and M. Watanabe "On the CFT Operator Spectrum at Large Global Charge" *JHEP* **12** (2015) 071 [arXiv:1505.01537].

[2] D. Banerjee, S. Chandrasekharan, and D. Orlando "Conformal dimensions via large charge expansion" [arXiv:1707.00711].

[3] S. Hellerman and S. Maeda "On the Large R-charge Expansion in $\mathcal{N} = 2$ Superconformal Field Theories" [arXiv:1710.07336].

[4] D. Jafferis, B. Mukhametzhanov, and A. Zhiboedov "Conformal Bootstrap At Large Charge" [arXiv:1710.11161].

[5] L. Alvarez-Gaumé, P. Ginsparg, G. Moore, and C. Vafa "An O(16)xO(16) heterotic string" *Physics Letters B* **171** (Apr., 1986) 155–162.

[6] W. Plesken and T. Schulz "Counting crystallographic groups in low dimensions" *Experimental Mathematics* **9** (2000) no. 3, 407–411 [arXiv:http://dx.doi.org/10.1080/10586458.2000.10504417].

[7] S. Groot Nibbelink and P. K. S. Vaudrevange "T-duality orbifolds of heterotic Narain compactifications" *JHEP* **04** (2017) 030 [arXiv:1703.05323].

Papers by Dr. Orestis Louaks

provided via INSPIRE-HEP

November 11, 2018

1. **"An AdS/EFT correspondence at large charge"**
   O. Loukas, D. Orlando, S. Reffert and D. Sarkar.
   arXiv:1804.04151 [hep-th]
   DOI:10.1016/j.nuclphysb.2018.07.020
   Nucl. Phys. B **934**, 437 (2018)
   INSPIRE-HEP entry
   5 citations counted in INSPIRE as of 11 Nov 2018

2. **"A matrix CFT at multiple large charges"**
   O. Loukas.
   arXiv:1711.07990 [hep-th]
   DOI:10.1007/JHEP06(2018)164
   JHEP **1806**, 164 (2018)
   INSPIRE-HEP entry
   6 citations counted in INSPIRE as of 11 Nov 2018

3. **"Tension Between a Vanishing Cosmological Constant and Non-Supersymmetric Heterotic Orbifolds"**
   S. Groot Nibbelink, O. Loukas, A. Mtter, E. Parr and P. K. S. Vaudrevange.
   arXiv:1710.09237 [hep-th]
   TUM-HEP-1104-17
   INSPIRE-HEP entry
   3 citations counted in INSPIRE as of 11 Nov 2018

4. **"Matrix models at large charge"**
   O. Loukas, D. Orlando and S. Reffert.
   arXiv:1707.00710 [hep-th]
   DOI:10.1007/JHEP10(2017)085
   JHEP **1710**, 085 (2017)
   INSPIRE-HEP entry
   11 citations counted in INSPIRE as of 11 Nov 2018

5. **"Abelian scalar theory at large global charge"**
   O. Loukas.
   arXiv:1612.08985 [hep-th]
   DOI:10.1002/prop.201700028
   Fortsch. Phys. **65**, no. 9, 1700028 (2017)
   INSPIRE-HEP entry
   12 citations counted in INSPIRE as of 11 Nov 2018

6. **"Compensating strong coupling with large charge"**
   L. Alvarez-Gaume, O. Loukas, D. Orlando and S. Reffert.
   arXiv:1610.04495 [hep-th]
   DOI:10.1007/JHEP04(2017)059
   JHEP **1704**, 059 (2017)
   CERN-TH-2016-221
   INSPIRE-HEP entry
   22 citations counted in INSPIRE as of 11 Nov 2018

7. **“(MS)SM-like models on smooth Calabi-Yau manifolds from all three heterotic string theories”**
   S. Groot Nibbelink, O. Loukas and F. Ruehle.
   arXiv:1507.07559 [hep-th]
   DOI:10.1002/prop.201500041
   Fortsch. Phys. **63**, 609 (2015)
   DESY-15-126, LMU-ASC-47/15
   INSPIRE-HEP entry
   21 citations counted in INSPIRE as of 11 Nov 2018

8. **“Calabi-Yau compactifications of non-supersymmetric heterotic string theory”**
   M. Blaszczyk, S. Groot Nibbelink, O. Loukas and F. Ruehle.
   arXiv:1507.06147 [hep-th]
   DOI:10.1007/JHEP10(2015)166
   JHEP **1510**, 166 (2015)
   DESY-15-125, LMU-ASC-46-15, MITP-15-053
   INSPIRE-HEP entry
   22 citations counted in INSPIRE as of 11 Nov 2018

9. **“Infinite number of MSSMs from heterotic line bundles?”**
   S. Groot Nibbelink, O. Loukas, F. Ruehle and P. K. S. Vaudrevange.
   arXiv:1506.00879 [hep-th]
   DOI:10.1103/PhysRevD.92.046002
   Phys. Rev. D **92**, no. 4, 046002 (2015)
   DESY-15-082, FLAVOUR(267104)-ERC-102, LMU-ASC-37-15
   INSPIRE-HEP entry
   9 citations counted in INSPIRE as of 11 Nov 2018

10. **“Non-supersymmetric heterotic model building”**
    M. Blaszczyk, S. Groot Nibbelink, O. Loukas and S. Ramos-Sanchez.
    arXiv:1407.6362 [hep-th]
    DOI:10.1007/JHEP10(2014)119
    JHEP **1410**, 119 (2014)
    LMU-ASC-47-14, MITP-14-052
    INSPIRE-HEP entry
    36 citations counted in INSPIRE as of 11 Nov 2018

11. **“MSSM-like models on Z(8) toroidal orbifolds”**
    S. Groot Nibbelink and O. Loukas.
    arXiv:1308.5145 [hep-th]
    DOI:10.1007/JHEP12(2013)044
    JHEP **1312**, 044 (2013)
    LMU-ASC-60-13
    INSPIRE-HEP entry
    19 citations counted in INSPIRE as of 11 Nov 2018

Letter of Support for Orestis Loukas

Dear Colleagues,

Is is a pleasure to write a letter of support for Orestis Loukas, who is applying for a postdoctoral position at your institute.

Orestis is currently an official PhD student at the University of Bern under the supervision of Professor Susanne Reffert. Before that, he spend some time in Munich, where he worked with Professor Stefan Groot and others in non-supersymmetric model building in heterotic string theories, using among other tools holomorphic line bundles in complete intersection Calabi-Yau manifolds. I have a lot of sympathy for this work. It consists of an exploration of MSSM-like theories derived directly from string theory, using supersymmetry breaking mechanisms that are available for string theory but are not obvious from the low energy field theory point of view. This is the case for instance of the $SO(16)\times SO(16)$ heterotic string, a theory I am rather fond of as you can imagine. They explored a rather large number of theories, exhibiting many interesting features regarding the quantum numbers of light matter and gauge fields. I am not an expert on string theory model building, but I find this work of great quality and interest.

I met Orestis in person nearly two years ago. I was intrigued by the paper by Hellerman, Orlando and Reffert on the spectrum of operators in CFT with a global, conserved charge in the limit of large charge. This prompted discussions with Reffert and Orlando, and of course with Loukas. This led to our approach to the problem. Through some heuristic arguments we related the study of that sector of the spectrum with computations in a theory which effectively has weak coupling. The original theory is at strong coupling, hence the use of a Lagrangian formulation is quite heuristic, however the results obtained are rather remarkable, and coincide will full lattice simulations with impressive and unexpected precision. There is much to be understood in this context, and it provides an complementary view to bootstrap computations. The work was extended by Loukas, Orlando and Reffert to matrix models, and we are now investigating different ways to understand quantitatively and qualitatively field theory sectors at large charge. When I started discussing with them, I thought Orestis was a postdoc. He was already quite mature, and it was a pleasure to work with him (and the others) on this project.

Orestis is a very dynamical, independent, creative and enthusiastic young physicist. His command of QFT, String Theory and related areas in physics and mathematics is very impressive. In my opinion he is among the ten percent of students I have seen in my life, and I support his application without reservations.

Luis Alvarez-Gaumé
Senior Physicist
Department of Theoretical Physics, CERN
.
Director
Simons Center for Geometry and Physics
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LMU LUDWIG-MAXIMILIANS-UNIVERSITÄT MÜNCHEN

ARNOLD SOMMERFELD CENTER FOR THEORETICAL PHYSICS

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November 1, 2017

Recommendation letter for Orestis Loukas

Dear colleagues,

it is a great pleasure for me to write this letter of recommendation for Orestis Loukas in order to support his application for a postdoc position in very strong terms.

Orestis Loukas was a master student at LMU Munich, where he was writing a master thesis on Heterotic String Compactifications under the supervision of Prof. Stefan Groot Nibbelink. I got an excellence impression about him and we are very pleased with his performance. It was amazing for me to see, how fast he was learning the rather difficult and advanced topic. Already during his Bachelor thesis he was working on heterotic strings together with Stefan Groot Nibbelink, and in 2013 he published already one paper on the Z_8 orbifold compactification. During his PhD work he published four very nice and original papers in particular on non-supersymmetric heterotic vacua, which will be in my opinion important for the further development of this field.

After his master thesis, Orestis became PhD student at university of Bern under the supervision of Susanne Reffert. As I can see, now a bit more from the distance, he is continuing to do very interesting research. I am particularly attracted by his work on large global charges in field theory. This is a very original and promising method to set up a large charge expansion in gauge theories. The approach has the aim to compute correlation functions in the large charge limit also for strongly coupled theories, which do not allow for a Langrangian description. I find this work very interesting.

I think that Orestis Loukas deserves the best possible support for his career. He is intellectually very strong, very good in theoretical physics and mathematics. He also full of energy and has a lot of motivation and drive. I most strongly recommend to accept him.

With best regards,

Dieter Lüst

Prof. Dieter Lüst

b
UNIVERSITÄT
BERN

AEC
ALBERT EINSTEIN CENTER
FOR FUNDAMENTAL PHYSICS

Institute for Theoretical Physics, Sidlerstrasse 5, CH-3012 Bern

Bern, November 1, 2017

Subject: **Recommendation letter for Orestis Loukas**

Dear Sir or Madam,

I is my pleasure to recommend my PhD student Orestis Loukas for a postdoc position at your institution in the strongest possible terms. Orestis came to me in October 2015 with excellent recommendations from LMU Munich, where he received his Masters degree from the Elite Program in Mathematical Physics. Quite unusually for a student at his level, he had by the end of his Masters degree already five published papers, the first one even being a result of his bachelor thesis. In Munich, Orestis had worked on heterotic string model building but expressed an interest in exploring more formal topics.

In my group, Orestis joined our effort to study QFTs in sectors of large charge. From the beginning, he has been able to actively contribute to our collaboration. I was impressed by his ability to very quickly absorb a large amount of new knowledge from the literature and to successfully put it into practice. He has given proof of this ability not only working on our joint projects, but also presenting journal club talks in our group seminar.

In our first joint publication arXiv:1610:04495, *Compensating strong coupling with large charge* (by Luis Alvarez-Gaume, Orestis Loukas, Domenico Orlando and myself), we studied field theories with global symmetries in the sector where the value of the global charge Q is large. We found (as expected) that the low energy excitations of this sector are described by the general form of Goldstones theorem in the non-relativistic regime. We also showed that the effective field theory describing such sector of fixed Q contains effective couplings $\lambda_{eff} \sim \lambda^b/Q^a$, where λ is the original coupling. We also presented an outline of how to compute anomalous dimensions of the $O(n)$ vector model in this limit.

For this project, Orestis had identified some key papers in the literature and performed a large amount of calculations on his own. Based on calculations he had undertaken by himself, he published a single-author paper as a follow-up to our joint work, arXiv:1612.08985, *Abelian scalar theory at large global charge*. In this paper, he constructed the ground state $|v\rangle$ from the zero modes and verified the

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appearance of a centrifugal potential is quantum mechanically. Using the path integral formulation, he systematically analyzed the quantum fluctuations around $|v\rangle$ in order to derive an effective action for the Goldstone mode, which becomes perturbatively meaningful when the charge is large. In this regime he explicitly showed that the whole construction is stable against quantum corrections, in the sense that any higher derivative couplings to Goldstone's tree-level action are suppressed by appropriate powers of the large charge.

To apply the large-charge paradigm beyond the vector model thus far treated in the literature, we next tackled models in $2+1$ space-time dimensions at the infrared fixed point where the order parameter is a Hermitian traceless matrix, i.e. lives in A_{N1} and the system has $SU(N)$ global symmetry. In arXiv:1707.00710, *Matrix models at large charge* (by Orestis Loukas, Domenico Orlando and myself), we studied the explicit example of the conformal $SU(3)$ matrix model at fixed charge and calculated the anomalous dimension and fusion coefficients at leading order in the $U(1)$ charge. For this project, I was able to leave Orestis largely in charge of the explicit calculations. In order to compute the CFT data, Orestis has successfully acquired and put into practice the CCWZ formalism.

Currently, Orestis is investigating the $SU(4)$ matrix model, which is algebraically much more involved but has a richer structure at large charge. In the course of his PhD work, Orestis has truly become an expert on CFTs at large charge.

Aside from his work on CFTs in sectors of large charge, he has retained an active interest in string phenomenology and is following the recent literature in the field. He recently completed another paper in the field of heterotic string phenomenology (arXiv:1710.09237) with his collaborators from his time in Munich.

During his PhD, Orestis has had so far four papers: two in collaboration with my group in Bern, to which he has contributed in an important way, one which he wrote entirely by himself, and one in string phenomenology. His fifth paper is near completion.

On top of his research work and courses, he has also been teaching exercise sessions for a variety of courses such as Quantum Mechanics, Mathematical Methods and Statistical Physics.

Orestis is highly motivated and hard working. He enjoys a fast-paced and interactive collaboration style, but is also able to work on his own. He readily takes up any challenges and is able to find creative solutions to the problems he encounters on the way. He is very ambitious and determined to succeed in his research in an academic setting. I believe that Orestis is an excellent candidate for a postdoctoral position and am confident that he would be a valuable and productive member of any group.

Best regards,

S. Reffert

S. Reffert

Priv.Doz. Dr. Stefan Groot Nibbelink
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Phone: +31 6 24480971
E-mail: groos@hr.nl

Postdoc selection committee

Munich, November 1, 2017

Subject: Letter of recommendation for Orestis Loukas

Dear selection committee,

this letter of recommendation is in very strong support of Orestis Loukas's application for a postdoctoral position at your institution. Orestis has been a bachelor and master student under my supervision at the LMU University Munich and is currently finishing his PhD. at Bern University. In addition, Orestis has assisted me as tutor for the course "String theory I" in the winter semester 2014/15. Orestis scientific output as a graduate is truly remarkable. Since I have not been involved in all his research, I will only focus on his projects I was involved in.

For his bachelor and master theses Orestis has worked in the field of theoretical physics under my supervision. For his bachelor thesis I asked him to study model building in the context of string theory. Concretely, his task was to search for constructions of the Standard Model of Particle Physics from the heterotic string by orbifold compactifications. At the time such studies had only been performed for certain so-called factorizable toroidal orbifolds, using a computer code called the "orbifolder". Therefore, I suggested to him to preform a similar investigation on a non-factorizable orbifold; for this purpose we choose T^6/Z_8. So far this orbifold had only been considered in a single paper. Orestis not only studied that paper, but even pointed some of its fatal mistakes: This paper violates certain crucial string theoretical consistency conditions, called modular invariance, leading to inconsistent (anomalous) models. In addition, he setup a detailed search for supersymmetric Standard Models and found over 750 of them on the five different Z_8 geometries. These results were published the high impact journal Journal for High Energy Physics: JHEP 1312 (2013) 044 [arXiv:1308.5145].

The next project that Orestis worked on was in the context of non-supersymmetric model building. This project marked the start of his master work and also lead to to a publication in JHEP: JHEP 1410 (2014) 119 [arXiv:1407.6362]. This work shows that model building starting from the non-supersymmetric heterotic SO(16)$\times$SO(16) string is potentially viable. We showed that to leading order in the α' and g_s expansions in string theory, tachyons can be avoided provided that one compactifies this theory on a smooth Calabi-Yau manifold with a holomorphic stable vector bundle. Hence, one of the major problems of non-supersymmetric theories, the appearance of tachyons, can be brought under control. Moreover, Orestis preform extended scans of orbifold compactifications of the non-supersymmetric theory. To this end he extended the "Orbifolder" computer package to be able to work with the non-supersymmetric SO(16)$\times$SO(16) string as a starting point. Using this he showed that even though tachyons can in principle could appear on orbifolds (because of α' corrections), but in roughly more than 50% models tachyons are nevertheless absent. Within such models he showed that a large set (over 12,000 models) have spectra similar to the Standard Model (not MSSM!) of particle physics.

In a followup project Orestis considered smooth compactifications of all three heterotic strings, the supersymmetric $E_8 \times E_8$ and SO(32) and the non-supersymmetric SO(16)×SO(16) theories, side by side, to look for models that get close to the Standard Model or its supersymmetric extension. Such a systematic model building study of smooth Calabi-Yau compactifications of the SO(16)×SO(16) theory was never undertaken in the past. To this end Orestis had to completely revised the "Orbifolder package", so that computing spectra etc. became fully automated on smooth Calabi-Yau spaces, like the Complete Intersection Calabi-Yau spaces or the Schoen manifold for any of the three heterotic string theories. The results of this project were published in JHEP 1510 (2015) 166 [arXiv:1507.06147] and Fortsch.Phys. 63 (2015) 609-632 [arXiv:1507.07559].

During this project on smooth Calabi-Yau with line bundle gauge backgrounds, Orestis realized, that the fundamental model building constraints, like charge quantization and the Bianchi identities, allow for infinite sets of line bundle backgrounds, which can be enumerated by one (or more) integer(s). Since is sounds very odd, that it would be possible to have infinite number of theories arising from a single Calabi-Yau, Orestis investigated the situation in more detail. The resolution was that in the limit where the enumerating integer becomes very large, the large volume assumption of the supergravity approximation breaks down. For further details see Phys.Rev. D92 (2015) no.4, 046002 [arXiv:1506.00879].

More recently we investigate under which conditions the cosmological constant vanishes perturbatively at the one-loop level for heterotic strings on non-supersymmetric toroidal orbifolds. This lead to the pre-print arXiv:1710.09237. Orestis suggested to require that the right-moving fermionic partition function vanishes identically in every orbifold sector individually, to ensure more model-independent results (that are insensitive to the gauge bundle details). To ensure that all right-moving fermionic partition functions vanish, each sector needs to preserve at least one Killing spinor, but not always the same one. Orestis was the first in our collaboration to realize that this is impossible for Abelian orbifolds: There is always at least one sector that does not admit any Killing spinors if the orbifold is non-supersymmetric. This lead us to the conjecture that this no-go result holds for all (Abelian and non-Abelian) six-dimensional toroidal orbifolds. This we subsequently proved in a joint effort using two different methods. In the explicit construction of the spinor action of the point group, Orestis emphasized that the double cover of Spin-group over the SO-group leads to a number of different choices of this action on the spinors. Hence, Orestis made a large number of essential contributions to this investigation.

In all these projects Orestis has shown a remarkable ability to quickly master new theories and techniques at such a level that he is able both to implement them in computer routines and ask questions that go beyond the current knowledge in the literature. This helped to drive these projects forward fast. He had a publication as a bachelor student and by the end of his PhD he published closed to ten papers and achieved over a hundred citations on Inspires HEP.

In light of all this I very strongly support Orestis' application for a postdoctoral position at your institution.

Sincerely yours,

Stefan Groot Nibbelink

Lu, Bo-Qiang

Address		**Email** luboqiang0803@gmail.com (update 2018/11/24)	
Zhong Guan Cun East Street 55# Beijing, Beijing 100190 China		**Home Phone** **Cell Phone** (0086) 17611591355 **Office Phone** **Skype Name** live:luboqiang0803	
Current Title / Dates	postdoc, 2017.07-2019.06		
Current Institution	Institute of Theoretical Physics, Chinese Academy of Sciences	**Department**	Institute of Theoretical Physics, Chinese Academy of Sciences
Location	55 ZhongGuanCun East Street, Beijing, Beijing 100190, China		

Highest Degree	Ph.D	**Institution** Nanjing University	**Date** 2017/06
Thesis Advisor	Hong-Shi Zong		
Thesis Title	Study of Cosmic Rays and Dark Matter detection		
Research Interests	**Primary** Dark matter astronomical phenomena and its direct and indirect detection		
Secondary	Gravitational wave observation; Cosmology		
Current Research Interests: *My main research interests lie in studying the nature of dark matter and dark matter detections. Recently, I also pay attention to the gravitational wave observations.*			
Discipline(s)	Cosmology/Particle Astrophysics; Cosmology and Astroparticle Physics; Cosmology; Physics		
Position(s) applied	PHD		
Also Consider For	**Temporary:** Postdoc 2 Year 1 Year		
1. Yue-Liang Wu, Institute of Theoretical Physics, Chinese Academy of Sciences, ylwu@itp.ac.cn (2018/11/23)		file (PDF, PDF, 2018/11/23)	
2. Yu-Feng Zhou, Institute of Theoretical Physics, Chinese Academy of Sciences, yfzhou@itp.ac.cn (2018/11/18)		file (PDF, PDF, 2018/11/19)	
3. H. S. Zong, Department of Physics, Nanjing University, zonghs@nju.edu.cn (2018/11/18)		file (PDF, PDF, 2018/11/20)	
4. Yizhong Fan, Purple Mountain Observatory, Chinese Academy of Sciences, yzfan@pmo.ac.cn			

Received Materials	**PHD**	**Cover Letter:** file (PDF, PDF 2019/01/28) **Curriculum Vitae:** file (PDF, PDF 2018/11/24) **Research Statement:** file (PDF, PDF 2018/11/24)

January 28, 2019
Bo-Qiang Lu
55 ZhongGuanCun East Street
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Phone: (+86) 17611591355
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Dear Sir or Madam,

I am writing to apply for the Postdoctoral Researcher position to begin in September 2019, as advertised on the Inspire website. I obtained the Ph.D. in theoretical physics from Nanjing University in 2017. I am currently a postdoc at the Institute of Theoretical Physics, Chinese Academy of Sciences, and fully expect to complete this postdoctoral research by June 2019. I am looking forward to taking part in your lab where I can continue my research.

I became a doctoral candidate at Nanjing University in 2013 and finished the main courses of theoretical physics. I took part in the theoretical group of DAMPE collaboration in 2014 and learned knowledge of cosmic ray propagation and dark matter detection there. I also pay attention to the particle models of dark matter and the dark matter distributions in the dwarf galaxy. My recent work is on the constraints on primordial black holes abundance in dark matter using the observations from dwarf galaxies. Therefore, I believe that my education and research background would be a good match for your group, I am also confident that a postdoc position on your team would provide me with helpful discussions that I need to improve my research to a new level.

I have attached my curriculum vitae and research statement for your review. Please feel free to contact me for further information, I welcome any questions from you regarding this application. Thank you very much for your time and consideration and I am looking forward to hearing from you.

Sincerely yours,

Bo-Qiang Lu

Curriculum vitae

PERSONAL INFORMATION

Bo-Qiang Lu

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POSITION **Postdoc**

EDUCATION AND TRAINING

01/08/2017–Present

Postdoc

Institute of Theoretical Physics, Chinese Academy of Sciences, Beijing (China)

01/09/2013–01/06/2017

Ph.D. in theoretical physics

Nanjing University, Nanjing (China)

01/09/2009–01/06/2013

Bachelor of Science

Yangzhou University, Yangzhou (China)

WORK EXPERIENCE

01/08/2017–Present

Postdoc

Institute of Theoretical Physics, Chinese Academy of Sciences, Beijing (China)

Working with Prof. Yue-Liang Wu and Prof. Yu-Feng Zhou.

Mainly works during this stage including 1. calculation of Sommerfeld-enhanced J-factors and put constraints on the Sommerfeld-enhanced dark matter annihilation using gamma rays observations of subhalos and dwarf galaxies. 2. Revisiting the calculation of the gravitational wave spectra generated during a strongly first-order phase transition in a scale-invariant SU(2) gauge sector with a scalar field in the adjoint representation. 3. By defining the effective distance which incorporates damping effects, we put constraints on damping rate of gravitational waves in a viscous Universe using luminosity distance inferred from the gravitational wave and electromagnetic radiation observations. We also show its implications for the self-interacting dark matter. 4. Most recently, I also pay attention to the dark matter explanation of gravitational wave observations and 21-cm signal.

01/05/2014–01/05/2016

Student

Purple Mountain Observatory, Chinese Academy of Sciences, Nanjing (China)

Taking part in the theoretical group of DAMPE collaboration.

Learning knowledge of cosmic ray propagation and dark matter detection.

PERSONAL SKILLS

Job-related skills

I have taken part in the main courses of theoretical physics when I was a doctoral student, for instance, quantum mechanics, quantum field theory, statistical physics, and cosmology. I'm also familiar with the probability theory and data analysis. The programming languages that I mastered include Python, Fortran and mathematical. I'm familiar with the Linux and Mac operating system.

Digital skills

SELF-ASSESSMENT				
Information processing	Communication	Content creation	Safety	Problem solving
Proficient user	Proficient user	Proficient user	Independent user	Independent user

Digital skills - Self-assessment grid

Research Statement

Bo-Qiang Lu

Institute of Theoretical Physics, Chinese Academy of Sciences, Beijing, 100190, China

November 21, 2018

The evidence for the existence of dark matter (DM) is overwhelming, however, the nature of DM still remains a mystery in science today [1]. Since my Ph.D., I have focused on studying the DM properties and detections, recently, I also pay attention to the gravitational wave (GW) observations. In this statement, I give a summary of my previous and current achievements and also prospect the future research work.

1 Overview of doctoral works

In this section, I briefly review the major works in my doctoral studies. These works concentrate on the propagation of cosmic rays (CRs) and DM indirect detection experiments, the main progress has been achieved as follows:

1. The CR flux is strongly influenced by the solar activity at energies $\lesssim 20$ GeV. Generally, this solar modulation effect is fitted by a force field approximation. Making use of the method developed recently which solves the transport equation with a set of stochastic differential equations [2], we independently develop a three-dimensional solar modulation program. Using this program we study the energy loss effects of CRs in the solar system and show that the solar modulation in the solar cycle qA < 0 is much more strong than that in the cycle qA > 0. We also explain the behavior of positron fraction data varying with time at energies $10 \lesssim$ GeV [3].

2. High energy electron and positron CRs suffer strongly energy losses when propagation in the Galactic space, thus their energy spectra will soften with the increase of energy. Based on the analysis of PAMELA [4] and Fermi-LAT [5] electron CR data, we find that the electron spectrum shows a hardened trend at energy $\gtrsim 100$ GeV. We confirm this [10] by using much higher accuracy electron data released by AMS-02 [6]. Through the analysis of energy losses and diffusion effects of the electron, we show that the near-by and middle-age supernova remnants (SNRs), such as Geminga and Monogem, can play a leading role in the electron spectrum hardening. We propose that the CRs are trapped in the source for a long time before released into the galactic space [7], and we give a relation between the escape time and the CRs' energies. With these conclusions, we explain the sharp decay in electron spectrum at energy $(1-4)$ TeV observed by HESS [8].

3. We assume that the excesses in the electron CR data are the contributions from astronomical sources, such as SNR and pulsar, and use a broken power-law spectrum to fit the

electron data. For the first time, we use the electron CR data to impose strong limits on DM parameters space [11]. We find that our constraints are much stronger than those limits from positron CR data [9] at DM mass $m_\chi \gtrsim 100$ GeV. After AMS-02 releases high accuracy positron fraction data and antiproton ratio data [12, 13], we take the same assumption and put much more stringent limits on DM parameters space [14]. We also study the effects of CR propagation parameters on the 95% C.L. limits. We find that the solar modulation can play a dominant role in the constraints at DM mass $m_\chi \lesssim 100$ GeV, while the diffusion parameters play a leading role at much larger DM mass range.

4. Analysis of the Fermi-LAT gamma-ray data shows that there is an extended excess in the gamma-ray at the Galaxy center and the peak appears to be at energies around (1−3) GeV [15]. We assume that the excess is contributed from the DM annihilation, with the limits from both the gamma-ray observation on dwarf spheroidal satellite galaxies and the AMS-02 experiment, we find that the τ lepton channel is the only permissive channel for the interpretation of the Galaxy center excess. We propose a Leptophilic DM model to account for the GeV gamma-ray excess and give the DM parameters space at 3σ confidence level [16]. Meanwhile, we also take into account the constraints from the DM direct detection, AMS-02 CRs observation results, and DM relic density. We find that only two of the effective interactions remain available for accounting for the excess, while other interactions are excluded by the observations.

2 Current achievements

Here I summarize my postdoctoral works, I would like to thank Prof. Yu-Feng Zhou and members of his group for helpful discussions.

1. Under the assumption that the DM annihilation cross section is velocity-independent, the gamma-ray flux from the annihilation of DM in a subhalo can be expressed as a product of the J-factor and a component depending on the particle physics models on DM annihilation. However, in generic cases the DM cross section can be velocity-dependent, for instance, in some models the DM annihilation cross section is p-wave suppressed [17]. Furthermore, it has been shown that the DM annihilation cross section may be enhanced at low relative velocities by the so-called Sommerfeld enhancement (SE) [18–20], which results from the exchange of light mediators between DM particles. The SE provides a physical mechanism for the DM explanation of the rising positron fraction at energies $\gtrsim 10$ GeV. When the annihilation is velocity-dependent, the produced cosmic-ray flux is also affected by the distribution of DM particle velocities, which depends on the location in the subhalo, thus the DM annihilation cross section cannot be extracted from the J-factor directly [21]. In Ref. [22], we determine the dark matter velocity distribution for a given dark matter density profile using the Eddington's formula and calculate the SE J-factor for subhalos and 15 known dwarf spheroidal galaxies. For the subhalo observations, we count the numbers of sources that may be observed by Fermi-LAT and use this to determine the 95% C.L. Poisson upper limit on the predicted numbers of such sources. For the dwarf satellite galaxies searches, we use the likelihood and upper limits on the gamma-ray flux provided by the Fermi collaboration to determine the upper limits on the dark matter parameters space at 95% C.L.. We find that in a wide region of parameter space, the constraints can be a few orders of magnitude more stringent than that in the case without the SE. With

these results, we show that the SE parameter spaces that may account for the positron anomaly have been excluded by Fermi-LAT.

2. We revisit the calculation of the GW spectra generated during a strongly first-order phase transition in a scale-invariant SU(2) gauge sector with a scalar field in the adjoint representation [23], as discussed by J. Jaeckel, et al [24]. Based on accurate numerical calculations [25] of the nucleation bubble profiles and the 3d on-shell actions, which are shown different from those in Ref. [24] in peak frequencies and spectrum shapes. We then argue that this inconsistency is mainly caused by the inappropriate use in Ref. [24] of the triangle approximation, which greatly underestimates the broadness of the finite-temperature potential barriers when calculating thickwall bubble actions. We confirm the detectability of GW produced in this framework at temperature $T_* \sim 30$ PeV by the fifth phase of LIGO.

3. It was pointed out by Hawking half a century ago that GWs experience the damping effect when it propagates in a fluid with nonzero shear viscosity [26]. In Ref. [27], we propose a new method to constrain the GW damping rate and thus the fluid shear viscosity. By defining the effective distance which incorporates damping effects, we can transform the GW strain expression in a viscous Universe into the same form as that in a perfect fluid. Therefore, the constraints of the luminosity distances from the observed GW events by LIGO and Virgo can be directly applied to the effective distances in our formalism. We exploit the lognormal likelihoods for the available GW effective distances and a Gaussian likelihood for the luminosity distance inferred from the electromagnetic radiation observation of the binary neutron star merger event GW170817 [28]. Our fittings show no obvious damping effects in the current GW data, and the upper limit on the damping rate with the combined data is 6.75×10^{-4} Mpc^{-1} at 95% C.L.. By assuming that the dark matter self-scatterings are efficient enough for the hydrodynamic description to be valid [29], we find that a GW event from its source at a luminosity distance D $\gtrsim 10^4$ Mpc can be used to put a constraint on the dark matter self-interactions.

3 Vision for the Future

As a continuation of my doctoral and postdoctoral works, revealing the properties of DM using DM detection experiments and astronomical observations will be one of the major topics of my research agenda. By now various experiments have been designed to aim at the weakly interacting massive particles (WIMPs) [30], which have masses and coupling strengths at the electroweak scale. No obvious evidence for WIMPs has been observed both in direct and indirect DM detection so far and stringent limits have been set on the WIMP hypothesis [31–33]. Exploring DM in MeV range has been put on the agenda for the upcoming DM experiments [34]. Recently, the EDGES Collaboration has reported the detection of an excess absorption feature in the global 21-cm spectrum [35], centered at a frequency corresponding to a redshift of $z \sim 17$. Ref. [36] declares that if minicharged particles (MCPs) comprise a subpercent fraction of the DM, and have millicharges $\epsilon \sim 10^{-6}$ and masses $m_\chi \sim (1-60)$ MeV, they can significantly cool down the baryonic gas during this era, and explain the 21-cm absorption signal. The interaction between MCPs and the intracluster gas in the inner regions of galaxy cluster can be a heating source for the cooling gas [37]. By requiring that the gas heating rate by MCPs does not exceed the required heating rate, I put constraints on the $\epsilon - m_\chi$ parameters space. My results have constrained the parameter space for 21-cm absorption anomaly, my results are similar to those limits from Galactic Center Gas Clouds [38]. I wish to push this work forward in future studies.

Another of my research interest lies in the GW generation and propagation and its intersection with DM. It is suggested in Ref. [39] that the detection of GW by LIGO may produce from the merger of primordial black holes (PBHs) and the merger rate estimated from GW event observations can be explained if PBHs constitute a small fraction of DM [40]. It is shown in Refs. [41,42] that the stellar distribution in a star cluster near the center of the ultra-faint dwarf galaxy provides strong constraints on PBHs as the main component of dark matter. A star cluster is a dynamic system in which gravitational encounters lead to the exchange of energy between stars. In the weak encounter approximation, the diffusion of the system can be described by Fokker-Planck equation. This enables us to model the density and velocity distributions of the star cluster. If stars of different masses are present, encounters will lead to mass segregation [43] in which the lighter stars will accelerate and evaporate from the core while the heavier stars will tend to settle to the center of the system. This will lead to the evolution of the half-light radius [41]. In my future research, I plan to solve the Fokker-Planck equation with taking into account the encounters between stars and PBHs. This allows us to determine the star density distribution, by comparing with the observed surface density of dwarf galaxy, we can constrain the fraction of PBHs in DM. My preliminary results show that the fraction of PBHs should less than $10^{-3} - 10^{-4}$ for PHB mass $m_{\rm PBH} \gtrsim 10 M_{\odot}$. This stringent constraint already rules out the possibility that the merger of two PBH as the observed GWs source.

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November 23, 2018

To whom it may concern,

As requested by Dr. Bo-Qiang Lu, I am pleased to write a reference letter to support his application for the postdoctoral researcher position in your group. Bo-Qiang will complete his first postdoctoral research in my group in June 2019.

I became acquainted with Dr. Lu in December 2016, when he wrote to show his research interest during his doctoral research and express his willingness to join my group. After getting Ph.D. in theoretical physics, he joined my group in 2017 as a postdoctor and worked mainly on the dark matter detection through the measurements of high energies cosmic rays and the properties of dark matter.

I was deeply impressed by his strong interest and enthusiasm in scientific research. He is a hardworking young man with active mind by seeking new ideas in his study. He often shows some interesting papers he read and shares ideas with us. His ability to get the main points at issue and improve his ideas in the discussion shows his talent of research.

Dr. Lu has obtained a series of intriguing and meaningful results during his postdoctoral research. In one of the published work (JCAP 04, 035, 2018), he showed that the dark matter annihilation cross section cannot be extracted from the J-factor directly if the annihilation is enhanced by Sommerfeld enhancement (SE). The dark matter distribution was determined by using the Eddington's formula and the SE J-factor was calculated. The resulting constraints can exclude thermal relic dark matter for the dark matter mass below about 1 TeV. In another work (PRD, 97, 068303, 2018), the calculation of the gravitational wave (GW) spectra generated during a strongly first-order phase transition in the SU(2) gauge sector was revisited. The results showed that GW produced in this framework at a temperature about 30 PeV may be detected by aLIGO O5. Most recently, he proposed a new method which enables to use the luminosity distances inferred from GW and electromagnetic radiation observations to constrain the damping rate of GW in a viscous Universe.

It is my pleasure to give Dr. Lu a strong recommendation. He is a talented young person with the active mind and creativity, and I expect him to continue to be as productive and creative as he was as a postdoc in my group. He would be a good catch for your group.

Sincerely,

Yue-Liang Wu

Institute of Theoretical Physics
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Institute of Theoretical Physics,
Chinese Academy of Sciences,
No.55 Zhongguancun East Road,
Beijing, China, 100190,

November 19, 2018

Dear Colleague

It is my great pleasure to write this recommendation letter in support of Dr. Bo-Qiang Lu for his application for a postdoc position in your research group.

In the last September, Bo-Qiang joined our research group as a postdoc fellow. We worked together on the phenomenology of dark matter indirect detection, and the damping effects of gravitational waves. In arXiv:1711.00749 (JCAP), Bo-Qiang and I parametrized the effect of Sommerfeld enhancement of s-wave dark matter annihilation on the gamma-ray flux as the Sommerfeld-enhanced J-factors, and explicitly calculated their values for 15 known dwarf spheroidal galaxies. Using the Fermi-LAT 3FGL data on the unassociated point-sources and the N-body simulation results on the dark matter subhalo distribution, we derived upper limits on the dark matter annihilation cross sections with Sommerfeld enhacement. We found that in a wide region of parameter space, the constraints can be a few orders of magnitude more stringent than that in the case without the Sommerfeld enhancement which exclude thermal relic dark matter for the dark matter mass below about 1 TeV. Bo-Qiang has gained a broad range of experience in particle physics of the future. He is very hard working. I am sure that he will do well as a postdoctoral fellow and make significant contributions to your research group.

Yours sincerely,

Zhouyufeng

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Prof. Hong-Shi Zong Department of Physics

To whom it may concern,

I am delighted to be called upon as a reference for Boqiang Lu. As his PhD supervisor, I know him and fully support his application for the postdoctoral fellowship in your lab.

Early in 2013, Boqiang came to my office and expressed his willingness to join my group. He impressed me with his knowledge of physics and his research enthusiasm. I accepted him to my group and started advising him with his research. Boqiang showed his interest in dynamical chiral symmetry breaking and I suggested him to read several papers in this field. He worked very hard and discussed with me whenever he had a question. Just after a few weeks, I found that he had already gotten a clear picture and grasped the field theoretical method for this subject. Moreover, not only being a diligent student, Boqiang is also a sincere and honest young man. He is modest, always prepared to learn from others and shares ideas with colleagues. These are good qualities that will help him integrate himself into the life and research in your lab. I believe an aspiring and determined young researcher as him has a great career prospect.

In 2014, Dr. Feng visited my lab and gave a talk on cosmic ray and dark matter detection and invited Boqiang to join Dr. Fan's group. From then on, cosmic ray propagation and dark matter indirect detection became his major research interests, he told me that he was attracted by mysteries of dark matter's nature. I also learned from Dr. Fan that Boqiang always accomplished the mission outstandingly and he thought highly of this young man. About two years later, Boqiang published his research in Phys. Rev. D. His works showed that there are excesses in AMS02 electron data and the near-by supernova remnants made the main contribution to these excesses, he also stringently constrained dark matter annihilation cross section using the AMS02 data.

Over the years, Boqiang had been a hard-working student with the immense curiosity and strong determination. I saw his growth and progress while exchanging our thoughts and ideas. I was deeply impressed by his intelligence and diligence, which were also reflected in his academic accomplishments and publications. Therefore, I am pleased to give my full support and recommendation to Dr. Lu's application. I sincerely hope the information I provided above could be helpful for you to assess Dr. Lu's application and consider him favorably.

Sincerely yours,

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Highest Degree	Master of Science (M.Sc.)	**Institution** University of Delhi	**Date**
Thesis Advisor	Debajyoti Choudhury		
Thesis Title	Some Aspects of Universal Extra Dimensions		
Research Interests	**Primary** Theoretical Particle Physics (Beyond Standard Model Physics)		
Secondary			
Current Research Interests: *To summarise briefly, my broad area of interest is Elementary Particle Physics (Theory and Phenomenology) and specific areas of interest are model building and phenomenology of Beyond Standard Model Scenarios that tackle the Naturalness and Hierarchy problems while providing viable Dark Matter candidates and probing into the Dark Matter sector via Effective Field Theory techniques as well as by constructing interesting Simplified Models.*			
Discipline(s)	Particle and Astroparticle Phenomenology; Physics; Electroweak Particle Physics; Theoretical Physics		
Position(s) applied	PHD		
1. Debajyoti Choudhury, Department of Physics and Astrophysics, University of Delhi, debajyoti.choudhury@gmail.com (2019/02/07)			
2. Anirban Kundu, Department of Physics, University of Calcutta, anirban.kundu.cu@gmail.com (2019/02/07)			file (PDF, PDF, 2019/02/07, tailored)
Received Materials	**PHD**	**Cover Letter:** file (PDF, PDF 2019/02/06) **Curriculum Vitae:** file (PDF, PDF 2019/02/06) **Research Statement:** file (PDF, PDF 2019/02/06) **Copies of grades transcripts:** file (PDF, PDF 2019/02/06)	

Cover Letter

Suvam Maharana
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February 6, 2019

For: **Ph.D. Position**
Collaborative Research Center TRR 257
"Particle Physics Phenomenology After the Higgs Discovery"

Dear Admission Panel,

I am writing to apply for a PhD position at the aforementioned center in reference to the inSPIRE-HEP listing- **Theoretical Particle Physics (AJO-13034)**. I completed my Master of Science (M.Sc.) degree in Physics from University of Delhi, India in 2018 with theoretical specializations alongwith the submission of a dissertation thesis titled "Some Aspects of Universal Extra Dimensions" supervised by Prof. Debajyoti Choudhury. Since then I have been working on a research paper focusing on Complex Scalar Singlet Extensions of the Standard Model with Prof. Anirban Kundu, University of Calcutta, India.

My primary research interest is in Particle Physics Beyond the Standard Model (Theory and Phenomenology) and hence I am particularly inclined towards working on one of the following projects (in order of preference) for my Doctoral Thesis:

- **A3a: Extended Higgs sectors at the LHC**
- **C3b: New Physics models for flavour observables**
- **B3a: Dark sectors at the LHC**

I hope the panel will get a better idea of my research interests, exposures and motivations from the attached CV and Statement of Interest. I strongly believe that I can contribute productively to the projects mentioned above and that it would be absolutely rewarding for me to be given the opportunity to pursue my doctoral work at the center.

Sincerely,

Suvam Maharana

Suvam Maharana

SUVAM MAHARANA

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EDUCATION

2016-18:

- Master of Science (M.Sc.) in Physics at **Department of Physics and astrophysics, University of Delhi**.
- Placed in the **First Division** with specialization in Quantum Field Theory, Particle Physics and General Theory of Relativity & Cosmology. Among the top **20%** in a batch of 20 students with theoretical specializations.
- Submitted a dissertation thesis titled **Some Aspects of Universal Extra Dimensions**.
- Was awarded the Raman Ramkumar Memorial Award for outstanding performance in M.Sc.(Physics) Computer Programming Laboratory.

2013-16:

- Bachelor of Science (B.Sc.) in Physics (Honours) at **Asutosh College, University of Calcutta**.
- Ancillary subjects included Mathematics and Computer Science.

2013:

- Passed 12th Grade (High School) from **Kendriya Vidyalaya Ballygunge, Kolkata** with an aggregate of **89.6%**.

2011:

- Passed 10th Grade from **Kendriya Vidyalaya Ballygunge, Kolkata** with **CGPA 10**.

MASTER'S THESIS

Title: Some Aspects of Universal Extra Dimensions

Supervisor: Prof. Debajyoti Choudhury, University of Delhi

Abstract: Beginning with a brief discussion on the old Kaluza-Klein theory, Beyond Standard Model scenarios pertaining to Universal Extra Dimensions(UED) have been studied for scalar, gauge and fermonic field theories in one and two extra spatial dimensions involving compactification on the manifold S^1, and subsequently on the orbifolds S^1/Z_2 and $S^1/Z_2 \times S^1/Z_2$. As an exposition in field theory, detailed reduction to effective four dimensional theories have been presented, but only some of the phenomenological implications have been very briefly discussed.

AREAS OF INTEREST

- **Broad Interests:** Elementary Particle Physics (Theory and Phenomenology), Quantum Field Theory.
- **Specific Interests:** Currently I am interested in model building and phenomenology of Beyond Standard Model Scenarios that tackle the Naturalness and Hierarchy problems while providing viable Dark Matter candidates and probing into the Dark Matter sector via Effective Field Theory techniques as well as by constructing interesting Simplified Models.

RESEARCH EXPOSURE

- **Since August, 2018 :** Research Project on Complex Scalar Singlet Extensions of the Standard Model with Prof. Anirban Kundu, University of Calcutta.
- **Jan-April, 2018:** Thesis Project titled "Some Aspects of Universal Extra Dimensions" supervised by Prof. Debajyoti Choudhury, University of Delhi.

SPECIALIZATION COURSES TAKEN

- Two-semester course in Field Theory and QED.
- Two-semester course in Particle Physics.
- Two-semester course in GTR & Cosmology.
- One-semester course in Mathematical Physics (Group Theory and Integral Equations).
- One-semester course in Advanced Numerical Techniques (Computer Lab Course).

COMPUTER SKILLS

- C, C++, Mathematica, LaTeX.

REFEREES

- **Debajyoti Choudhury:** Professor, Department of Physics and Astrophysics, University of Delhi. (debajyoti.choudhury@gmail.com)
- **Anirban Kundu:** Professor, Department of Physics, University of Calcutta. (anirban.kundu.cu@gmail.com)
- **Sukanta Dutta:** Associate Professor, High Energy Physics and Cosmology Research Lab, SGTB Khalsa College, University of Delhi. (sukanta.dutta@gmail.com)

Statement of Interest

Suvam Maharana
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(msuvam221@gmail.com)

Introduction

To articulate briefly, my broad area of interest is Elementary Particle Physics (Theory and Phenomenology) and specific areas of interest are model building and phenomenology of Beyond Standard Model Scenarios that tackle the Naturalness and Hierarchy problems while providing viable Dark Matter candidates and probing into the Dark Matter sector via Effective Field Theory techniques as well as by constructing interesting Simplified Models.

Research Exposure

- It was not until I got into the Department of Physics and Astrophysics, University of Delhi for my Master's degree that I had the opportunity to work on a thesis project. There I worked on my thesis, titled "Some Aspects of Universal Extra Dimensions", under the supervision of Prof. Debajyoti Choudhury. It was my first exposure to a higher dimensional theory, particularly to the field theoretic aspects of it. I began by studying the old Kaluza-Klein theory of 5D Gravity and considering a simple scalar field model of one flat extra spatial dimension (4+1 D) compatified on a circle (S^1) to obtain a tower of scalar fields ($\phi^{(n)}$), called KK-modes, on reduction to the effective (3+1)D theory. From there I went on to get acquainted with the minimal Universal Extra Dimension (mUED) model that proposes extra spatial dimensions to be compactified on a manifold of small size (small extra dimensions) and allows all SM fields to propagate in the entire bulk of spacetime, but for it to be a viable BSM model the crucial concept of orbifolding is adopted. A grasp of the these concepts led me to consider theories of different types of fields with extra dimensions compactified on various orbifolds (S^1/Z_2 and $S^1/Z_2 \times S^1/Z_2$) and reducing them to effective (3+1)D theories. The most challenging part therein was to understand the construction of higher dimensional theories involving spinors the inevitable and non-trivial task of extending the Clifford Algebra to higher dimensions. Being only a one-semester long project it could result primarily in an exercise on the field theoretic aspects of mUED, but it most certainly motivated me to explore further the literature on extensions of SM, in particular the fact that these extensions provide viable Dark Matter candidates as well (LKPs in the UED case).

- Since August, 2018 I have been engaged in a research project with Prof. Anirban Kundu of University of Calcutta on Complex Scalar Singlet Extensions of the SM. This has been an enlightening experience till now, being my first exposure to phenomenology in particle physics. It is an established fact that any scalar extension of the SM poses a possible solution to the Naturalness problem but it was the added feature of a possible Cold Dark Matter (CDM) candidate via Higgs portal in this model that attracted my attention in the first place. It is one of the simplest Simplified Models for Dark Matter. Although there exists a lot of literature in this area since the last decade, it has become extremely relevant now, more than ever, to re-consider these models and study their parameter space more closely as particle physics experiments (both terrestrial and cosmic) are making rapid progress. In our case, one of the components of the complex gauge singlet scalar field that acquires a VEV mixes with the SM Higgs while the other can be treated as a DM field if Z_2 symmetry is imposed which stabilises the DM against decay. As of now, the discovery of a ∼125 GeV scalar at the LHC and the subsequent determination of its decay branching ratios has facilitated us with the fixing of one of the non-DM mass eigenvalues and a tight constraint on the mixing angle in our model. Moreover, model-independent constraints from DM direct-detection experiments like LUX and the prospect of finding a singlet scalar <1 TeV at the LHC have led us to obtain a larger allowed parameter space with the singlet DM as compared to the one real scalar singlet extension model. This is an ongoing project as I write this document and thus hope to make significant progress with it subsequently.

Current Research Interests

- **BSM Models:** I have keen interest in the phenomenology of existing BSM scenarios and also in the construction of new models or modifications to the existing ones. The most pressing motivations for me to pursue this area are the unsettling problems of Higgs mass instability and naturalness of the electroweak theory as well as the absence of a DM candidate in the SM. To this end I am, as stated earlier, currently working on Gauge Singlet Scalar Extensions of the SM that, alongwith dealing with the naturalness issue, accomodates a viable DM candidate. Before getting involved in the aforementioned project I had spent some time understanding Non-Linear Representations in phenomenological field theories which led me to study another naturalness-inspired scenario- the Little Higgs model. So I would certainly like to work on the phenomenology of Little Higgs models if given the opportunity. Another BSM model that I am fascinated to work on is the UED model. My introduction to this scenario as a dissertation project has only motivated me further to explore its phenomenology particularly with respect to its Dark Matter content (Lightest Kaluza-Klein Particle, LKP). In addition, I also have an inclination towards Brane-World scenarios, of which I have not any hands-on acquaintance but only a general idea that I acquired while working on my dissertation, like the Randall-Sundrum (RS) and ADD models and their derivatives.

- **Dark Matter Phenomenology:** It goes without saying that Dark Matter sector is the single most essential aspect of any BSM theory that strives to become a phenomenologically valid extension of the SM. Bounds from various direct detection experiments like DAMA/LIBRA, XENON, LUX etc. severely constrain the parameter space of a model indicating necessary modifications to the BSM scenarios. This is essentially what I intend to do in this area, to analyse the parameter space of different BSM scenarios and make necessary modifications in order for them to reconcile with DM experimental data, and also to study the DM sector in model-independent ways either through EFT techniques or the more recent avenue of Simplified Models.

University of Delhi
(Post Graduate Semester Examination May-June 2018)

Statement of Marks

Exam Roll No. :1613848
Name :SUVAM MAHARANA
Course Name :(816) (P.G)-M.Sc. PHYSICS
Exam Sem :IV
College/Deptt. Name :(056) Ramjas College
Enrollment No. :

Date of Printing: 08 Jul 2018

Sr. No.	Paper Code	Paper Name	Sem	TH (Obt/Max)	IA (Obt/Max)	PR/PW (Obt/Max)	Paper Result
1	PHYS401	CLASSICAL MECHANICS	I	*29	11		P
2	PHYS402	QUANTUM MECHANICS-I	I	*30	16		P
3	PHYS403	ELECTROMAGNETIC THEORY & ELECTRODYNAMICS	I	*39	12		P
4	PHYS404	NUCLEAR & PARTICLE PHYSICS	I	*33	20		P
5	PHYS410	SOLID STATE PHYSICS AND WAVES & OPTICS	I			74	P
6	406	QUANTUM MECHANICS - II	II	*56	21		P
7	407	STATISTICAL MECHANICS	II	*46	20		P
8	408	RADIATION THEORY	II	*38	21		P
9	409	ATOMIC & MOLECULAR PHYSICS	II	*43	22		P
10	PHYS405	NUCLEAR PHYSICS & ELECTRONIC LAB-I	II			73	P
11	PHYS-551	PARTICLE PHYSICS - I	III	46	20		P
12	PHYS-552	FIELD THEORY AND QUANTUM ELECTRODYNAMICS - I	III	44	18		P
13	PHYS-556	GENERAL THEORY OF RELATIVITY & COSMOLOGY - I	III	53	22		P
14	PHYS-557	MATHEMATICAL PHYSICS	III	43	24		P
15	501	COMPUTER PROGRAMMING	III			100	P
16	PHYS 571	PARTICLE PHYSICS-II	IV	52/70	21/30		P
17	PHYS 572	FIELD THEORY AND QUANTUM ELECTRODYNAMICS-II	IV	46/70	25/30		P
18	PHYS 576	GENERAL THEORY OF RELATIVITY & COSMOLOGY-II	IV	50/70	25/30		P
19	PHYS 580	ADVANCED NUMERICAL TECHNIQUES (COMPUTER LAB)	IV	70/70	25/30		P
20	DISS	DISSERTATIONN	IV			77/100	P

Sem	Total Obtained Marks	Max Total Marks	Result
I	264	500	

II	340	500	
III	370	500	
IV	391	500	

Division : First; Grand Total: 1365; Grand Max Total: 2000

Abbreviations: RL: Result will be declared later, if necessary; ER: Essential Repeat;Imp: Improvement; TH: Theory; PR: Practical;PW: Project Work; IA: Internal Assessment; P: Passed in Paper; F: Failed in Paper; F-TH: Failed in Theory; F-PR: Failed in Practical; *: Already Appeared; NA: Not Available

Note: This is web-based statement of marks and is valid for all official purpose. Students are also advised to get this statement of marks duly authenticated by the Head/Principal of the Department/College.

Date of Result Declaration: 08 Jul 2018

Dr. Satish Kumar
O.S.D.(Examinations)

Disclaimer:

1. The result displayed on university website is subject to correction, if any discrepancy is noticed at any point of time.
2. Student should immediately contact examination branch if there is any discrepancy in the above result of marks in theory and passing criteria to Window No.-7 (between 9.30am and 3.00pm), New Examination Building (North Campus) within one month after the declaration of the result.

University of Delhi
(Post Graduate Semester Examination Nov-Dec 2017)

Statement of Marks

Exam Roll No. :1613848
Name :SUVAM MAHARANA
Course Name :(816) (P.G)-M.Sc. PHYSICS
Exam Sem :III
College/Deptt. Name :(056) Ramjas College
Enrollment No. :

Date of Printing: 26 Mar 2018

Sr. No.	Paper Code	Paper Name	Sem	TH (Obt/Max)	IA (Obt/Max)	PR/PW (Obt/Max)	Paper Result
1	PHYS401	CLASSICAL MECHANICS	I	*29	11		P
2	PHYS402	QUANTUM MECHANICS-I	I	*30	16		P
3	PHYS403	ELECTROMAGNETIC THEORY & ELECTRODYNAMICS	I	*39	12		P
4	PHYS404	NUCLEAR & PARTICLE PHYSICS	I	*33	20		P
5	PHYS410	SOLID STATE PHYSICS AND WAVES & OPTICS	I			74	P
6	406	QUANTUM MECHANICS - II	II	56	21		P
7	407	STATISTICAL MECHANICS	II	46	20		P
8	408	RADIATION THEORY	II	38	21		P
9	409	ATOMIC & MOLECULAR PHYSICS	II	43	22		P
10	PHYS405	NUCLEAR PHYSICS & ELECTRONIC LAB-I	II			73	P
11	PHYS-551	PARTICLE PHYSICS - I	III	46/70	20/30		P
12	PHYS-552	FIELD THEORY AND QUANTUM ELECTRODYNAMICS - I	III	44/70	18/30		P
13	PHYS-556	GENERAL THEORY OF RELATIVITY & COSMOLOGY - I	III	53/70	22/30		P
14	PHYS-557	MATHEMATICAL PHYSICS	III	43/70	24/30		P
15	501	COMPUTER PROGRAMMING	III			100/100	P

Sem	Total Obtained Marks	Max Total Marks	Result
I	264	500	
II	340	500	PASSED
III	370	500	

Abbreviations: RL: Result will be declared later, if necessary; ER: Essential Repeat;Imp: Improvement; TH: Theory; PR: Practical;PW: Project Work; IA: Internal Assessment; P: Passed in Paper; F: Failed in Paper; F-TH: Failed in Theory; F-PR: Failed in Practical; *: Already Appeared; NA: Not Available

Note: This is web-based statement of marks and is valid for all official purpose. Students are also advised to get this statement of marks duly authenticated by the Head/Principal of the Department/College.

Date of Result Declaration: 26 Mar 2018

Skumar

Dr. Satish Kumar
O.S.D.(Examinations)

Disclaimer:

1. The result displayed on university website is subject to correction, if any discrepancy is noticed at any point of time.
2. Student should immediately contact examination branch if there is any discrepancy in the above result of marks in theory and passing criteria to Window No.-7 (between 9.30am and 3.00pm), New Examination Building (North Campus) within one month after the declaration of the result.

University of Delhi

(Post Graduate Semester Examination May-June 2017)

Statement of Marks

Exam Roll No. :1613848
Name :SUVAM MAHARANA
Course Name :(816) (P.G)-M.Sc. PHYSICS
Exam Sem :II
College/Deptt. Name :(056) Ramjas College
Enrollment No. :

Date of Printing: 18 Jul 2017

Sr. No.	Paper Code	Paper Name	Sem	TH (Obt/Max)	IA (Obt/Max)	PR/PW (Obt/Max)	Paper Result
1	PHYS401	CLASSICAL MECHANICS	I	29	11		P
2	PHYS402	QUANTUM MECHANICS-I	I	30	16		P
3	PHYS403	ELECTROMAGNETIC THEORY & ELECTRODYNAMICS	I	39	12		P
4	PHYS404	NUCLEAR & PARTICLE PHYSICS	I	33	20		P
5	PHYS410	WAVES & OPTICS LAB-II	I			74	P
6	406	QUANTUM MECHANICS - II	II	56/70	21/30		P
7	407	STATISTICAL MECHANICS	II	46/70	20/30		P
8	408	RADIATION THEORY	II	38/70	21/30		P
9	409	ATOMIC & MOLECULAR PHYSICS	II	43/70	22/30		P
10	PHYS405	NUCLEAR PHYSICS & ELECTRONIC LAB-I	II			73/100	P

Sem	Total Obtained Marks	Max Total Marks	Result
I	264	500	
II	340	500	PASSED

Abbreviations: RL: Result will be declared later, if necessary; ER: Essential Repeat;Imp: Improvement; TH: Theory; PR: Practical;PW: Project Work; IA: Internal Assessment; P: Passed in Paper; F: Failed in Paper; F-TH: Failed in Theory; F-PR: Failed in Practical; *: Already Appeared; NA: Not Available

Note: This is web-based statement of marks and is valid for all official purpose. Students are also advised to get this statement of marks duly authenticated by the Head/Principal of the Department/College.

Date of Result Declaration: 18 Jul 2017

Skumar

Dr. Satish Kumar

O.S.D.(Examinations)

Disclaimer:

1. The result displayed on university website is subject to correction, if any discrepancy is noticed at any point of time.
2. Student should immediately contact examination branch if there is any discrepancy in the above result of marks in theory and passing criteria to Window No.-7 (between 9.30am and 3.00pm), New Examination Building (North Campus) within one month after the declaration of the result.

University of Delhi
(Post Graduate Semester Examination Nov-Dec 2016)

Statement of Marks

Exam Roll No. :1613848
Name :SUVAM MAHARANA
Course Name :(816) (P.G)-M.Sc. PHYSICS
Exam Sem :I
College/Deptt. Name :(056) Ramjas College
Enrollment No. :

Date of Printing: 28 Mar 2017

Sr. No.	Paper Code	Paper Name	Sem	TH (Obt/Max)	IA (Obt/Max)	PR/PW (Obt/Max)	Paper Result
1	PHYS401	CLASSICAL MECHANICS	I	29/70	11/30		P
2	PHYS402	QUANTUM MECHANICS-I	I	30/70	16/30		P
3	PHYS403	ELECTROMAGNETIC THEORY & ELECTRODYNAMICS	I	39/70	12/30		P
4	PHYS404	NUCLEAR & PARTICLE PHYSICS	I	33/70	20/30		P
5	PHYS410	WAVES & OPTICS LAB-II	I			74/100	P

Sem	Total Obtained Marks	Max Total Marks	Result
I	264	500	

Abbreviations: RL: Result will be declared later, if necessary; ER: Essential Repeat;Imp: Improvement; TH: Theory; PR: Practical;PW: Project Work; IA: Internal Assessment; P: Passed in Paper; F: Failed in Paper; F-TH: Failed in Theory; F-PR: Failed in Practical; *: Already Appeared; NA: Not Available

Note: This is web-based statement of marks and is valid for all official purpose. Students are also advised to get this statement of marks duly authenticated by the Head/Principal of the Department/College.

Date of Result Declaration: 28 Mar 2017

Dr. Satish Kumar
O.S.D.(Examinations)

Disclaimer:
1. The result displayed on university website is subject to correction, if any discrepancy is noticed at any point of time.
2. Student should immediately contact examination branch if there is any discrepancy in the above result of marks in theory and passing criteria to Window No.-7 (between 9.30am and 3.00pm), New Examination Building (North Campus) within one month after the declaration of the result.

RAMAN RAMAKUMAR MEMORIAL AWARD

Department of Physics & Astrophysics,
University of Delhi

AWARDED TO

Suvam Maharana

for

OUTSTANDING PERFORMANCE IN M.SC (PHYSICS) COMPUTER PROGRAMMING LABORATORY
FOR 2017-18

Head of the Department

20/04/2018

Date

3012-61-0274

000586

University of Calcutta

This is to certify that

Suvam Maharana

obtained the degree of Bachelor of Science (Three Year Course) with Honours in this University in the year 2016 and that he was placed in the Second Class in Physics.

Sugata Marjit

Vice-Chancellor.

Senate House,
The 21st June, 2016

Sl. No. : 16/- 0030892

1414001720163120

012/14001720/063/661701 001048

ASUTOSH COLLEGE ESTD-1916 BHOWANIPUR

UNIVERSITY OF CALCUTTA

STATEMENT OF MARKS

B.SC. PART-III (THREE YEAR HONOURS) EXAMINATION, 2016
(UNDER 2009 REGULATIONS, 1+1+1 SYSTEM)

NAME SUVAM MAHARANA

Roll Number. 3012-61-0274 **& Registration number** 012-1121-0732-13

Compulsory Language Group at Part-I Examination :[Consisting of Compulsory English (ENGC) of 50 marks and a Modern Indian Language (MIL) in Bengali (BNGM)/Hindi(HINM)/ Urdu(URDM)/ Nepali (NPLM)/ Alternative English (ENGM) of 50 marks.]					Compulsory Paper on Environmental Studies (ENVS) at Part III level:[Consisting Project Work of 25 marks Theoretical Examination of 75 marks under CSR/ 54/09]. At Part -I Full marks 50 under CSR/61/06 & CSR/79/05			
SUBJECT	YEAR OF EXAMINATION	MARKS OBTAINED	GRADE SCORED	SUBJECT STATUS	YEAR OF EXAMINATION	MARKS OBTAINED	GRADE SCORED	SUBJECT STATUS
ENGC	2014	27	B	P	2016	92	A	P
ENGM	2014	25	B	P				

GRADE SCORE	RANGE OF MARKS
A	60% & Above
B	30 % to below 60 %
C	Below 30 %

HONOURS / GENERAL / MAJOR SUBJECTS

Subject Codes	Marks Credited Previously: Exam Part I / II / III	Year of Examination	FM	MO	PAPER/S	Marks obtained at the current examination: Theoretical Marks FM	Theoretical Marks MO	Practical Marks FM	Practical Marks MO	Subject total [Theory & Practical Marks taken together] I+II+III FM	I+II+III MO	Subject Status
PHSA					V	100	43					
					VI	100	41					
HONS					VIIA	50	23					
					VIIB			50	40			
					VIIIA			50	38			
					VIIIB			50	36			
	I	'14	200	130								
Total	II	'15	200	108		250	107	150	114	800	459	H
MTMG												
GENL												
	I	'14	100	52								
Total	II	'15	200	131								P
CMSG												
GENL												
	I	'14	100	61								
Total	II	'15	200	145								P

Aggregate Marks & Result

[Part - I, Part - II & Part - III marks taken together(excluding marks in ENVS & Compulsory Language Group).For Honours / Major Course, marks obtained in Honours / Major papers only are taken into account for the purpose of calculating final result on completion of Part I, Part II & Part III Examinations]

FOR PART III EXAMINATION ONLY: Aggregate Marks	Marks Obtained	EXAMINATION RESULT #: PART I	PART II	PART III
800	459	QH	QH	II

Class	Range of Marks
I	60 % & above
II	40 % to below 60 %
Division	
1	60% & above
2	45 % to below 60 %
P	30 % to below 45 %
X	—

#Minimum Marks/Grade to be obtained in each Subject :

	Under CSR/54/09	Under CSR/79/05 & CSR/61/06
Hons Subject	35% in each of theoretical & Practical Portions of Part I, II & III Examinations & 40% in the Aggregate of Part I, II & III taken together.	30% in each of theoretical & Practical Portions, 35% in aggregate of each Part I, II & III & 40% in the Aggregate of Part I, II & III Examinations taken together.
Major/General Subject	30% in each of theoretical & Practical Portions at each Part I, II & III Examinations.	25% in each of theoretical & Practical Portions and 30% in the Aggregate of Part I, II taken together 30% in the Aggregate of Part I, II& III Examinations taken together.
Compulsory Languages & ENVS	Grade C	20% in each of ENGC & MIL and 30% in ENGC+MIL; 30% in ENVS

 # Remarks:

PASSED WITH HONOURS AND
PLACED IN SECOND CLASS

Common Codes	Explanation of codes
H	- Qualified with Honours
G	- Qualified in General Course
P	- Passed
F/X	- Failed
t	- Theoretical Portion
p	- Practical Portion
r	- Previous marks retained
c	- Current marks in credit
AB/ABS	- Absent
FM	- Full Marks
MO	- Marks Obtained
EC	- Examination Cancelled
HONS	- Honours
GENL	- General
MAJR	- Major
MOD	- Module
CRS	- Course

CONTROLLER OF EXAMINATIONS

(VIDE REVERSE)

UG-ASC-015/ 0320440

012/14001720/057/5C1201 001675

UNIVERSITY OF CALCUTTA

STATEMENT OF MARKS

ASUTOSH COLLEGE ESTD-1916 BHOWANIPUR

B. SC. PART-II (THREE YEAR HONOURS) EXAMINATION, 2015
(UNDER 2009 REGULATIONS, 1+1+1 SYSTEM)

NAME SUVAM MAHARANA

Roll Number. 3012-41-0180 **& Registration number** 012-1121-0732-13

Compulsory Language Group at Part-I Examination :[Consisting of Compulsory English (ENGC) of 50 marks and a Modern Indian Language (MIL) in Bengali (BNGM)/Hindi(HINM)/ Urdu(URDM)/ Nepali (NPLM)/ Alternative English (ENGM) of 50 marks.]					Compulsory Paper on Environmental Studies (ENVS) at Part III level:[Consisting Project Work of 25 marks Theoretical Examination of 75 marks under CSR/ 54/09]. At Part -I Full marks 50 under CSR/61/06 & CSR/79/05			
SUBJECT	YEAR OF EXAMINATION	MARKS OBTAINED	GRADE SCORED	SUBJECT STATUS	YEAR OF EXAMINATION	MARKS OBTAINED	GRADE SCORED	SUBJECT STATUS
ENGC	2014	27	B	P				
ENGM	2014	25	B	P				

GRADE SCORE	RANGE OF MARKS
A	60% & Above
B	30 % to below 60 %
C	Below 30 %

HONOURS / GENERAL / MAJOR SUBJECTS

Subject Codes	Marks Credited Previously: Exam Part I / II / III	Year of Examination	FM	MO	PAPER/S	Marks obtained at the current examination: Theoretical Marks FM	Theoretical Marks MO	Practical Marks FM	Practical Marks MO	Subject total [Theory & Practical Marks taken together] FM	MO	Subject Status
PHSA					III	100	43					
HONS					IV	50	30	50	35			
Total	I	'14	200	130		150	73	50	35	200	108	H
MTMG					II	100	61					
GENL					III	100	70					
Total	I	'14	100	52		200	131					P
CMSG					II	100	63					
GENL					III			100	82			
Total	I	'14	100	61		100	63	100	82	200	145	P

Aggregate Marks & Result

[Part - I, Part - II & Part - III marks taken together(excluding marks in ENVS & Compulsory Language Group).For Honours./ Major Course, marks obtained in Honours./ Major papers only are taken into account for the purpose of calculating final result on completion of Part I, Part II & Part III Examinations]

FOR PART III EXAMINATION ONLY: Aggregate Marks	Marks Obtained	EXAMINATION RESULT #: PART 1	PART II	PART III
		QH	QH	

Class	Range of Marks
I	60 % & above
II	40 % to below 60 %
Division	
1	60% & above
2	45 % to below 60 %
P	30 % to below 45 %
X	—

	Under CSR/54/09	#Minimum Marks/Grade to be obtained in each Subject : Under CSR/79/05 & CSR/61/06
Hons Subject	35% in each of theoretical & Practical Portions of Part I, II & III Examinations & 40% in the Aggregate of Part I, II & III taken together	30% in each of theoretical & Practical Portions, 35% in aggregate of each Part I, II & III & 40% in the Aggregate of Part I, II & III Examinations taken together
Major/General Subject	30% in each of theoretical & Practical Portions at each Part I, II & III Examinations.	25% in each of theoretical & Practical Portions and 30% in the Aggregate of Part I, II taken together 30% in the Aggregate of Part I, II& III Examinations taken together
Compulsory Language & ENVS	Grade C	20% in each of ENGC & MIL and 30% in ENGC+MIL; 30% in ENVS

Common Codes	Explanation of codes
H	- Qualified with Honours
G	- Qualified in General Course
P	- Passed
F/X	- Failed
t	- Theoretical Portion
p	- Practical Portion
r	- Previous marks retained
c	- Current marks in credit
AB/ABS	- Absent
FM	- Full Marks
MO	- Marks Obtained
EC	- Examination Cancelled
HONS	- Honours
GENL	- General
MAJR	- Major
MOD	- Module
CRS	- Course

 # Remarks:

QUALIFIED FOR PART-III HONOURS COURSE

CONTROLLER OF EXAMINATIONS

(VIDE REVERSE)

UG-ASC-015/ 0084043

012/14000700/054/510101 002106

UNIVERSITY OF CALCUTTA
STATEMENT OF MARKS

B. SC. PART-I(THREE YEAR HONOURS) EXAMINATION, 2014
(UNDER 2009 REGULATIONS, 1+1+1 SYSTEM)

NAME SUVAM MAHARANA

Roll Number. 3012-21-0362 **& Registration number** 012-1121-0732-13

Compulsory Language Group at Part-I Examination :[Consisting of Compulsory English (ENGC) of 50 marks and a Modern Indian Language (MIL) in Bengali (BNGM)/Hindi(HINM)/ Urdu(URDM)/ Nepali (NPLM)/ Alternative English (ENGM) of 50 marks.]					Compulsory Paper on Environmental Studies (ENVS) at Part III level:[Consisting Project Work of 25 marks Theoretical Examination of 75 marks under CSR/ 54/09]. At Part -I Full marks 50 under CSR/61/06 & CSR/79/05			
SUBJECT	YEAR OF EXAMINATION	MARKS OBTAINED	GRADE SCORED	SUBJECT STATUS	YEAR OF EXAMINATION	MARKS OBTAINED	GRADE SCORED	SUBJECT STATUS
ENGC								
ENGM		27	B	P				
		25	B	P				

GRADE SCORE	RANGE OF MARKS
A	60% & Above
B	30 % to below 60 %
C	Below 30 %

HONOURS / GENERAL / MAJOR SUBJECTS

Subject Codes	Marks Credited Previously: Exam Part I/II/III	Year of Examination	FM	MO	PAPER/S	Marks obtained at the current examination: Theoretical Marks FM	Theoretical Marks MO	Practical Marks FM	Practical Marks MO	Subject total [Theory & Practical Marks taken together] FM	MO	Subject Status
PHSA					I	100	61					
HONS					II	50	27	50	42			
Total						150	88	50	42	200	130	H
MTMG					I	100	52					
GENL												
Total						100	52			100	52	P
CMSG					I	100	61					
GENL												
Total						100	61			100	61	P

Aggregate Marks & Result

[Part - I, Part - II & Part - III marks taken together(excluding marks in ENVS & Compulsory Language Group).For Honours/ Major Course, marks obtained in Honours/ Major papers only are taken into account for the purpose of calculating final result on completion of Part I, Part II & Part III Examinations]

FOR PART III EXAMINATION ONLY: Aggregate Marks	Marks Obtained	EXAMINATION RESULT #: PART I	PART II	PART III
		QH		

Class	Range of Marks
I	60 % & above
II	40 % to below 60 %
Division	
1	60% & above
2	45 % to below 60 %
P	30 % to below 45 %
X	

#Minimum Marks/Grade to be obtained in each Subject :

	Under CSR/54/09	Under CSR/79/05 & CSR/61/06
Hons Subject	35% in each of theoretical & Practical Portions of Part I, II & III Examinations & 40% in the Aggregate of Part I, II & III taken together.	30% in each of theoretical & Practical Portions, 35% in aggregate of each Part I, II & III & 40% in the Aggregate of Part I, II & III Examinations taken together.
Major/General Subject	30% in each of theoretical & Practical Portions at each Part I, II & III Examinations.	25% in each of theoretical & Practical Portions and 30% in the Aggregate of Part I, II taken together 30% in the Aggregate of Part I, II& III Examinations taken together.
Compulsory Languages & ENVS	Grade C	20% in each of ENGC & MIL and 30% in ENGC+MIL, 30% in ENVS

Common Codes	Explanation of codes
H	- Qualified with Honours
G	- Qualified in General Course
P	- Passed
F/X	- Failed
t	- Theoretical Portion
p	- Practical Portion
r	- Previous marks retained
c	- Current marks in credit
AB/ABS	- Absent
FM	- Full Marks
MO	- Marks Obtained
EC	- Examination Cancelled
HONS	- Honours
GENL	- General
MAJR	- Major
MOD	- Module
CRS	- Course

 # Remarks:

QUALIFIED FOR PART-II HONOURS COURSE

CONTROLLER OF EXAMINATIONS

(VIDE REVERSE)

UG-ASC-14/

0197116

U N I V E R S I T Y O F C A L C U T T A
Department of Physics
92, A.P.C. Road, Kolkata 700009, India

Anirban Kundu
Professor

E-mail: anirban.kundu.cu@gmail.com
akphy@caluniv.ac.in
Tel: (91) (33) 2360 7854

February 7, 2019

Reference Letter for Mr. Suvam Maharana

Dear Colleague,

This is to recommend Mr. Suvam Maharana for the graduate programme of your department.

Suvam did his M.Sc. from Delhi University, and is now doing a project with me for the last three months or so. He is working on a possible Dark Matter model, namely, the Standard Model enhanced with a complex singlet. He has already found some interesting results, including some subtle properties of the parameter space, and this work will be put in the arXiv repository soon.

Based on this project, I would say unhesitatingly that his performance was excellent and it was evident that he has a very good grasp on theoretical quantum mechanics, quantum field theory, and particle physics.

I would like to emphasize the following qualities:

Depth of knowledge and intellectual ability: Suvam has a very good grasp on the basic theoretical subjects, in particular quantum mechanics, quantum field thery, and mathematical physics. He should also be able to act as a very good TA, as I could gather from the way he discussed the project with me.

Analytical thinking: Quite mature for his level.

Motivation and aptitude for research: Based on his performance in the project, I would say it is extremely good and I would have liked to have him as my own graduate student. Theoretical particle physics or astrophysics and cosmology would suit him best.

Maturity: Sufficiently mature for his age, knows enough material outside his courses, and is well aware of the cutting edge of research.

Grasp of English: Very good.

Self-confidence: Very high. I never found him feeling diffident or nervous even in the face of quite tough calculations.

I recommend him very strongly for the graduate programme.

Anirban Kundu

Anirban Kundu
(Professor, Department of Physics, Calcutta University)

Mondal, Buddhadeb

<table>
<tr><td>Address</td><td></td><td colspan="2">Email nadigodeb@gmail.com (update 2019/01/22)</td></tr>
<tr><td colspan="2">room-c615, Hostel 13, IIT Bombay, Powai
Mumbai, Maharashtra 400076
India</td><td colspan="2">Home Phone 9046144043
Office Phone</td></tr>
<tr><td>Current Title / Dates</td><td colspan="3">Student</td></tr>
<tr><td>Current Institution</td><td>Indian Institute of Technology Bombay</td><td>Department</td><td>Physics</td></tr>
<tr><td>Location</td><td colspan="3">IIT Bombay, Powai, Mumbai, Maharashtra 400076, India</td></tr>
<tr><td>Highest Degree</td><td>M.Sc</td><td>Institution Indian Institute of Technology Bombay</td><td>Date 2018/08</td></tr>
<tr><td>Thesis Advisor</td><td colspan="3">Prof. Manoranjan Guchait</td></tr>
<tr><td>Thesis Title</td><td colspan="3">Jet physics at the LHC</td></tr>
<tr><td>Research Interests</td><td colspan="3">Primary Particle physics phenomenology</td></tr>
<tr><td>Secondary</td><td colspan="3">Collider phenomenology; Data analysis</td></tr>
<tr><td>Discipline(s)</td><td colspan="3">Physics</td></tr>
<tr><td>Position(s) applied</td><td colspan="3">PHD</td></tr>
<tr><td colspan="3">1. Dr. Manoranjan Guchait, Tata Institute of Fundamental Research, guchait@tifr.res.in (2019/01/22)</td><td></td></tr>
<tr><td colspan="3">2. Prof. Iris Gebauer, Karlsruhe Institute of Technology, iris.gebauer@kit.edu (2019/01/22)</td><td>data (TEXT, PDF, 2019/01/22)</td></tr>
<tr><td colspan="4"></td></tr>
<tr><td>Received Materials</td><td>PHD</td><td colspan="2">Cover Letter: file (PDF, PDF 2019/01/22)
Curriculum Vitae: file (PDF, PDF 2019/01/22)
Research Statement: file (PDF, PDF 2019/01/22)
Copies of grades transcripts: file (PDF, PDF 2019/01/22)</td></tr>
</table>

Physics Department, IIT Bombay,
Mumbai, India 400076
Phone: +919531651091
Email: nadigodeb@gmail.com

Collaborative Research Center TRR 257,
Karlsruhe Institute of Technology, Germany

Dear Members of the Search Committee,

I am writing this letter to express my deep interest in the doctoral position at the Collaborative Research Center ”Particle Physics Phenomenology after the Higgs Discovery” (CRC P3H). I recently finished my M.Sc in physics from Indian Institute of Technology Bombay (IIT Bombay), Mumbai, India and TIFR, Mumbai, India. Currently I am working at TIFR on several phenomenological projects on Higgs physics and supersymmetric top quark search. In future I would like to study Higgs physics, top quark physics to search for new physics, Dark sector and related areas. The Collaborative Research Center ”Particle Physics Phenomenology after the Higgs Discovery” is a great collaborative network supervised by the world’s leading experts in this field. I would be very much interested to join this collaborative network and work with my full potential to solve the present and future problems in particle physics and continue revealing our understanding about the nature at the very fundamental level.

My intellectual curiosity and passion for asking questions is what led me to pursue higher study in physics. I am always very curious about understanding fundamental building blocks of our universe, what is it our universe made of. Probably that is why I have decided to purse my research career in particle physics. During my master project I studied top quark physics, jet physics, studied properties of jets, using jet substructure technique top quark tagging and search for physics beyond the standard model. Please see my CV for further information about me. I learned machine learning and implemented image based Deep Learning in the top quark tagging. After that I have been working on Higgs physics phenomenology and supersymmetric top quark search.

Discovery of Higgs has changed our understanding about the universe by providing a consistent mathematical framework that can be used to describe nature in fine detail. It is very important to study Higgs and how we can use Higgs to search for new physics. Top being the heaviest quark has the potential to discover new physics. The Collaborative Research Center has a very well designed research projects from the precision physics to the models for new physics on Higgs, Top quark physics, QCD, Electroweak physics and Flavor physics. I would be very much interested to take part in any of the projects. As it has been asked to select three projects, I would be very much interested to work on: Extended Higgs sector at LHC, Dark sector at the LHC and Precision top-quark physics at the LHC.

Throughout my academic career I have worked hard to become a good researcher. I have earned a broad set of skills by attending lectures, seminars, workshops, working with Professors and classmates. With my past experience in particle physics research, broad set of technical skills, high motivation in pursuing doctorate in particle physics, I believe I would work very effectively in this project.

After completing my Ph.D., I plan to pursue a postdoc in this field. I hope to continue in academia as a professor with my own research so that I can mentor students and take physics forward by making my own original contributions. I am positive that doctoral study with the CRC P3H network would be the right step towards achieving my goals.

Thank you for your time and consideration.

Sincerely,

Buddhadeb Mondal

Buddhadeb Mondal

Contact Information

Date of Birth: January 09, 1996 **Nationality:** Indian

Gender: Male

Current Address: Hostel 13, C-wing, Room no-615, IIT Bombay, Powai, Mumbai 400076, India **Phone:** +91 9531651091, +91 8169261594

Email: nadigodeb@gmail.com **Website:** http://home.iitb.ac.in/ bmondal/

Research Interests

I am very open minded. Being just a fresh M.Sc graduate, I am open to do research in any field. I believe any problem you study and try to solve, and gradually it becomes your research interests.

Education

Indian Institute of Technology Bombay, Mumbai, India — July 2016 – July 2018
Master of Science — (CPI 6.73/10.0)

Jadavpur University, Kolkata, West Bengal. India — August 2013 – Jun 2016
Bachelor of Science — (Percentage 70.1 %)

West Bengal Council of Higher Secondary Education,
Khodambari Union B.P.H.S School, West Bengal. India — 2011 – 2013
Intermediate+2 — (Percentage 84.4 %)

Awards and Fellowships

Awarded internship grant from Karlsruhe House of Young Scientists sponsored by DAAD, Germany(KHYS) for the research work with AMS-02 experiment (2012 EUR) — 2017

Awarded Internship Certificate from IEKP (Institut fur Experimentelle Kernphysik) at Karlsruhe Institute of Technology, Germany(KIT) after successfully completing the internship program for 67 days. — 2017

DST INSPIRE Fellow ("Innovation in Science Pursuit for Inspired Research (INSPIRE)" is an innovative programme sponsored and managed by the Department of Science and Technology, Government of India. It is awarded to only 1% students all over the India pursuing science as their career) (60,000 INR per year) — 2013 – 2018

Awarded Central Sector Scheme for Scholarship by State Government for outstanding result in higher secondary board exam (10, 000 INR during bachelor and 20,000 INR during master) — 2013 – 2018

Qualified and got admission in IIT Bombay (one of the top IIT in India, probably rank 2nd) in the IIT-JAM (Joint Admission Test for M.Sc.) Physics 2016 exam amongst nearly 11,000 physics undergraduate students across India. — 2016

Awarded by the principle of school for being the class topper in secondary and higher secondary school.

Research Projects and Internships

(1) Phenomenological search for Supersymmetric top partners using boosted technique and machine learning — Tata Institute of Fundamental Research (TIFR), Mumbai — with Prof. Monoranjan Guchait and Aravind H. Vijay October 2018 - present

***The work has been finished. Currently the paper is being written for submission in a journal.

(2) Probing heavy charged Higgs in two different decay channels at the Large Hadron Collider — Tata Institute of Fundamental Research (TIFR), Mumbai — with Prof. Monoranjan Guchait September 2018 - present

We are investigating the signature of heavy charged Higgs boson in two different decay modes.

(3) Top quark tagging using Deep learning — Tata Institute of Fundamental Research (TIFR), Mumbai — with Prof. Monoranjan Guchait July 2018 - August 2018

Machine learning can be used to study jet at the LHC. Our main focus is to tag highly boosted top quark using Deep Learning. For highly boosted top quark in the decay of heavy resonances, final state particles are very collimated. These collimated spray of final state particles are called jet. Using jet algorithm in the final state particles and applying some standard preprocessing steps jet image is created. This jet images can be used to train the neural network and creating an image based convolutional neural network (CNN) classifier we can separate signal and background jet images. Further from jet images we can extract the information of the top quark.

- We are interested in the highly boosted top quarks in the decay of Z'. We have used PYTHIA8 (event generator) and HEPMC to generate hepMC events for the process $Z' \longrightarrow t\bar{t}$. A detector simulation has been implemented using DELPHES3. We have used FastJet3 along with DELPHES to create jet from final state particles. Delphes root files have been used for preprocessing the jet image. We have used python in the entire analysis.
- We have used tflearn and tensorflow as backend and created a CNN (Convolutional Neural Network) and trained the network with 250000 jet images corresponding to the signal and background. After training the network has been tested with new data. With a simple Convolutional Neural Network we get a AUC (Area Under the Curve) score 82%.

(4) Jets at the LHC — Master Project— Tata Institute of Fundamental Research (TIFR), Mumbai — under the supervision of Prof. Monoranjan Guchait August 2017 - April 2018

Jets are the closest experimentally we can get to a parton. So, studying jets is very important in particle physics experiments. For that we need a very good jet algorithm to create jets from the stable particle detected by the detector. We also need to decluster jet and get the information of the original parton by using algorithm (taggers) which separates the signal from the background soft QCD radiation.

- **Theoretical Study**: I started my project by making a solid theoretical understanding about the elementary particle physics.
  - calculated mathematically different high energy scattering processes in the tree level using Feynman calculus
  - Learned mathematical formalism of the elementary particle physics and collider physics to acquire the theoretical knowledge before jumping into the research.
- **Detailed Study of Top Production and Decay to Quark and Leptonic Channel**: In top production ($pp \longleftrightarrow t\bar{t}$) I have thoroughly studied different properties of the event (p_T, η distribution of top quark and lepton). What fraction of top decay to leptonic channel and to the quark channel. I have verified the fact that when mass is significant (in case of top quark) rapidity and pseudo rapidity becomes different. I also have studied the missing energy sector. I have calculated true missing transverse energy (because of neutrinos are invisible

to the detector) and missing transverse energy from visible sector. I have used PYTHIA8 as event generator and CERN ROOT for analysis work.

- **Properties of Jet and Jet Substructure Analysis Study**:
  - Studied different properties of jet by varying the input parameters. Top production process has been used in this study. FastJet3 jet finder has been used to cluster final state particles into jet.
  - **jet substructure analysis:** Using HEPTopTagger2 and JHTopTagger, reconstructed the top quarks from the final state particles and from the decayed top, we have reconstructed a heavy resonance Z'.
  - For the signal We have used PYTHIA8 to generate $Z' \longrightarrow t\bar{t}$ with mass of $Z' = 1500 GeV$ with all the top quarks are forced to decay hadronically. For background we have used QCD processes.
  - **Performance study of two top taggers:** We have studied the performance of two top taggers. We have calculated their top tagging efficiency and mis-tagging efficiency. We have done this performance study in two cases, (1) Varying the boostness of the top quark (this study implies taggers performance based on the top quarks's boostness), (2) Varying the cone size of the fat jet (this study shows how we should choose the cone radius of fat jet based on our top quark's boostness or transverse momentum) .Finally studied the ROC curve for two top taggers.
  - Studied event kinematics with both the top taggers in all the above mentioned cases.

(5) Internship — Worked with Kai Fabian Bindel to study the anisotropy in the cosmic rays with Alpha Magnetic Spectrometer (AMS-02) experiment — IEKP, KIT, Germany— Under the guidance of Kai Fabian Bindel (PhD under the guidance of Prof. Wim de Boer) May 2017 - July 2018

- Selection of He and Carbon events among all the cosmic ray particles data taken within first five years by the AMS-02 detector in the International Space Station.
- Calculation of the rate at which different particles is being detected at the detector at various energy ranges and its projection on the sky using HealPix map at different coordinate systems.
- Deeply studied how different cuts on the detector make the differences in the selected particles and using that we got the best selection for different analyses purposes. How different selection changes the selection efficiency of each part of the detector.
- Analysed projection sky map ratio in different coordinate system, calculation of error in the analyses were done.
- CERN ROOT data analysis framework had been used for the whole analysis.

(6) Neutrino Astronomy: Detection of Cosmic Neutrino Background (CNB) — IIT Bombay —Course Instructor Prof. Vikram Rentala May 2017 - July 2017

This project is all about how we can detect Cosmic Neutrino Background (CNB). We studied various methods and how these methods can be improved further for more precise detection of CNB. We also worked on how the study of CNB will help our understanding of the universe. It is like looking at the universe using cosmic neutrino instead of photons. The best thing is that it does not interact that much with anything, so it does not get deflected. We studied whether KATRIN experiment (Karlsruhe, Germany) can be used to detect CNB. We hypothesized some different approach to detect those CNB.
Link to the project: https://sites.google.com/site/polaris17iitb/

Course Projects

Squeezed States of Light — IIT Bombay 2018
Here is the link to the website: https://drive.google.com/open?id=1iah2NPZZMiDHhmfL3XedV6RJ1vmqpX1a

Raman Spectroscopy — IIT Bombay 2017
It was a class project in which i studied (1) the theory behind the Raman spectroscopy, (2) Designed experiment to perform it, and (3) Its application in real life.

Automatic watering system to the plants — IIT Bombay 2016
I designed a practical electronic circuit to water the plants sensing the moisture of the soil.

Technical Skills

- **Machine learning with Python**: Tensorflow (An open source machine learning framework), tflearn (Deep learning library built on top of tensorflow), Keras (Neural network API built on top of tensorflow).
- **Neural networks with which I have worked on**: Deep Neural Network (DNN), Convolutional Neural Network (CNN), Recurrent Neural Network (RNN), Generative Adversarial Network (GAN).
- **Programming and Scripting Languages**: C, Mastery of C++, Proficient with Python, Fortran, Mathematica and Bash Script, html, css
- **Data Analysis Software**: TMVA (Toolkit for Multivariate Data Analysis), CERN ROOT (Data Analysis Framework in high energy physics, worked more than 1.0 years)
- **High Energy Physics Packages**: PYTHIA 8 (event generator in high energy physics), MADGRAPH (event generator for high energy physics), DELPHES for fast detector simulation, Fastjet (To create jet in high energy experiments), HEPTopTagger (To tag top quarks from fat jet), JHTopTagger (used to tag top quark)
- **Graphing Software**: Origin, Qti plot, familiar with GNU plot
- **Software**: Git hub, LATEX
- Other office applications under Linux or MS-Windows.
- **Operating Systems**: Windows, Linux

Online Project Challenges

TrackML Challenge:
A online challenge of "Reconstruction of particle track from 3D hit points on the different detector layers" was posted by CERN at www.kaggle.com. I was working on that challenge by myself. I had successfully reconstructed the track path from the training dataset. I used unsupervised machine learning in this case.

Machine Lerning Projects

Image Classifier using Deep Convolutional Nural Network:
I have created a model using Deep Convolutional Network with TFlearn to classify images of different category. First the network is trained with a large data set and then it is tested with a completely new data and it performs like a black magic.

A simple Chatbot using Tensorflow:
Using Recursive Neural Network (RNN), I have created a LSTM (Long Short Term Memory). This AI can conducts a conversation via textual method.

Artificial Intelligence which can generate music:
I have created a network which can generate new music.

PRESENTATIONS	Graded presentation for the master's thesis project (part II) on "Jets at the LHC".	May 2018
	Graded presentation for the master's thesis project (part I) on "Study of properties of jets at LHC".	November 2017
	Graded presentation of course project on "Raman Spectroscopy" in PH 440 "Introduction to Atomic and Molecular Physics" course.	October 2017
	Presentation given to the AMS-02 group at Karlsruhe Institute of Technology, Germany on "Study of anisotropy in the cosmic rays with AMS-02".	July 2017
	A graded presentation of work done in the semester long astrophysics course project on 'Neutrino Astronomy' focusing on the detection of cosmic neutrino background (CNB) and how to detect them.	April 2017

KEY COURSES

Physics Courses: Quantum Field Theory (online course by Prof. David Tong), Statistics in particle physics (online course), Quantum Mechanics I-II-III, Group Theory, Particle Physics I, Particle Physics II, Electrodynamics I, II, Special Theory of Relativity, Astrophysics, Classical mechanics, Statistical mechanics, Electronics, Thermodynamics, Modern Physics, Elementary particle physics, Experimental techniques in particle and collider physics, Condensed matter physics, Light matter interaction, Mathematical physics, spectroscopy lab, optics lab, general physics lab, nuclear and particle physics lab.

Mathematics: Numerical analysis, Complex analysis, Partial Differential Equations, Differential Equations, Integral Transforms, Special Functions, Vector algebra and Calculus, Vector Space.

ONLINE COURSES

Quantum Field Theory, Higgs Physics, Statistics in particle physics by G. Cowan, Machine Learning by Andrew NG (Stanford University)

LANGUAGE

Fluent in English

REFERENCES

Prof. Monoranjan Guchait
Department of High Energy Physics,
Tata Institute of Fundamental Research
Mumbai-400005, India,
Email: guchait@tifr.res.in
Tel: 91-22-2278-2479
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Prof. Iris Gebauer
Institute of Experimental Kernphysik (IEKP),
Karlsruhe Institute of Technology (KIT)
Email: iris.gebauer@kit.edu
Tel: +49 72160847578
Geb. 30.23, Raum 08/15
Wolfgang-Gaede Str. 1, 76131 Karlsruhe

Statement of Research Interests and Experiences

Buddhadeb Mondal

My ultimate goal is to understand our universe at its fundamental level. With the help of the current technology and knowledge, how well we can understand this. That is why I have decided to pursue particle physics as my career. I want to study and understand what is happening at the very fundamental level. The LHC and other particle colliders are great piece of technology to study fundamental building blocks. I would like to study those unsolved problems and find explainable solutions of them.

Earlier project: I got involved in my first project with three other classmates on Neutrino Astrophysics at IIT Bombay. We studied how cosmic neutrino background (CNB) can be studied with our currently available neutrino detectors and proposed further development. CNB would be a great tool to study our universe. It is like seeing our universe with a camera which can see things with the help of neutrino instead of photon. We studied whether KATRIN (Karlsruhe, Germany) experiment can be used to detect CNB or not. We hypothesized some different approaches to detect those CNB.

Internship at KIT, Germany: During summer I went to Karlsruhe Institute of Technology (KIT, Germany) and got involved with AMS-02 experiment. Using past five years data collected by the AMS-02 detector I studied at which rate different cosmic rays particles are hitting the detector surface, separated He and Carbon from all the cosmic ray particles, efficiency study based on cuts on different detector module and finding the optimal cut for different analysis purposes. I also studied skymap of the detected particles at different coordinate systems. It was a small part of major study of search for anisotropy in the cosmic rays. I learned and used CERN ROOT (data analysis framework) which has helped me a lot in my later projects.

Master project at TIFR, Mumbai: During my master project I studied phenomenologically top quark physics, jet physics, properties of jet at the LHC, jet substructure technique and how it can be used to tag top quark jet from the final state detectable particles. In particle collision at the LHC, after collision, detectors only detect final state particles and from those detected particles we try to understand what hard process is going on. Basically we trace back from final state particles to the main process whose result is those final state particles. Using top quark tagging technique, I reconstructed the whole event and used top quark tagging technique to search for resonance particle beyond the standard model. (I have included my work on CV, please have a look). I did a comparative performance study between HEPTopTagger2 and JHTopTagger and showed which top tagging technique is better and should be implemented depending on the top quarks's transverse momentum. I also showed how the performance of the top quark tagging depends on the fat jet radius. This performance study shows there is a range in fat jet radius and a threshold transverse

momentum of top quark, in which the tagger performs the best.
The efficiency of top tagging was not very good. At that time people were using machine learning in different problems. I learned machine learning and applied image based deep learning in the top quark tagging. I showed the result is little better in deep learning top tagging. All available top quark tagging works very well in the boosted regime and perform really poorly in the moderately boosted regime. I have been working in this to tag top in moderately boosted regime using deep learning.

Current work: Throughout the world particle physicists have been working a lot to find the signature of the Supersymmetric particles. They have not found it yet. I have been working on a phenomenological search for the supersymmetric top partner using boosted technique and machine learning with Prof. Monoranjan Guchait at TIFR. Which can be used in the near future search for the Supersymmetric top partner at the LHC. We have come up with an observable which we believe will be very helpful in the supersymmetric top quark search. I believe there are lot of mysteries which can be solved using particle colliders and I want to take part on those.

My diverse background in physics and broad research experience in the field of high energy physics has built a solid ground for pursuing career in physics. I would be very much interested in working with you and I am confident that I can do the work very effectively.

JADAVPUR UNIVERSITY

KOLKATA-700 032

GRADE CARD

No. - BSC. 000380

(3 Year Degree Course)

Results of the FIRST B.Sc. (PHYSICS) 1ST. SEM. Examination 2014

for the session 2013 - 2014 for BUDDHADEB MONDAL

studying in the Department of PHYSICS

with Class Roll No. 001320701054 and Examination Roll No. BP1411041

Registration No. ______ of -

Examination held in NOVEMBER - DECEMBER, 2013

Subject	Grades
PHYSICS H01	B
PHYSICS H02	B
MATHEMATICS 1S	D
MATHEMATICS 2S	D
MATHEMATICS 3S	D
CHEMISTRY PAPER I (1S PART I)	C
CHEMISTRY PAPER II (1S PART II)	D

Remarks P

Prepared by

Checked by

Date of issue 19 / 03 / 2014

Bhattacharyya

Controller of Examinations

[see overleaf]

JADAVPUR UNIVERSITY

KOLKATA-700 032

No. - BSC. 083449

GRADE CARD

(3 Year Degree Course)

Results of the 1ST B. Sc.(PHYSICS) 2ND SEMESTER Examination 2014

for the session 2013-2014 for BUDDHADEB MONDAL

studying in the Department of PHYSICS

with Class Roll No. 001320701054 and Examination Roll No. BP1412041

Registration No. 124268 of 2013-2014

Examination held in May-June, 2014.

Subject	Grades
PHYSICS HO3	C
PHYSICS HO4	B
PHYSICS HO1 (PRACTICAL)	B
PHYSICS HO2 (PRACTICAL)	B
MATHEMATICS 4S	C
MATHEMATICS 5S	C
MATHEMATICS 6S	B
CHEMISTRY PAPER 3	D
CHEMISTRY PAPER 4	C
CHEMISTRY PAPER 1 (PRACTICAL)	C
CHEMISTRY PAPER 2 (PRACTICAL)	A
** PASSED in Environmental Studies **	

Remarks P

Prepared by

Checked by

Date of issue 09 / 01 / 2015

Controller of Examinations

[see overleaf]

JADAVPUR UNIVERSITY

KOLKATA-700 032

No. - BSC. 003737

GRADE CARD

(3 Year Degree Course)

Results of the INTER B.Sc. (PHYSICS) 1ST. SEM. Examination 2015

for the session 2014 - 2015 for BUDDHADEB MONDAL

studying in the Department of PHYSICS

with Class Roll No. 001320701054 and Examination Roll No. BP1521039

Registration No. 124268 of 13-14

Examination held in NOVEMBER - DECEMBER, 2014

Subject	Grades
PHYSICS H05	A
PHYSICS H06	A
CHEMISTRY V(IIIS, Part-I)	C
CHEMISTRY VI(IIIS, Part-II)	C
MATHEMATICS 7S	C
MATHEMATICS 8S	C
MATHEMATICS 9S	D

Remarks P

Prepared by

Checked by

Date of issue 06 - 04 - 2015

Bhattacharyya

Controller of Examinations

[see overleaf]

JADAVPUR UNIVERSITY

KOLKATA-700 032

No. - BSC. 002574

GRADE CARD

(3 Year Degree Course)

Results of the INTER B.Sc. (PHYSICS) 2ND. SEM. Examination 2015

for the session 2014-2015 for BUDDHADEB MONDAL

studying in the Department of PHYSICS

with Class Roll No. 001320701054 and Examination Roll No. BP1522039

Registration No. 124268 of 2013-2014

Examination held in MAY-JUNE, 2015

Subject	Grades
PHYSICS H07	A
PHYSICS H08	A
PHYSICS PRACTICAL H03	B
PHYSICS PRACTICAL H04	A
MATHEMATICS 10S	B
MATHEMATICS 11S	A
MATHEMATICS 12S	C
CHEMISTRY PAPER VII	C
CHEMISTRY PAPER VIII	C
CHEMISTRY PRACTICAL PAPER IIIS	C
CHEMISTRY PRACTICAL PAPER IVS	A
COMPUTER PROGRAMMING(COMPULSORY)	C
COMPUTER PROGRAMMING(PRACTICAL)	D

Remarks P

Prepared by

Checked by

Date of issue 11 / 09 / 2015

Bhattacharyya

Controller of Examinations

[see overleaf]

JADAVPUR UNIVERSITY

KOLKATA-700 032

No. - BSC. 003876

GRADE CARD

(3 Year Degree Course)

Results of the FINAL B.Sc. (PHYSICS) 1ST SEM. Examination 2016

for the session 2015 - 2016 for BUDDHADEB MONDAL

studying in the Department of PHYSICS

with Class Roll No. 001320701054 and Examination Roll No. BP1631039

Registration No. 124268 of 2013-2014

Examination held in NOVEMBER-DECEMBER , 2015

Subject	Grades
UNIT H09	C
UNIT H10	A
UNIT H11	A

Remarks P

Prepared by

Checked by

Date of issue 01 - 04 - 2016

Bhattacharyya
Controller of Examinations

[see overleaf]

JADAVPUR UNIVERSITY

KOLKATA-700 032

GRADE CARD

No. : BSC/16022/ 0000081

3 Year Degree Course

Result of the Bachelor of Science PHYSICS Final Examination

for the session 2015-2016 for BUDDHADEB MONDAL

studying in the Department of PHYSICS

with Class Roll No. 001320701054 and Examination Roll No. BP1632039

Registration No. 124268 of 2013-2014

Grades of Final Year Second Semester Examination held on MAY, 2016

Subject	Grades
PAPER H12	C
PAPER H13	B
PAPER H14	B
CLASS TEST	B
PAPER H05 : PRACTICAL	B
PAPER H06 : PRACTICAL	C

Aggregate marks obtained in Honours and Subsidiary subjects of Bachelor of Science PHYSICS Examination

HONOURS SUBJECT			SUBSIDIARY SUBJECTS		
Examination	Theoretical	Practical	Subject	Theoretical	Practical
1st B.Sc.	129/200	70/100	MATHEMATICS CHEMISTRY	150/300 96/200	66/100
Inter B.Sc.	166/200	75/100	MATHEMATICS CHEMISTRY COMP. PROG.	193/300 106/200 52/100	69/100
Final B.Sc.	275/400	126/200			
Total	570/800	271/400		597/1100	135/200

Honours Total 841 (Out of 1200) Subsidiary Total 732 (Out of 1300)

Remarks FIRST CLASS WITH DISTINCTION

Prepared by [signature]

Checked by [signature]

Date of Issue 05 / 07 / 2016

Controller of Examinations

(See Overleaf)

भारतीय प्रौद्योगिकी संस्थान मुंबई
INDIAN INSTITUTE OF TECHNOLOGY BOMBAY
पवई / Powai, मुंबई / Mumbai 400 076

Official Transcript

Roll Number:	165120021	Academic Unit:	Physics
Name of the Student:	BUDDHADEB MONDAL	Joining Month & Year:	July 2016
Programme:	Master of Science (2 Yr M.Sc)		

Academic Year: 2016 - 2017, Term: Semester Autumn

Code	Name	Credits	Tag	Grade
PH 401	Classical Mechanics	8.0	MA	CC
PH 403	Quantum Mechanics I	8.0	MA	BB
PH 405	Electronics	6.0	MA	CC
PH 407	Mathematical Physics I	8.0	MA	CC
PH 411	Physics Lab I	3.0	MA	AA
PH 414	Electronics Laboratory	3.0	MA	BB

SPI= 6.94/10 CPI= 6.94/10

Academic Year: 2016 - 2017, Term: Semester Spring

Code	Name	Credits	Tag	Grade
ES 200	Environmental Studies: Science and Engineering	3.0	MA	CD
HS 200	Environmental Studies	3.0	MA	CD
PH 304	Statistical Physics	6.0	MA	BC
PH 408	Mathematical Physics II	8.0	MA	CC
PH 413	Programming Lab	5.0	MA	CC
PH 424	Electromagnetic Theory I	6.0	MA	BC
PH 426	Astrophysics	6.0	AU	AU

SPI= 5.19/10 CPI= 6.05/10

Academic Year: 2017 - 2018, Term: Semester Autumn

Code	Name	Credits	Tag	Grade
PH 409	Introduction to Condensed Matter Physics I	6.0	MA	CD
PH 412	Physics Lab II	6.0	MA	AA
PH 440	Introduction to Atomic and Molecular Physics	6.0	MA	CD
PH 505	Introduction to Nuclear & Particle Physics	6.0	MA	CD
PH 520	Group Theory Methods	6.0	MA	CC
PH 595	Project I	6.0	MA	AA

SPI= 6.83/10 CPI= 6.31/10

Academic Year: 2017 - 2018, Term: Semester Spring

Code	Name	Credits	Tag	Grade
EP 408	Methods in Experimental Nuclear and Particle Physics	6.0	MA	CC
PH 454	Light Matter Interaction	6.0	MA	CC
PH 512	Physics Lab IV	6.0	MA	BC
PH 525	Electromagnetic Theory II	6.0	MA	CC
PH 540	Elementary Particle Physics	6.0	MA	BC
PH 596	Project II	6.0	MA	AB

SPI= 6.83/10 CPI= 6.44/10

Academic Year: 2017 - 2018, Term: Semester Summer

Code	Name	Credits	Tag	Grade
PH 422	Quantum Mechanics II	6.0	MA	BC

SPI= 7.00/10 CPI= 6.73/10

Mandatory Course Credits (MA)	**= 145.0**	**Overall CPI**	**= 6.73/10**
Overall Credits Completed	**= 145.0**		
Overall Grade Points	**= 976.0**		

Final Result

The student has completed the academic requirements of the programme in the month of July 2018 for the award of Master of Science in Physics

Signature & Seal of Transcript Issuing Authority:

Joint/Assistant Registrar (Academic), IIT Bombay

सहायक कुलसचिव (शैक्षिक)
Assistant Registrar (Academic)
भारतीय प्रौद्योगिकी संस्थान, मुंबई
Indian Institute of Technology, Bombay
पवई, मुंबई / Powai, Mumbai - 400 076.

Date: 28-July-2018

Place: Mumbai

भारतीय प्रौद्योगिकी संस्थान, मुंबई ★ पवई, मुंबई Powai, Mumbai-76. Indian Institute of Technology, Bombay ★

CONTINUED

TO WHOM IT MAY CONCERN

Buddhaeb Mondal has asked me for a letter of recommendation for his application as a PhD student and I gladly follow his request.

Buddha perfomed an 8-week internship within my group in spring 2017.
He was part of a group of Indian summer students visiting KIT on a DAAD grant. Buddha was one of two interns who did their internship within the AMS group.

Since the preexisting knowledge of the two interns was not known to us, we designed two short research projects in AMS data analysis. The projects were on the level of a bachelor thesis research project. Within his project Buddha received a basic introduction to working with the ROOT analysis framework and learned to work with large software packages (C++).

Since Buddha dealt exclusively with a top-level AMS data analysis on pre-defined n-tuples, I cannot comment on the quality of his physics education in India.

Within these 8 weeks, Buddha has impressed us with his technical skills and his motivation. He was a pleasure to work with, he was eager to learn and he clearly tried to make the most of his time with us. He very quickly adapted to the workflow within the group and within a very short time started to participate actively in our group meetings, asking interested questions and presenting his results in a clear and structured way. However, I always had the impression that his questions were on a very general level. At the time we had him with us (Spring 2017), he clearly had not taken any classes on detectors for particle physics or statistical methods.

As mentioned before I am not able to comment on the breadth and depth of his physics education from this rather technical 8 week internship. You will have to rely on the insights of other referees for this. What I can say is that Buddha is an extremely motivated and hard working candidate. He quickly integrates into existing workflows and is a pleasure to have around.

Given the fact that I have little insight into his physics background, I have no basis to make a strong recommendation for him to be considered as a PhD candidate at your institution. I would advice to carefully check the classes he took during his masters following his internship at KIT.

Best regards,
Iris Gebauer

Moran, Claire

Address		**Email** c.moran@students.uu.nl (update 2019/02/05)	
Varkenmarkt 18 Utrecht, Utrecht 3511BZ Netherlands		**Home Phone** **Office Phone**	
Current Title / Dates	Master student, September 2017-July 2019		
Current Institution	Utrecht University	**Department**	Institute of theoretical phsyics
Location	Princetonplein 5, Utrecht, Utrecht 3584 CC, Netherlands		
Highest Degree	MS	**Institution** Utrecht University	**Date** 2019/07 exp
Thesis Advisor	Umut Gursoy		
Thesis Title	A magnetically induced quantum critical point in holography. (not confirmed title)		
Research Interests	**Primary** B3a: Dark sectors at the LHC		
Secondary	A2a: The effective electroweak Lagrangian in the light of the LHC; B2b: Operator Analysis of New Physics in Top-Quark Observables		
Discipline(s)	Physics		
Position(s) applied	PHD		
1. Umut Gursoy, Utrecht University, u.gursoy@uu.nl (2019/02/07)			file (PDF, PDF, 2019/02/07, tailored)
2. Michael Tuite, National University of Ireland Galway, michael.tuite@nuigalway.ie (2019/02/07)			file (PDF, PDF, 2019/02/08, tailored)
Received Materials	**PHD**	**Cover Letter:** file (PDF, PDF 2019/02/07) **Curriculum Vitae:** file (PDF, PDF 2019/02/06) **Research Statement:** file (PDF, PDF 2019/02/07) **Copies of grades transcripts:** file (PDF, PDF 2019/02/07)	

Claire Moran
✉ *c.moran@students.uu.nl*

February 2019

To whom it may concern,

I would like to express my interest in the PhD positions advertised by the Collaborative Research Center "Particle Physics Phenomenology after the Higgs discovery". These positions were shown to me by my thesis supervisor who was sent them to be forwarded to prospective applicants. I am currently a student in Utrecht University, doing a Master in theoretical physics, and I will be finished my degree in July this year. I am eager to pursue a PhD in particle physics and these positions are exactly what I would hope to do. My Master has prepared me very well for a PhD so I am sure I can make a valuable contribution to this research.

I am very interested in these doctoral programs as this area of research is exactly the kind in which I would like to pursue my PhD. The collaborative research being done in all partaking universities is on the forefront of research in particle physics, and I would be very pleased to be a part of that and work with such a fantastic array of physicists. Any of these universities would be an ideal place for me to pursue my research interests and continue to learn. The research conducted is very in line with the direction I have taken in my Master program; I have completed courses in quantum field theory, general relativity, field theory in particle physics, string theory, and others that can be seen in my CV. My main subjects of interest have been in particle physics and string theory, which is why I decided to do my Master thesis on the gauge/gravity duality. However my primary interests lie more in the area of particle physics and so that is the main direction I would like to go in. I will discuss my thesis and a more detailed account of my research interests in my personal statement however.

I look forward to hearing from you, and do not hesitate contacting me if you have any questions.

Yours faithfully,

Claire Moran

CLAIRE MORAN – Academic CV

Varkenmarkt 18, 3511BZ, Utrecht, Netherlands

Email: c.moran@students.uu.nl

Tel: 00353862197475

PERSONAL PROFILE

I am currently doing a Master degree in Theoretical Physics at Utrecht University, with an ambition to peruse further education through a PhD. I am a highly inquisitive person and I work hard in every aspect of my life. Through my education and work experience so far I have acquired many skills in problem solving, teamwork, communication, and acting on my own initiative.

EDUCATION

Sept. 2017 – present: Utrecht University – Master in Theoretical Physics

Year 1

<u>Semester 1</u>:

Statistical field theory, Quantum field theory, General relativity.

<u>Semester 2</u>:

Advanced topics in theoretical physics (symmetry breaking), Field theory in particle physics, String theory, Complex analysis.

Year 2

<u>Semester 1</u>:

Philosophy of space and time.

Master thesis – gauge gravity duality in a condensed matter system undergoing a quantum phase transition.

<u>Semester 2</u>:

Continuing master thesis.

Sept. 2013 – Jun. 2017: National University of Ireland Galway- Bachelor of Science (Physics)

Specialised in theoretical physics, taking courses in both physics and mathematics.

<u>Final year project:</u>

Computationally modelling chaos exhibited in electronic circuits. For more information please contact me.

Sept. 2015 – Dec. 2015 Hong Kong University of Science and Technology

Semester Exchange

Sept. 2008 - June 2013

Leaving Certificate - Ballyhaunis Community School, Ballyhaunis, Co.Mayo, Ireland

WORK EXPERIENCE:

Research Internship – Valeo, Tuam Galway, Ireland

June 2017 – August 2017

- Took part in research into autonomous cars, specifically testing and improving algorithms used.
- Unable to say more due to confidentiality contract.

Research Internship – National University of Ireland Galway

June 2016 – September 2016

- Trained to use an Atomic Force Microscope (AFM)
- Project involved comparing and contrasting the surface textures, at the nanoscale, of materials that could be potentially be used in tissue scaffolds.
- Tasked with producing high quality images using the AFM of craters on a polymer surface that was created with a femtosecond laser.
- Had to analyse different samples using software, and postulate which laser light, UV or IR would be more suitable for constructing tissue scaffolds and other inorganic biological structures.

SKILLS & CHARACTERISTICS:

- Problem solving:

As a result of my studies I have developed excellent problem solving skills, as demonstrated in the projects and modules that I have completed.

- Computing:

Programming skills in Python, MATLAB, and Mathematica, utilizing these in my studies to solve problems. I am also proficient in Microsoft Excel and Word.

- Teamwork:

Highly developed ability to work efficiently and effectively as part of a team, demonstrated through group projects and laboratory work in university, past work experience, and being part of several successful sports teams.

• Teaching:

I was a tutor in physics (mechanics, electricity and magnetisim, optics etc) and applied mathematics (classical mechanics, fluid mechanics, continuum mechanics, partial differential equation etc) during my bachelor degree, giving lessons to first and second year students.

Achievements:

- Awarded two Excellence Scholarships from the National University of Ireland Galway in recognition of my examination results.
- I was chosen by my university to be one of ten students to go on an exchange program where I studied in the Hong Kong Institute of Science and Technology for one semester.
- Selected by my university to take part in a research internship over the summer of 2016.
- Took part in a mathematical modelling workshop (Stokes workshop) in my university.
- Fully qualified lifeguard with extra qualifications in first aid, CPR, and AED operation.
- I have received awards from the Leinster School of Music and Drama, and from the Royal Irish Academy of Music.

Personal/Research Statement

Now I will introduce myself a little. I am from the west coast of Ireland, a place that is very remote, and as a result it was always dark enough that it was possible to view a vast array of stars, and even the Milky way on some nights. It was from looking at this every night that I became curious about physics and mathematics, and even though I went to a school that didn't have a physics class, it motivated me to pursue it nonetheless. I went on to obtain a Bachelor in physics from the University of Ireland Galway, where my interests grew each year and led me to apply to the theoretical physics Master in Utrecht. The first year was incredible for me, I found it very difficult but I loved it all the same, as I was fascinated by everything I learned, and I couldn't believe how much I learned in a short period of time.

This Master greatly increased my passion for physics and I soon discovered the areas I would like to focus on; in the first year I found I was highly intrigued by quantum field theory, general relativity, field theory in particle physics, and string theory. I have a strong dual interest in mathematics and the links between pure mathematics and theoretical physics fascinate me, so that is another reason I enjoyed these courses so much. Upon finishing the first year I was particularly interested in field theory in particle physics, string theory, and general relativity. So after learning about the gauge/gravity duality it seemed like something I would very much enjoy, and I decided I would like to do my thesis in this area. Particle physics was extremely fascinating to me, I find the intimate connection to mathematics, in particular group theory to be incredible, and the fundamentals of how these theories are built is also something that fascinates me and that I would like to understand more.

My thesis involves using the gauge/gravity duality to study a magnetically induced quantum critical point; in particular in a 2+1 dimensional gauge theory at finite chemical potential and magnetic field. The dual theory is a 4 dimensional gauged supergravity, and we consider black brane and thermal gas solutions. The main focus of my thesis is calculating the quasinormal modes of the black brane in order to find the field theory particle spectrum. I have very much enjoyed learning about the duality, it is strange and fascinating, and I would be interested in its applications to QCD, looking at quark-gluon plasmas etc if applicable. Although my thesis was not entirely about particle physics, I am highly motivated to do research in this area. In particular I am very drawn to the phenomenology of elementary particle physics, and physics beyond the standard model; the latter is fascinating and its interconnections with other fields such as cosmology make it highly appealing for me. The research topics listed are very attractive to me, in particular the Higgs physics research area, and the top quark, electroweak gauge bosons and QCD research area. That the goal of the research is to eventually develop the necessary methodologies for physics beyond the standard model is very lucrative to me, as I stated this area is of primary interest to me and I would be delighted to contribute and be in active research in this area. Finally, I think it is worth noting that I took a course in spontaneous symmetry breaking and non-perturbation dynamics in field theories, and I would interested in learning more about/applying this if it were useful to the research.

I am sure my studies in Utrecht have well prepared me for a PhD in particle physics, and I am quick to learn any additional things that are necessary, such as using new software and computational techniques. Since I have a range of interests in high energy physics I can be flexible to whatever I need to do and learn. My Master degree has given me a solid foundation in all aspects of theoretical physics that I am eager to build upon now. When I came to Utrecht University two years ago, I was slightly disadvantaged as my Bachelor degree was not of as high a level as most other students. As a result I had to work extremely hard to get to where I am today, and I will continue to put in this work throughout my PhD, which of course does not bother me as this is something I am very passionate about.

Universiteit Utrecht

C. Moran
Gurteen NA
Co.Mayo
Ballyhaunis
Ireland

Study Progress Overview

Student number	6259545
Date	22 January 2019
Degree programme	Theoretical Physics - Full-time
Cohort	2017
Study programme	NS-MTP2016 - Theoretical Physics 2016 en later

ECTS

Study programme	**Minimum credits to be obtained**	**Credits obtained**	**Passed**
Basic Programme	120.0	65.5	No
Others		0.0	
Total	**120.0**	**65.5**	**No**

Programme

Study programme component	**Type**	**Minimum credits to be obtained**	**Credits obtained**	**Passed**
all parts below				
1 Mandatory courses	Mandatory	30.0	20.5	No
2 Primary electives physics	Restricted choice	22.5	22.5	Yes
3 Primary electives mathematics	Restricted choice	7.5	7.5	Yes
4 Secondary electives	Minor or electives	15.0	0.0	No
5 Master thesis	Restricted choice	30.0	15.0	No
Total		**120.0**	**65.5**	**No**

UNIVERSITEIT UTRECHT

Universiteit Utrecht

Grades - Study programme

Component	Course		Credits	Date	Grade	Category
Mandatory courses	GSNS-INTRO	Introducing Natural Sciences	0.5	06-09-2017	P	M
	NS-TP402M	Statistical field theory	10.0	30-01-2018	6.0	M
	NS-TP401M	Quantum field theory	10.0	01-02-2018	6.0	M
	NS-TP503M	Student seminar theoretical physics	(9.0)			M
Primary electives physics	NS-TP428M	General relativity	7.5	02-02-2018	6.0	M
	NS-TP526M	String theory	7.5	13-04-2018	7.0	M
	NS-TP529M	Field theory in particle physics	7.5	13-06-2018	7.0	M
Primary electives mathematics	WISB311	Complex analysis	7.5	28-06-2018	6.5	3
Secondary electives	FI-MHPSPST	Philosophy of space and time	(7.5)			M
	WISL503	Differential geometry	(8.0)			M
Master thesis	NS-TP551M	Thesis part 1 Theoretical physics	15.0	17-12-2018	P	M
	NS-TP552M	Thesis part 2 Theoretical physics	(30.0)			M

Averages

Academic year	Average grade
2017	6,38
2018	
Total	**6,38**

UNIVERSITEIT - UTRECHT -

4.3 Programme details - (e.g. modules or units studied), and the individual grades/marks/credits obtained:

CODE	SUBJECT	STAGE Year	MARKS GRADES	ECTS CREDITS
MP305	Modelling I	Continuous Calculator (M.Sc) (PG Dip)	95	5
MP356	Quantum Mechanics I		92	5
MP357	Quantum Mechanics II		100	5
MP403	Cosmology And General Relativity	Honours	93	5
MP410	Non-Linear Elasticity		77	5
MP491	Non Linear Systems	Honours	81	5
PH422	Solid State Physics		66	5
PH423	Applied Optics and Imaging		70	5
PH426	Problem Solving and Physics Research Skills		56	5
PH428	Atmospheric Physics and Climate Change		81	5
PH432	Project		68	10
HKU300	HKUST: Sem I Study Exchange with Hong Kong University of Science		70	30
MP307	Modelling II		85	5
MP346	Mathematical Methods II		92	5
MP365	Fluid Mechanics		77	5
PH335	Nuclear & Particle Physics		69	5
PH337	Thermal Physics		66	5
PH338	Properties of Materials		54	5
CS209	Algorithms And Scientific Computing		46	5
CS211	Programming and Operating Systems		67	5
MP231	Mathematical Methods I		91	5
MP232	Mathematical Methods II		92	5
MP236	Mechanics I		79	5
MP237	Mechanics II		94	5
PH215	Electricity, Magnetism and Circuits		66	5
PH216	Mechanics		68	5
PH217	Light, Atomic and Nuclear Physics		91	5
PH218	Thermodynamics		84	5
PH222	Astrophysical Concepts		73	5
PH223	Observational Astronomy		53	5
CS103	Computer Science		64	5
MA180	Mathematics (Honours)	Honours	76	15
MP180	Applied Mathematics		84	15
PH101	Physics		89	15
PH109	Physics Special Topics		77	10

Overall Award Result: **77**

7. CERTIFICATION OF THE SUPPLEMENT

7.1 Date	7.2 Signature	7.3 Capacity	7.4 Official stamp or seal
19-Oct-17	Pól Ó Dochartaigh	Registrar and Deputy President	National University of Ireland, Galway Ollscoil na hÉireann, Gaillimh

Universiteit Utrecht

25.1.2019

Recommendation letter for CLAIRE MORAN

This letter is to support my masters student Claire Moran's application to your PhD position. I am currently supervising her masters' research and her progress is quite satisfactory.

Her thesis topic is the quantum phase transitions in strongly coupled 2+1 dimensional holographic QFTs in the presence of external magnetic fields. Holographic correspondence relates these systems generically to black brane solutons to Einstein's gravity coupled to scalars and gauge fields in 4 dimensions. Such analytic black brane solutions were constructed some time ago by Ceccatori and Klemm and these solutions were already used to study a quantum phase transition in a holographic QFT in arXiv: 1604.04221. The QPT in this paper is driven by an external magnetic field, and, is between a plasma phase, described by a dyonic black brane solution and a vacuum phase described by a "thermal gas" geometry with no horizon and a repulsive singularity. Magnetization of the system can be viewed as an order parameter to distinguish these two phases as its scaling with external magnetic field differs qualitatively. The particular topic I gave to Claire was an extension of this work by investigating the spectrum of fluctuations in this system which can be used to gain more information, e.g. the boundaries of the quantum critical region, more generally on the dynamics near the quantum transition. These fluctuations on the plasma phase are mapped on the quasinormal mode spectrum of the corresponding black brane solution, hence Claire's problem, from a technical point of view, is to work out the quasinormal modes of an analytic dyonic asymptotically AdS black brane in 4 dimensions. So far she managed to reproduce all our results in the paper (with my guidance) and set up the calculation for the QNMs.

I think Claire is very motivated and sufficiently knowledgeable to continue a PhD in theoretical high energy physics and I recommend him for your position warmly.

Yours sincerely,

Umut Gursoy, dr.

ITP, Utrecht
Tel: +31302535904

Letter of Recommendation for Claire Moran

I have known Claire Moran since 2014 when she took a module in Mathematical Methods with me in the second year of her BSc in Physics with Theoretical Physics at the National University of Ireland Galway. Claire also took two modules in Quantum Mechanics with me in her fourth academic year. Claire performed outstandingly in these three modules scoring 91%, 92% and 100% respectively and was first in a class of 34 students in the latter case. Claire graduated in 2017 with a first class honours BSc. After graduating Claire enrolled in the Masters programme in Theoretical Physics at Utrecht University which she is now completing.

Throughout all of the modules and tutorials taken with me, Claire was a very active participant and a pleasure to work with. She asks excellent questions, is highly motivated with an inquiring mind and demonstrates an excellent aptitude for mathematical and theoretical physics. Altogether she is very thorough in her work and possesses a very strong desire and ability to work problems out for herself. She consistently impressed me and showed all the right signs of becoming an excellent future researcher having the necessary mathematical talent, physical intuition, energy, tenacity, enthusiasm and self-reliance to successfully work in research. I believe she is perfectly suited for further independent PhD research and is very likely to continue on to a successful scientific career.

In conclusion, I would also like to say that Claire is a very friendly, reliable and sociable person with excellent communication and team skills. I believe she has the ability to make an excellent contribution to any research group. I am happy to give you a very strong recommendation for your PhD programme.

Yours sincerely,

Michael Tuite
Professor of Mathematical Physics,
Head of Applied Mathematics
School of Mathematics, Statistics and Applied Mathematics, NUI Galway
Feb 2019

AcademicJobsOnline.org

Müllender, Philipp

Address		**Email** philipp.muellender@hotmail.de (update 2019/01/30)
König Baudouin Straße 50 Lontzen, Liege 4710 Belgium		**Home Phone** **Office Phone**
Current Institution		**Department**
Location	, N/A	
Highest Degree	MS	**Institution** RWTH Aachen University — **Date** 2017/09
Thesis Advisor	Prof. Dr. rer. nat. Michael Krämer	
Thesis Title	Probing Dark Matter at the LHC with Vector-Boson Fusion	
Research Interests	**Primary** C3a: New sources of flavour- and CP-violation at high transverse momenta	
Secondary	A3a: Extended Higgs sectors at the LHC; A3b: Precision predictions for Higgs boson properties as a probe for New Physics	
Discipline(s)	Physics	
Position(s) applied	PHD	
Also Consider For	**Temporary:** 2 Year	
1. Michael Kraemer, RWTH Aachen University, mkraemer@physik.rwth-aachen.de (2019/01/30)		file (PDF, PDF, 2019/02/08)
Received Materials	**PHD**	**Cover Letter:** file (PDF, PDF 2019/01/30) **Curriculum Vitae:** file (PDF, PDF 2019/01/30) **Research Statement:** file (PDF, PDF 2019/01/30) **Copies of grades transcripts:** file (PDF, PDF 2019/01/30)

Philipp Müllender
König Baudouin Straße 50, 4710 Lontzen - Belgium
0032/87/662623
philipp.muellender@hotmail.de

Prof. Kirill Melnikov
Institut für Theoretische Teilchenphysik
Campus Süd
Karlsruher Institut für Technologie (KIT)
D-76128 Karlsruhe

Dear Prof. Melnikov,

I´m hereby applying for a Ph.D. Position at the Collaborative Research Center “Particle Physics Phenomenology after the Higgs discovery“. My name is Philipp Müllender and my Master´s thesis was supervised by Prof. Michael Krämer who mentioned this opportunity and who will also be my reference writer. Given that my interests are lying in theoretical particle physics and especially in physics beyond the standard model, I am certain that I fit into this collaboration.

I am a diligent student and was always fascinated about what lies beyond the horizon of established models in physics. I achieved high scores in my Master´s exams and also in my Master´s thesis about “Probing Dark Matter at the LHC with Vector-Boson Fusion“. During this time, I began to learn how to work as a scientist and I also gained knowledge in Madgraph, Mathematica and Python. After I got my Master´s degree, I took a break from science to also gain experience in other fields such as teaching and working in the industry.
However, I realized that I need to go back to science and I´m willing to take the next step to make a Ph.D. in theoretical particle physics with the main focus lying in phenomena which could be understood by choosing particular models that go beyond the established standard model of particle physics and in calculating observables to high precision. Therefor, I would like to participate in one of the following topics:

- A3a: Extended Higgs sectors at the LHC
- A3b: Precision predictions for Higgs boson properties as a probe for New Physics
- C3a: New sources of flavour- and CP-violation at high transverse momenta

After reviewing my cover letter and my curriculum vitae, I hope that you will agree that I am motivated to go beyond my own horizon to go deeper into research and that I am capable to do so.

Thank you for your consideration, and I look forward to hearing from you soon.

Curriculum Vitae

Philipp Müllender
König Baudouin Straße 50
4710 Lontzen - Belgium
0032 87 662623
philipp.muellender@hotmail.de

Sex: Male Date of birth: 28/07/1994

Work Experience

September 2018 - January 2019 Cutting Machine Operator Apprentice

Capaul S.A.

Industriestraße 39
4700 Eupen - Belgium

- Quality control
- Tool management
- Assembly
- Machine programming

October 2017 - August 2018 Science Teacher

Königliches Athenäum Eupen

Lascheter Weg 20
4700 Eupen - Belgium

Teacher for:

- Physics
- Chemistry
- Biology
- Geography

Education and Training

October 2015 - September 2017 Master of Science in Physics

RWTH Aachen University, Aachen - Germany

Main focus in theoretical physics on:

- Quantum field theories
- General relativity and cosmology

Master´s thesis supervised by Prof. Dr. rer. nat. Michael Krämer on
“Probing Dark Matter at the LHC with Vector-Boson Fusion“

October 2012 - August 2015 Bachelor of Science in Physics

RWTH Aachen University, Aachen - Germany

Bachelor´s thesis supervised by Prof. Dr. rer. nat. Michal Czakon on
“Pfadintegral und semiklassische Näherungen“

September 2006 - June 2012 Secondary School

Pater Damian Sekundarschule
Kaperberg 2-4
4700 Eupen - Belgium

Personal Skills

Mother tongue(s): German

Other language(s): French (C1)
English (B2)

Computer skills:
- competent with most Office applications
- competent with LaTeX
- competent with MadGraph5_aMC@NLO
- competent with Python
- competent with Mathematica and MapleBewerbu
- experience with C++

Driving skills: B

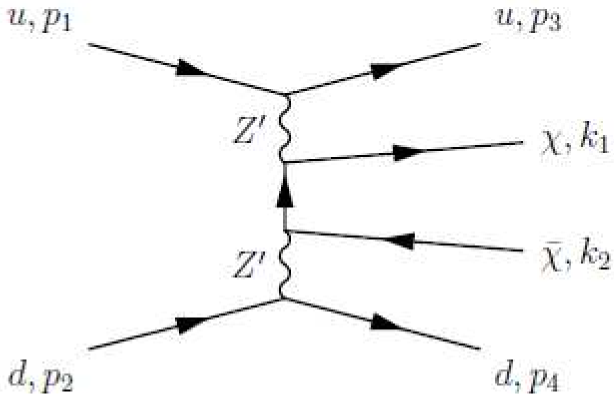
Research Statement

Philipp Müllender

Since school, I´ve always been interested in science and especially physics. Finding something new that has never been seen before and to understand what our universe is fundamentally made of, has always motivated me to go further in my studies. So, it is no wonder that I dived into quantum field theory and cosmology during my Master´s studies. When I learned that the standard model of particle physics itself cannot explain some of the major parts of our universe such as the nature of dark matter, dark energy, a whole bunch of other - not even smaller – problems and deviations from experimental data, I was simply excited to see what lies beyond this horizon. During my Master´s thesis on "Probing Dark Matter at the LHC with Vector-Boson Fusion", I delved into a variety of models that all tried to explain one or more of the problems we encounter all day during research. And to this point, the question remains to what extent these models can withstand the power of the collected experimental data.

Probing Dark Matter at the LHC with Vector-Boson Fusion

In my Master´s thesis, I considered an extension to the Standard Model by including dark matter as a fermion and an electrically neutral, massive vector boson which mediates gauge-like interactions between the dark sector and the Standard Model. I addressed the question how to search for dark matter at the LHC. Therefor, I investigated searches for one or more energetic, hadronic jets with missing transverse momentum coming out of the collision of two protons, and interpreted them in the context of the dark matter model under consideration involving calculations of the cross section using Madgraph.
While looking into processes including two hadronic jets, I encountered large cross sections if there are axial couplings of the newly introduced vector boson to the dark matter candidate and if the mass of the vector boson is sufficiently small with respect to the mass of the dark matter particle. I showed that in this case, using the effective vector boson approximation, the cross section is dominated by the vector-boson fusion channel (as pictured in the diagram below). In the diagram the Z´ denotes the new vector boson, whereas the χ is the dark fermion.



After I understood this stange behaviour, the calculation of exclusion limits for the input parameters (masses of the new particles and their couplings) in a broad range was made to see whether this model is viable in the context of dark matter searches at the LHC.

Future research

Still, after many years of probing many different models beyond the standard model of particle physics, there is no light at the end of the tunnel. There are still many unsolved mysteries in particle physics which I want to continue to research on. In the future, I want to delve into precision studies of obversables to see if experimental data might be closer to predictions coming from models that go beyond our standard model.

Urkunde
Certificate

RWTH AACHEN UNIVERSITY

Fakultät für Mathematik, Informatik und Naturwissenschaften
Faculty of Mathematics, Computer Sciences and Natural Sciences

verleiht
awards

Herrn / Mr.
Philipp Müllender

geboren am
28. Juli 1994
born on
July 28, 1994
in Eschweiler

aufgrund der abgeschlossenen Masterprüfung im Studiengang
on the basis of the completed Master examination

PHYSIK

PHYSICS

den akademischen Grad
the academic degree

MASTER OF SCIENCE
RWTH AACHEN UNIVERSITY
(M. Sc. RWTH)

Aachen,
26. September 2017
September 26, 2017

Univ.-Prof. Dr. rer. nat.
Stefan Schael

Der Dekan der Fakultät
Dean of the Faculty

Univ.-Prof. Dr. rer. nat.
Achim Stahl

Der Vorsitzende des Prüfungsausschusses
Chair of the Examination Board

Fakultät für Mathematik, Informatik und Naturwissenschaften Rhein.-Westf. Technischen Hochschule Aachen Z 3

Zeugnis
Certificate

RWTH AACHEN UNIVERSITY

Herr **Philipp Müllender**

geboren am 28. Juli 1994
in Eschweiler

hat die **Masterprüfung**

nach der Prüfungsordnung
für den Studiengang **Physik**

abgelegt und mit der Gesamtnote **sehr gut (1,1)**
bestanden

Masterarbeit		Credits	Note
Thema der Masterarbeit	Probing Dark Matter at the LHC with Vector-Boson-Fusion	25	sehr gut (1,3)
Prüfer/-in	Krämer		

Das Studium wurde in der Regelstudienzeit abgeschlossen.

Aachen, 26. September 2017

Der Vorsitzende des Prüfungsausschusses

Univ.-Prof. Dr. rer. nat. Achim Stahl

Fakultät für Mathematik, Informatik und Naturwissenschaften der Rhein.-Westf. Technischen Hochschule Aachen
Siegel
Z 3

Zeugnis
Certificate | RWTH AACHEN UNIVERSITY

Philipp Müllender geboren am 28.07.1994 in Eschweiler
hat folgende Einzelergebnisse erzielt:

	Credits	Note
Astroparticle Physics and Cosmology	**30**	**sehr gut (1,1)**
Modul Quantum Field Theory of Particle Physics I	10	sehr gut (1,0)
Modul Theory of Relativity and Cosmology	10	sehr gut (1,3)
Modul Quantum Field Theory of Particle Physics II	10	sehr gut (1,0)
Spezial-/Wahl/- Nebenfachveranstaltungen	**30**	**sehr gut (1,0)**
Modul Geometry and Symmetry in Physics	10	sehr gut (1,0)
Modul Astronomy und Astrophysics	10	sehr gut (1,0)
Modul The Perturbed Universe	10	sehr gut (1,0)
Modul Master's Seminar	**15**	**bestanden**
Modul Master's Practical	**15**	**bestanden**
Masterkolloquium	**5**	**sehr gut (1,3)**

Folgende zusätzliche Prüfungsleistungen wurden während dieses Studiengangs erbracht:

Particle, Fields and Strings (Seminar)	10	gut (2,3)
Advanced Quantum Field Theory	10	sehr gut (1,0)

Dieses Zeugnis wurde ebenfalls in einer englischsprachigen Version ausgestellt.
Ein Credit Point entspricht einem geschätzten Arbeitsaufwand von etwa 30 Stunden.

Diploma Supplement | RWTH AACHEN UNIVERSITY

1. ANGABEN ZUM INHABER / ZUR INHABERIN DER QUALIFIKATION

1.1 Familienname / 1.2 Vorname

Müllender, Philipp

1.3 Geburtsdatum, Geburtsort

28.07.1994, Eschweiler

1.4 Matrikelnummer oder Code des / der Studierenden

318260

2. ANGABEN ZUR QUALIFIKATION

2.1 Bezeichnung der Qualifikation (ausgeschrieben, abgekürzt)

Der Mastergrad entspricht der Qualifikationsstufe 7 des DQR / EQR.

Bezeichnung des Grades (ausgeschrieben, abgekürzt)

Master of Science RWTH Aachen University (M. Sc. RWTH)

2.2 Hauptstudienfach oder –fächer für die Qualifikation

Physik

2.3 Name der Einrichtung, die die Qualifikation verliehen hat

Rheinisch Westfälische Technische Hochschule Aachen (RWTH Aachen)

Status (Typ / Trägerschaft): Universität des Landes Nordrhein-Westfalen, Deutschland / Staatliche Hochschule des Landes Nordrhein-Westfalen, Deutschland

2.4 Name der Einrichtung, die den Studiengang durchgeführt hat

Siehe 2.3

Status (Typ / Trägerschaft)

Siehe 2.3

2.5 Im Unterricht / in der Prüfung verwendete Sprache(n)

Englisch

3. ANGABEN ZUR EBENE DER QUALIFIKATION

3.1 Ebene der Qualifikation

Zweiter Hochschulabschluss

3.2 Dauer des Studiums (Regelstudienzeit)

4 Semester (2 Jahre)

3.3 Zugangsvoraussetzung(en)

Zugangsvoraussetzung ist ein anerkannter erster Hochschulabschluss. Die Details zur fachlichen Vorbildung können der veröffentlichten Prüfungsordnung entnommen werden.

4. ANGABEN ZUM INHALT UND ZU DEN ERZIELTEN ERGEBNISSEN

4.1 Studienform

Vollzeit

4.2 Anforderungen des Studiengangs / Qualifikationsprofil des Absolventen / der Absolventin

Das Masterstudium der Physik vermittelt den Studierenden vertiefte fachliche Kenntnisse sowie Fähigkeiten und Methoden auf dem Gebiet der Physik. Es soll die Studierenden zu hoher wissenschaftlicher Qualifikation und Selbstständigkeit führen sowie zur kritischen Einordnung der wissenschaftlichen Erkenntnisse und zu verantwortlichem Handeln befähigen. Es bietet die intensive, vertiefte Ausbildung in einem Teilgebiet der Physik. In einem Nebenfach werden Verbindungen zu den Nachbarwissenschaften oder den Anwendungen der Physik in den Ingenieurwissenschaften oder der Medizin hergestellt.

4.3 Einzelheiten zum Studiengang

Hinsichtlich der Module und der Modulabschlussprüfungen vgl. „Transcript of Records", für Thema der Abschlussarbeit und Gesamtnote siehe Prüfungszeugnis.

4.4 Notensystem und Hinweise zur Vergabe von Noten

Allgemeines Notenschema (siehe Punkt 8.6)

4.5 Gesamtnote

sehr gut (1,1)

Basierend auf dem / den Studienfach / Studienfächern und der Abschlussarbeit, siehe Prüfungszeugnis.

5. ANGABEN ZUM STATUS DER QUALIFIKATION

5.1 Zugang zu weiterführenden Studien

Qualifiziert zur Aufnahme einer Promotion.

5.2 Beruflicher Status

Der akademische Grad Master of Science ist ein berufsqualifizierender Abschluss und berechtigt den Inhaber zur Führung des Titels Master of Science.

6. WEITERE ANGABEN

6.1 Weitere Angaben

Keine Angaben

6.2 Informationsquellen für ergänzende Angaben

Über die Institution und Studiengänge

http://www.rwth-aachen.de

7. ZERTIFIZIERUNG

Dieses Diploma Supplement nimmt Bezug auf folgende Original-Dokumente:

Urkunde über die Verleihung des Master vom 26.09.2017

Prüfungszeugnis vom 26.09.2017

Transcript of Records vom 06.12.2017

Fakultät für Mathematik, Informatik und Naturwissenschaften der Rhein.-Westf. Technischen Hochschule Aachen Z 3

Datum der Zertifizierung 06.12.2017

Univ.-Prof. Dr. rer. nat. Achim Stahl
Der Vorsitzende des Prüfungsausschusses

Siegel

8. ANGABEN ZUM NATIONALEN HOCHSCHULSYSTEM

Die Informationen über das nationale Hochschulsystem auf den folgenden Seiten geben Auskunft über den Grad der Qualifikation und den Typ der Institution, die sie vergeben hat.

RWTH AACHEN UNIVERSITY

Transcript of Records

Zentrales Prüfungsamt

Datum: 06.12.2017

Nachname: Müllender
Vorname: Philipp
Matrikelnummer: 318260

Geburtsdatum: 28.07.1994
in Eschweiler

Abschluss: Master
Studiengang: Physik

Module/Fächer	Noten	VM	PA	Pfl	Ang	CrB	SWS	Sem
Astroparticle Physics and Cosmology	1,10		MK	P	N	30,00	18,0	20161
Anmeldung Astroparticle Physics and Cosmology	++	++	AS	P	N		0,0	20172
Modul Quantum Field Theory of Particle Physics I	1,00		MK	P	N	10,00	6,0	20152
Quantum Field Theory of Particle Physics I	1,00		FP	P	N	10,00	6,0	20152
Modul Quantum Field Theory of Particle Physics II	1,00		MK	P	N	10,00	6,0	20161
Quantum Field Theory of Particle Physics II	1,00		FP	P	N	10,00	6,0	20161
Modul Theory of Relativity and Cosmology	1,30		MK	P	N	10,00	6,0	20152
Theory of Relativity and Cosmology	1,30		FP	P	N	10,00	6,0	20152
Advanced Quantum Field Theory	1,00		FP	ZU	N	10,00	0,0	20162
Modul Master's Seminar			MK	P	N	15,00	0,0	20162
Master's Seminar	++	++	FP	P	N	15,00	0,0	20162
Modul Master's Practical			MK	P	N	15,00	0,0	20162
Master's Practical	++	++	FP	P	N	15,00	0,0	20162
Masterkolloquium	1,30		MS	DI	N	5,00	0,0	20172
Probing Dark Matter at the LHC with Vector-Boson-Fusion	1,30		MS	DI	N	25,00	0,0	20171
Spezial-/Wahl/- Nebenfachveranstaltungen	1,00		MK	P	N	30,00	18,0	20162
Geometry and Symmetry in Physics	1,00		FP	PW	N	10,00	6,0	20152
Particle, Fields and Strings (Seminar)	2,30		FP	ZU	N	10,00	2,0	20161
Modul The Perturbed Universe	1,00		MK	P	N	10,00	6,0	20161
The Perturbed Universe	1,00		FP	P	N	10,00	6,0	20161
Modul Astronomy und Astrophysics	1,00		MK	P	N	10,00	6,0	20152
Astronomy and Astrophysics	1,00		FP	P	N	10,00	6,0	20152

Gesamtkonto	Noten	VM	PA	Pfl	Ang	CrB	SWS	Sem
Masterprüfung Physik	**1,10**		**MS**	**GN**	**N**	**120,00**	**36,0**	**20172**

RWTH AACHEN UNIVERSITY
Abteilung 1.3
Zentrales Prüfungsamt
52056 Aachen | GERMANY

Transcript of Records

Nachname: Müllender
Vorname: Philipp
Matrikelnummer: 318260

Geburtsdatum: 28.07.1994
in Eschweiler

Die gesamte Prüfung ist erfolgreich abgeschlossen.

Noten: 1,0-1,5 = sehr gut / 1,6-2,5 = gut / 2,6-3,5 = befriedigend / 3,6-4,0 = ausreichend / 4,1-5,0 = nicht ausreichend

VM = Vermerk: ++ = mit Erfolg teilgenommen / AT = Attest / NE = nicht erschienen / NMP = noch mündliche Ergänzungsprüfung / NZ = nicht zugelassen / RU/RT = Rücktritt / Z2 = fächerübergreifende Prüfung / mAb = mit Auszeichnung / pa = Prüfung annulliert / PMG = Prüfungsmeldung gestrichen / GLL = gelöschte Prüfungsleistung / PRA = Prüfung abgebrochen / NG = Note gestrichen

PA = Prüfungsart: BC = Bachelorprüfung / FP = Fachprüfung / HA = Staatsexamen Lehramt / HD = Diplomprüfung / HM = Magisterprüfung / HS = Staatsexamen / MK = Modul/Konto / MS = Masterprüfung / MZ = Magister Zwischenprüfung / SL = Studienbegleitende Leistung / TL = Teilleistung / TN =Teilnahmenachweis / VA = Vorprüfung Lehramt / VD = Diplom-Vorprüfung / VL = Leistungsnachweis / VS = Vorprüfung Staatsexamen

Pfl = Pflicht: DI = Abschlussarbeit / GN = Gesamtnote / P = Pflichtfach / PW = Wahlpflichtfach / W1-W4, WA, WM = Wahlfach / ZU = Zusatzfach

Ang = angerechnete Leistung aus anderem Studium oder Leistungsübertrag aus voriger PO-Version (J); angerechnete Leistung aus beruflicher Qualifikation (Q); angerechnete Leistung aus einem temporären Auslandsaufenthalt während des Studiums (A); reguläre Leistung (N)

CrB = Credits/Bonuspunkte

SWS = Semesterwochenstunden

RWTH AACHEN UNIVERSITY
Abteilung 1.3
Zentrales Prüfungsamt
52056 Aachen | GERMANY

Unterschrift und Stempel

Prof. Dr. Michael Krämer
Institute for Theoretical Particle Physics and Cosmology
RWTH Aachen University

Prof. M.Krämer, Inst. f. Theoretische Physik, RWTH Aachen, 52056 Aachen

RWTH AACHEN UNIVERSITY

Anschrift: Prof. Dr. Michael Krämer
Institute for Theoretical
Particle Physics and Cosmology
RWTH Aachen University
D - 52056 Aachen, Germany
Telefon: +49 241 80-27047/46
Fax: +49 241 80-22187
E-mail: mkraemer@physik.rwth-aachen.de

To whom it may concern

Aachen, 8. Februar 2019

Recommendation letter for Phillipp Müllender

Dear colleagues!

Philipp Müllender has applied for a PhD position with the CRC, and I support his application very strongly. Philipp was a Master student in my group at RWTH Aachen University. He finished in fall 2017 with very good marks, and then went on to pursue a career outside physics. He has recently contacted me to ask about possibilities to go back to research, and I have encouraged him to apply for a PhD position within the CRC.

Philipp Müllender has studied the LHC phenomenology of a popular simplified model with a dark matter fermion and a massive vector boson as the mediator between the SM and dark matter. He has analysed the theoretical consistency of such a model, exploring in particular bounds on masses and couplings from unitarity. The search for simplified dark matter models at the LHC typically relies on signatures with a hard jet and large missing transverse momentum. In his thesis Philipp has calculated the production of dark matter with two jets in the forward direction (vector boson fusion signature). He found large cross sections for such a signature, and thus the potential to probe simplified dark matter models in regions of parameter space where traditional searches are not sensitive. Through a detailed numerical analysis, Philipp Müllender has demonstrated that for small mediator masses and heavy dark matter, in particular, the sensitivity of the vector boson fusion signature is far better than that of the standard signature with a hard jet and large missing transverse momentum.

As a Master student Philipp Müllender has worked very reliably and independently. He has pursued various ideas to construct theoretically consistent simplified dark models with interesting phenomenology, and he has performed detailed analytical and numerical analyses of the cross sections and signatures of such models at the LHC. Philipp Müllender has presented the results of his work at various conferences and workshops. He has a very good training in quantum field theory and in theoretical particle physics, and he has acquired considerable expertise in LHC phenomenology. Philipp has demonstrated that he is able to familiarize himself with new theoretical concepts and methods quickly. I am confident that Philipp Müllender will prosper as a PhD student in theoretical particle physics; he has my very strong recommendation. I will be pleased to answer any additional questions you may have.

Sincerely,

Prof. Dr. Michael Krämer

AcademicJobsOnline.org

Muzakka, Khoirul Faiq

Address		**Email** khoirul.faiq.m@gmail.com (update 2019/02/14)	
Heiglhofstr. 66 0113 München, Deutschland 81377 Germany		**Home Phone** **Cell Phone** (+49) 17686184257 **Office Phone**	
Current Institution	Theoretical Particle Physics LMU München	**Department**	
Location	Theresienstr. 37, Munich, Bayern 80333, Germany		
Highest Degree	MSc	**Institution** LMU München	**Date** 2019/04 exp
Thesis Advisor	Prof. Gerhard Buchalla		
Thesis Title	Electroweak Chiral Lagrangian with Two Scalars and SO(6)/SO(5) Composite Higgs Model		
Research Interests	**Primary** Effective Field Theory		
Secondary	Higgs Physics, QCD, Flavour Physics; Machine and Deep Learning, Data Analysis		
Discipline(s)	Physics; High Energy Physics; High-Energy Theory; Particle and Astroparticle Phenomenology		
Position(s) applied	PHD		
1. Prof. Gerhard Buchalla, LMU München, gerhard.buchalla@physik.uni-muenchen.de			
Received Materials	**PHD**	**Cover Letter:** file (PDF, PDF 2019/02/14) **Curriculum Vitae:** file (PDF, PDF 2019/02/14) **Research Statement:** file (PDF, PDF 2019/02/14) **Copies of grades transcripts:** file (PDF, PDF 2019/02/14)	

Khoirul Faiq Muzakka
khoirul.muzakka@physik.uni-muenchen.de
Heiglhofstr 66 0113 81377 München

Prof. Kirill Melnikov
Institut für Theoretische Teilchenphysik
Campus Süd
Karlsruher Institut für Technologie (KIT)
D-76128 Karlsruhe

Dear Prof Melnikov,

I am writing this letter to show my enormous interest in the PhD positions advertised by the collaborative research center "Particle Physics Phenomenology after the Higgs Discovery". I am a master student at theoretical and mathematical physics (TMP) program of LMU and TUM. Currently, I am finishing my master thesis under Prof. Gerhard Buchalla and I expect myself to graduate in April 2019.

I have uncanny interest and passion in quantum field theory and particle physics. I am deeply in love with how the beauty of quantum field theory is applied to Particle physics. I wrote piles of my own notes and approaches of QFT based on many QFT textbooks with the hope that in the future I can write my own textbook on QFT. The research topics offered by the collaborative research center are very appealing to me because they are in line with my passion.

In my master thesis, I and my colleague (Andreas Lindner, who is also applying for this PhD position) study electroweak chiral Lagrangian (EWCL) and Composite Higgs model (CHM). We basically compute two things. First, We compute one loop divergence of electroweak chiral Lagrangian with N scalar singlets using background field and heat kernel methods. Eventually, we apply our results to SO(6)/SO(5) CHM and renormalize it. Second, we integrate out heavy scalar singlet from SO(6)/SO(5) composite Higgs model at tree level producing an EWCL with one light Higgs. The calculations are quite involved but I learned a lot of concepts, technique, and tricks. I also tasted how a collaboration looks like and how to split and finish a collaborative work efficiently.

Since TMP is a joint international program organized by LMU and TUM, I am allowed to take courses at both institutions. I took a seminar at TUM München on masterpieces of Quantum Field Theory. I was assigned to give a talk about Effective Field Theory and Euler-Heisenberg Lagrangian. I strengthened my basic of QFT when taking QED course at LMU and I enjoyed very much a QFT lecture taught by Prof. Martin Beneke at TUM. I took other courses at both universities as well, like supersymmetry at TUM and QCD at LMU. I really appreciate this flexibility. In this semester, I also take a machine learning course in astrophysics at LMU. It is an amazing lecture to train me the practical aspect of machine and deep learning. I self-study the theoretical aspect of machine learning from a machine learning textbook written by a theoretical physicist: Pattern and Recognition and Machine Learning by C. Bishop (it is considered by many as the bible for machine learning). I learned a lot of concepts, such as Bayesian probability theory and inference, model selection, supervised and unsupervised learning algorithm and neural network. Between October-December 2018, I also worked as a working student doing embedded system programming at LMU. It was a nice part-time job to sharpen my programming skill.

Before beginning my graduate study at TMP, I did my bachelor degree at Gadjah Mada University in Indonesia. I wrote my bachelor thesis in Astroparticle physics and cosmology. I examined how a viable Leptogenesis mechanism could arise in Modified mirror model (basically a variant of Mirror model) to explain matter-antimatter asymmetry. I studied how each of Sakharov conditions could be realized. Specifically, I derived a formula for masses of neutrinos in this model using Seesaw mechanism-like approach. I computed CP asymmetry produced by Majorana neutrino decays at one loop and computed final baryon to photon ratio using Boltzmann equation. After finishing my bachelor thesis, my passion in particle physics was greater than ever before and I was determined to pursue my career in particle physics ever since.

With my background, skills, and qualifications, I believe I am an ideal candidate for this PhD position. I look forward to hearing from you soon and thank you for your consideration.

Sincerely,
Khoirul Faiq Muzakka

Khoirul Faiq **Muzakka**

Heiglhofstr 66 0113 81377 München

(+49) 17686184257 | khoirul.faiq.m@gmail.com | khoirulmuzakka | khoirul-faiq-muzakka-208660107

Education

LMU München - TUM München *Munich*

ELITE MASTER THEORETICAL AND MATHEMATICAL PHYSICS *2016-Now*

- Currently working on my master thesis in Particle Physics
- Did some student projects in machine learning (see my Github).

Gadjah Mada University *Yogyakarta, Indonesia*

B.S. IN PHYSICS *2011-2015*

- Best Graduate of Department of Physics in my graduation period with GPA 3.72/4.00
- Did bachelor thesis on Astroparticle physics with title : Modified Mirror Model and Leptogenesis.
- Took courses related to programming: Computational Physics (Fortran) and Numerical Method and Programming (Python)
- Organized (as Chairman) Pestagama. Pestagama is one of the biggest event organized by students in Faculty of Science, Gadjah Mada University

Experience

Embedded System Programming and ELectronics *LMU München*

WORKING STUDENT *Oct. 2018 - Des 2018*

- Wrote python modules to control digital to analog converter (DAC) and analog to digital converter (ADC)
- Built an interface to control ADC and DAC using Python (TKinter Library)

Lab Assistant *Yogyakarta, Indonesia*

GADJAH MADA UNIVERSITY *2015 - 2016*

- Guided undergraduate students to conduct lab course. Topics : Gamma, beta and X-ray spectroscopy and detection.

Teaching Assistant *Yogyakarta, Indonesia*

GADJAH MADA UNIVERSITY *2015 - 2016*

- Teaching assistant for the following courses : Quantum Physics, Nuclear Physics, and Theory of Relativity

Teaching

INDONESIAN TEAM FOR INTERNATIONAL PHYSICS OLYMPIADS (IPHO) *2012 - 2016*

- Taught high school students (all of them are medalist in Indonesia Science Olympiads) as preparation toward International Physics Olympiads.

Honors & Awards

2018	**Awardee**, Bavarian Scholarship for International Student
2015	**Awardee**, Indonesia Endowment Fund for Education Scholarship
2012	**Gold Prize**, Indonesia Physics Olympiads for Undergraduate Students (ONMIPA)
2010	**Silver Prize**, Indonesia Physics Olympiads for High School Students (OSN)

Skill

- Python, Mathematica, PostgreSQL, C++, Tensorflow, Fortran
- Microsoft Office, Latex

Research Statement

Considering my backgrounds, I would like to be considered for research projects that involve Effective theory, Higgs phenomenology, QCD, flavour physics, and machine learning or data analysis methods. I want to be as close as possible to phenomenology but not too far away from theoretical aspects of quantum field theory. The following research projects will be perfect for me :

- (A2a) The effective electroweak Lagrangian in the light of the LHC
- (A1b) Higgs boson physics with higher order QCD corrections within the Higgs Effective Theory
- (C3b) New Physics models for flavour observables

Grade Statements

In this letter, I would like to give a clarification on why my grades are not very good. My master program is Elite master Theoretical and Mathematical Physics (TMP) which is jointly organized by Department of Physics and Mathematics of LMU and TUM Munich. To graduate TMP, students must acquire 120 ects. Master thesis itself is worth 45 ects, in contrast to the usual 60 ects in other master programs. So TMP students are required to take more courses to graduate. There are 2 mandatory courses that can be opted from 4 available courses: Differential Geometry, Mathematical Quantum Mechanics, Quantum Field Theory and Mathematical Statistical Physics. All these courses are usually cotaught by Physicist and Mathematician. For me, I took differential geometry (taught by a mathematician at the department of Mathematics LMU) and quantum field theory (at TUM). Unfortunately, I got a bad grade in differential geometry (for your information, more than half of the students were failed, and among ones who were not failed, only three of them got a "gute" grade, others got 4.0, including me). I can not improve my grades (of both differential geometry) due to the regulation, namely those who are not failed in exams, cannot improve their grades by participating in the next exams.

LMU
LUDWIG-MAXIMILIANS-UNIVERSITÄT MÜNCHEN

ELITE MASTER COURSE
THEORETICAL AND MATHEMATICAL PHYSICS

University Transcript 12 February 2019

STUDENT'S NAME	MATRICULATION NUMBER	BIRTHDATE
Khoirul Faiq Muzakka	11633562	27 November 1993

PLACE OF BIRTH	PROGRAM OF STUDY
Rembang, Indonesia	MSc Theoretical and Mathematical Physics

CREDITS

Course Name	Grade	Credits
Differential Geometry	4.0	9.00
Quantum Field Theory	1.7	9.00
Quantum Electrodynamics	1.0	9.00
Quantum Mechanics 2	2.3	9.00
Quantum Chromodynamics	1.3	9.00
Supersymmetry	1.0	9.00
Advanced Particle Physics	2.0	9.00
Heavy Quark Physics	2.0	6.00
Machine Learning in Astrophysics	Not yet out	6.00
Seminar on Masterpieces of Quantum Field Theory	Ungraded	3.00

Grading Scale

1.0	Very good
2.0	Good
3.0	Satisfactory
4.0	Sufficient
5.0	Fail

Intermediate grades in steps of 0.3 can be given.

TMP Theoretical and Mathematical Physics
Elite Master Course
Dr. Robert Helling (coordinator)
Theresienstr. 37
D-80333 München
Germany
Tel. +49 (0) 89 2180-4523
Fax +49 (0) 89 2180-4186
helling@lmu.de
http://www.theorie.physik.uni-muenchen.de/TMP

Dr. Robert Helling
Scientific Manager

AcademicJobsOnline.org

Nadiri Niri, Babak

Address		**Email** bnbnadiri9@gmail.com (update 2018/09/02)	
9Bulakhlar Av, Nir, Ardabil Nir, Ardabil Iran, The Islamic Republic of		**Home Phone** (+98) 045-32282605 **Cell Phone** (+98) 09144578145 **Office Phone**	
Current Institution		**Department**	RIAAM (Research Institute for Astronomy and Astrophysics of Maragha)
Location	, Ardabil , Iran, The Islamic Republic of		
Highest Degree	Ph.D.	**Institution** Research Institute for Astronomy and Astrophysics of Maragha	**Date** 2016/09
Thesis Advisor	Dr. Akbar Jahan		
Thesis Title	Gravitational Luminosity of a Hot Plasma in R^2-gravity		
Research Interests	**Primary** gravity		
Secondary	Quantum field theory; Particle physics (high energy and phenomenology)		
Current Research Interests: *I finished my Ph. D thesis entitled "Classical Gravitational Bremsstrahlung in f(R)-gravity" mainly focused on geometrical approach. Besides, I want to develop the field theoretical approach to gravitational radiation in the context of f(R)-gravity. I have applied the results to calculation of gravitational luminosity of the Sun (a hot plasma) as a test bed in this context. The agreement of our results with available data is notable...*			
Discipline(s)	Applied Mathematics; Astrophysics; Complex Systems; Cosmology/Particle Astrophysics; Fundamental Theory/Cosmology; High Energy Physics; High-Energy Theory; Mathematical Physics; Natural Sciences; Nuclear Physics; Physics; Quantum Gravity; quantum gravity/quantum cosmology; Theoretical Physics		
Position(s) applied	PHD		
Also Consider For	**Temporary:** Postdoc		
1. Akbar Jahan, Assistant Professor at RIAAM (Research Institute for Astronomy and Astrophysics of Maragha), akbar.jahan@hotmail.com (2018/09/02)			file (PDF, PDF, 2018/09/09)
2. Ali Ajabshirizadeh, The university of Tabriz, Fac. of physics, Dept.of Astrophysics, Tabriz, Iran, ali_ajabshir@yahoo.com (2018/09/02)			file (PDF, PDF, 2018/09/04)
3. Majid Modarres, Physics Department, University of Tehran, North-Kargar Ave., 1439955961 Tehran, Iran.,			

mmodares@ut.ac.ir (2018/09/02)		
4. Christian Corda, Professor of Theoretical Physics and Astrophysics and Director of the Dipartimento di Fisica,, cordac.galilei@gmail.com (2018/09/02)	file (PDF, PDF, 2018/09/05)	
Received Materials	**PHD**	**Cover Letter:** file (PDF, PDF 2019/02/09) **Curriculum Vitae:** file (PDF, PDF 2019/02/09) **Research Statement:** file (PDF, PDF 2019/02/09) **Copies of grades transcripts:** file (PDF, PDF 2019/02/09)

To whom it may concern,

I hereby declare that my application to the prestigious **"Collaborative Research Center TRR 257, Karlsruhe Institute of Technology"** be considered for a Ph. D position. I wish, by studying and working hard, I could enhance my knowledge of the world. I would regard my admission not only as a great honor but also as a great responsibility and an obligation to work hard.

Here, there is a list of my reference writers.

1. Prof. Dr. Christian Corda, PhD.

Professor of Theoretical Physics and Astrophysics and Director of the Dipartimento di Fisica,

Registered office : Via Tagliamento 45, 00188 Roma, Italy.

Email: cordac.galilei@gmail.com; Telephone: 00393803416037.

2. Dr. Ali. Ajabshirzadeh

Prof. of Astronomy and Astrophysics

Department of physics, University of Tabriz

Email: ali_ajabshir@yahoo.com

Tel: 09141156156

3. Dr. Akbar. Jahan

Assistant Prof. of theoretical Physics, cosmology and gravity

Research Institute for Astronomy and Astrophysics of Maragha

Email: akbar.jahan@ hotmail.com   jahan@riaam.ac.ir

Tel: +98(41)37412222   P.O.Box: 55134-441, Iran.

4. Dr. M. Modarres

Prof. of Theoretical Nuclear Physics

Department of physics, University of Tehran

Email: mmodares@ut.ac.ir

Tel: +98(21)61118645 Fax:88004781

Sincerely Yours,
Babak Nadiri Niri

Phone: +98-45-32282605
Mobile: +98-9305645495 and +98-09144578145 Email: bnbnadiri9@gmail.com

Nir city 09th Feb. 2019

Babak Nadiri Niri
bnbnadiri9@gmail.com

Personal Information

Name: Babak
Surname: Nadiri Niri
Date of birth: 1981/15/08
Sex: Male
Status: Married
Address: 44 unit, 4 Floor,25 Ladan, Shahid Beheshti Complex, Babaee Highway, Tehran, Iran
Telephone: +98(045)32282605 +98 9144578145
E-mail: bnbnadiri9@gmail.com b-nadiri@riaam.ac.ir

Education

2012-2016: Ph. D. program of theoretical physics, cosmology and gravity
From: Research Institute of Astronomy and Astrophysics of Maragha (RIAAM)
Graduation date: 09/2016 GPA: 19.25 /20
Supervisor: Dr. Akbar Jahan & Prof. Ali Ajabshirizadeh

2004-2007: M. Sc. degree of theoretical nuclear physics
From: University of Tehran, Tehran, Iran
Graduation date: 09/2007 GPA: 15.16 /20
Supervisor: Prof. Majid Modarres

2000-2004: B. Sc. in theoretical solid state physics

From: Khaje–Nasir Toosi (KNT) University of technology, Tehran, Iran
GPA: 14.91 out of 20

1996-2000: High School diploma majoring mathematics at sheikh Mofid Exceptional Talent high school, Ardebi-Iran
GPA: 18.90 /20

<u>Relevant Courses</u>:

Quantum Mechanics of many-body systems | Classical Mechanic
Quantum Field Theory | Nuclear Physics
Special and General relativity | Relativistic Quantum Mechanic
Elementary Particle Physics | Advanced Quantum Mechanics
Mathematical Physics

Research activities:

2012: Working on my Ph. D. thesis entitled "Gravitational Luminosity of a Hot Plasma in R^2-gravity"
-2005-2007: Working on my master thesis entitled "Finite nuclear size effect on Lamb shift of atomic states $S_{1/2}$, $P_{1/2}$."

-2003-2004: B.Sc. project on "Quantum seeing in dark".

-2002-2003: Teaching Assistant (TA) of "Analytical Mechanic" course at KNT University of technology, Tehran, Iran

Objective:

-Working in an active research group and decoding the laws of nature.

Honors:

-Graduated from Exceptional Talent high school
-3nd among 60 student of high school
-1nd among 12 Ph. D. students of "RIAAM"

Language Fluency (Other than English)

-Turkish (Azerbaijani): native language
-Farsi

English Qualification

-TOEFL (PBT) score: 567 [SECTION 1 : **56** / SECTION 2 : **56** / SECTION 3 : **58** / TWE SCORE : 3.00]
- **GRE score (GENRAL)** : VERBAL : **310** / QUANTITAVIE : **680** / ANALYTICAL WRITING : **2**. (
-GRE (PHYSCIS SUBJECT TEST) : 620

Publications:

1-A. Ajabshirizadeh and B. Nadiri Niri, "***Gravitational radiation of a 3d harmonic oscillator in f** (R)-**gravity***". ***Iranian Journal of Science & Technology*.**

(2015) 39A3: 345-347

2-A. Ajabshirizadeh, A. Jahan, B. Nadiri Niri. "***Classical Gravitational Bremsstrahlung in R^2 –Gravity***". ***Mod. Phys. Lett A. Vol. 29, No. 28 (2014) 1450145.***

3- B. Nadiri Niri, A. Jahan, C. Corda**, *"Gravitational Luminosity of a Hot Plasma in R^2 –Gravity". European Physical Journal C, DOI: 10.1140/epjc/s10052-016-4545-3. arxiv: 1609.09784v1 [gr-qc] 27 Sep 2016***

4-B. Nadiri Niri***. "Finite Nuclear Size effect on Lamb shift of Atomic State $S_{1/2}$". Submitted to Nuclear Physics. B, arxiv:1612.08042[atom-phys]21 Dec 2016***

5- A. Jahan, H. Sarvari, B. Nadiri Niri**. "*Multipolar graviton in the hydrogen atoms". Gravitation and Cosmology, vol 24, issue 1, (2018).***

6- B. Nadiri Niri**. *"Radial infall into a black-hole in R^2 –Gravity". Gravitation and Cosmology*, 2017, Vol. 23, No. 3, pp. 257–260. DOI:** 10.1134/S0202289317030112

7- B. Nadiri Niri, Arash Anjami**. *" Nuclear Size Corrections to the Energy Levels of Single-Electron Atoms. Nuclear Science.***
Vol. 3, No. 1, 2018, pp. 1-8. doi: 10.11648/j.ns.20180301.11.

8- B. Nadiri Niri**. *"Non-linear electrodynamics as a source for gravitation". Under construction…***

Hobbies & Interest:

Computer & Internet	mountain climbing
Reading novels	Playing soccer
Movies	Swimming

References :(4 references)

1. Prof. Dr. Christian Corda
Professor of Theoretical Physics and Astrophysics and Director of the Dipartimento di Fisica,
Registered office : Via Tagliamento 45, 00188 Roma, Italy.
Email: cordac.galilei@gmail.com; Telephone: 00393803416037.

2. Prof. Ali. Ajabshirizadeh
Prof. of Astronomy And Astrophysics
Department of physics, University of Tabriz
Email: ali_ajabshir@yahoo.com
Tel: 09141156156

3. Dr. Akbar. Jahan
Assistant Prof. of theoretical Physics, cosmology and gravity
Research Institute for Astronomy and Astrophysics of Maragha
Email: akbar.jahan@ hotmail.com jahan@riaam.ac.ir
Tel: +98(41)37412222 P.O.Box: 55134-441, Iran.

4. Dr. M. Modarres
Prof. of Theoretical Nuclear Physics
Department of physics, University of Tehran
Email: mmodares@ut.ac.ir
Tel: +98(21)61118645 Fax:88004781

Statement of Purpose

I was born in an educated Azerbaijani family with strong social values of hard work. Both of my parents are retired. My father was teacher. He taught literature and history and my mother was nurse. During my childhood they took their most effort to educate me and my siblings. They always encouraged us to study hard. Now my younger brother graduated in electrical engineering (M. Sc.) from Ardebil-Azad University. My younger sister is Ph. D. student in Malek-Ashtar university of Tehran (M.Sc. in Chemistry from university of Tehran) and the older one is teacher.

In 1996, I was accepted in the Exceptional Talents high school and I was among top-three in high school. My interest in physics aroused me to pursue extra-curriculum activities like astronomy and pragmatic physical experiment. In order to accomplish my eagerness and curiosity for both empirical and theoretical physics, I participated in the national entrance exam for university and I chose physics as field of study.

In 1999, I was admitted into faculty of science in Khaje Nasir Toosi (KNT) University of technology. As a student of physics from the first year of my study, I had a special tendency to theoretical physics. Thus, I had a wide variety of interest in some of courses such as Quantum Mechanic, Mathematical physics, Classical Mechanic, Special and General Relativity. My project in the last year of university was "Quantum seeing in Dark" that was related to dual behavior of light, one of the philosophical aspects of quantum mechanics, under supervision of Dr. E. Feyzabadi. My final GPA was 3 /4 (the average of department was about 2.5).

After my B.S. graduation in 2004, I took part in master entrance exam in 2005. I was admitted into university of Tehran in nuclear physics, the premier of Iranian universities. Due to my interest in theoretical physics I continued my research in this field with Prof. Majid Modarres on a project entitled "Finite nuclear size effect on Lamb shift of atomic states $S_{1/2}$, $p_{1/2}$ ". In this thesis we formulated an analytic method which accounted for the finite size of the nucleus by treating it as a boundary value problem. By considering appropriate charge distribution to the nucleus, we calculated energy shift of atomic levels. Our analytical findings were in good agreement with previous numerical results. I graduated from University of Tehran with final GPA 3.1 /4 (the average of department was 2.5).

I educated in 2007 from Tehran University. Then I passed the military service that is obligatory in Iran. Meanwhile, I took TOEFL (PBT), GRE (subject) and GRE (general) exams and passed them with acceptable marks.

In 2009, I got Ph.D. admission from the Department of physics of Ottawa University. But my research project entitled " Ab initio modeling of thermal barrier coating: "Effects of impurities on interface adhesion" was far from my interests. Moreover, due to low financial support from the University I couldn't stay for long time and I couldn't switch to theoretical physics; unfortunately after 3 months I left Canada.

In 2010, I admitted in Ph.D. program at Research Institute for Astronomy and Astrophysics of Maragha (RIAAM), Iran. Now, I have accomplished my Ph.D. thesis entitled "Classical gravitational bremsstrahlung in R^2-gravity" under supervision of Dr. Akbar Jahan and Prof. Ali Ajabshirizadeh. Besides, I have published some papers in the related field.

I enjoy learning and obtaining new knowledge and don't deprive myself of this potential pleasure by giving up my education. I know that this path will be challenging, but I am confident that I will be able to overcome them relying on determination and hard work.

I really like team-work and group projects. I always have believed that a group project exchange individual experience, such materials that never can be written in books or taught in classes.

All this significantly improved my understanding of the subject and further enhanced my interest in it. I found theoretical physics one of my greatest interests and I have planned to continue my scientific career in this field. Furthermore, I feel that what I have learned is far from sufficient to tackle some problems, thus I have decided to continue my research and education. I wish, by studying and working hard, I could enhance my knowledge of the world. I would regard my admission to "***Collaborative Research Center TRR 257, Karlsruhe Institute of Technology***" not only as a great honor but also as a great responsibility and an obligation to work hard.

بدر زمان نیک فطرت مترجم رسمی زبان انگلیسی
دارالترجمه مهاجران- خیابان میرزای شیرازی _ نبش کوچه شهدا
پلاک ۲۴۱ طبقه دوم - تلفن:۹- ۸۸۷۰۲۴۷۸
Badrezaman Nikfetrat, Official English Translator
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Corner,Mirzaye Shirazi Ave.Tehran
Tel:88702478-9

جمهوری اسلامی ایران
قوهٔ قضائیه _ اداره مترجمین رسمی

شماره ۷۰۵۴۹۳ سری ط
شماره دفتر مترجم

In the Name of God
K.N. Toosi University of Technology
Faculty of Science

Date reported: 26.04.2004

Transcript of Grades

Student no.: 781242037
Id. Cert. No.; 46
Full Name: **Mr. Babak Nadiri Niri**
Birth Date: 14.06.1981
Place born: Ardebil - **Field: Continuous Bachelor's Programme in Physics**

1st semester 1999-2000

Course	*Credit*	*Grade*
Persian language	3	18.75
Basic physics I	4	13.00
Pre-university math	4	16.00
Pre-university chemistry	4	18.00

Sem.	Average:	16.28	Taken credits:	15	Passed Credits:	15
Total	Average:	16.28	Taken credits:	15	Passed Credits:	15

2nd semester 1999-2000

Course	*Credit*	*Grade*
Islamic knowledge I	2	11.50
Physical education I	1	19.50
English language	3	10.50
General chemistry I	3	13.60
General chemistry Lab. I	1	16.00
Basic physics II	4	12.50
Math I	4	11.00

Sem.	Average:	12.49	Taken credits:	18	Passed Credits:	18
Total	Average:	14.21	Taken credits:	33	Passed Credits:	33

1st semester 2000-1

Course	*Credit*	*Grade*
Islamic revolution & its roots	2	16.50
Basic physics III	4	12.00
Analytical mechanics I	3	16.00
Math II	4	16.50
Differential equation	3	15.00
Computer programming	3	13.00

Sem.	Average:	14.68	Taken credits:	19	Passed Credits:	19
Total	Average:	14.36	Taken credits:	52	Passed Credits:	52

2nd semester 2000-1

Course	*Credit*	*Grade*
History of Islam	2	14.50
Basic physics Lab. I	1	13.50
Modern physics I	4	12.00
Physical Mathematics I	3	18.00
Thermodynamics & mechanics	4	18.00
Electromagnetism I	4	16.00

Sem.	Average:	15.58	Taken credits:	18	Passed Credits:	18
Total	Average:	14.69	Taken credits:	70	Passed Credits:	70

1st semester 2001-2

Course	*Credit*	*Grade*
Islamic knowledge II	2	15.00

Official English Translator
بدرزمان نیک فطرت
Badrezaman Nikfetrat

بدر زمان نیک فطرت مترجم رسمی زبان انگلیسی
دارالترجمه مهاجران- خیابان میرزای شیرازی _ نبش کوچه شهدا
پلاک ۲۴۱ طبقه دوم - تلفن:۹- ۸۸۷۰۲۴۷۸
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جمهوری اسلامی ایران
قوه قضائیه _ اداره مترجمین رسمی

شماره ۷۰۵۴۹۵ سری ط
شماره دفتر مترجم

Basic physics Lab. II				1	13.50
Analytical Mechanics II				3	15.50
Physical Mathematics II				3	13.00
Computer applied in physics				3	17.50
Electromagnetism II				4	19.25
Quantum Mechanics I				4	20.00
Sem. Average:	16.92	Taken credits:	20	Passed Credits:	20
Total Average:	15.19	Taken credits:	90	Passed Credits:	90

2^{nd} semester 2001-2

Course				Credit	Grade
Physical education II				1	19.50
Islamic texts				2	16.00
Solid-State Physics I				3	11.50
Electronics I				3	14.00
Basic physics Lab. III				1	14.00
Relativity				3	12.50
Crystallography				3	13.00
Quantum Mechanics II				4	17.50
Sem. Average:	14.43	Taken credits:	20	Passed Credits:	20
Total Average:	15.05	Taken credits:	110	Passed Credits:	110

1^{st} semester 2002-3

Course				Credit	Grade
Islamic ethics & education I				2	15.50
Optics				3	12.00
Specialized language				2	16.00
Electromagnetic environments				3	18.00
Statistical mechanics				3	14.50
Sem. Average:	15.12	Taken credits:	13	Passed Credits:	13
Total Average:	15.06	Taken credits:	123	Passed Credits:	123

2^{nd} semester 2002-3

Course				Credit	Grade
Modern physics Lab.				2	11.00
Atomic physics				3	12.25
Physics of semi conducting parts I				3	15.50
Solid-State Physics II				3	16.50
Optics Lab.				2	16.50
Plasma Physics				3	12.00
Laser				3	13.75
Sem. Average:	13.95	Taken credits:	19	Passed Credits:	19
Total Average:	14.91	Taken credits:	142	Passed Credits:	142

1^{st} semester 2003-4

Course				Credit	Grade
Glazing workshop				1	18.00
Sem. Average:	18.00	Taken credits:	1	Passed Credits:	1
Total Average:	14.93	Taken credits:	143	Passed Credits:	143

Signed and sealed: The registrar - K.N. Toosi University of Technology
Seen for authentication of university authorities' seals and signatures.
Signed & Sealed for Domestic Students Director General / Ministry Of Science, Research & Technology

---

True Translation Certified. 2009-12-19
PM- 4088

Official English Translator The Judiciary
بدرزمان نیک فطرت
مترجم رسمی زبان انگلیسی تهران، قوه قضائیه
شماره پروانه: ۳۰۴
Badrezaman Nikfetrat

بدر زمان نیک فطرت مترجم رسمی زبان انگلیسی
دارالترجمه مهاجران- خیابان میرزای شیرازی _ نبش کوچه شهدا
پلاک ۲۴۱ طبقه دوم - تلفن:۹-۸۸۷۰۲۴۷۸
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Corner,Mirzaye Shirazi Ave.Tehran
Tel:88702478-9

شماره ۷۰۵۴۹۲ سری ط

شماره دفتر مترجم

جمهوری اسلامی ایران
قوه قضائیه _ اداره مترجمین رسمی

Official Translation
In the Name of God
Emblem
Islamic republic of Iran
Ministry of Culture & Higher Education
K.N. Toosi University of Technology

Diploma of Bachelor's degree

Sealed Photo of Holder

No. 42799
Date 28.09.2009

According to the verdict of Higher Education Development Council dated Nov. 05, 1988,

Mr. Babak Nadiri Niri

son of Arsalan, holder of ID Card No. 46 issued in Ardebil, born in 1981, successfully completed the undergraduate programme of Faculty of Science in Feb.- Mar. of 2004, this Diploma of Bachelor's Degree in Physics is conferred upon him.

May he be successful in combining knowledge and piety towards satisfaction of God Almighty and serving the people.

Signed & Sealed by:
Dean of Faculty
Chancellor of University

ISLAMIC REPUBLIC OF IRAN
MINISTRY OF FOREIGN AFFAIRS
REGISTRATION AND PERSONAL STATUS DEPARTMENT

The authenticity of the seal & signature marked (X) is certified without any consideration to the contents.

Translation of Reverse Side:

This Diploma was registered under No. 37 dated 27.04.2005.

22 DEC 2009 -27915

Seen for authentication of the signatures and seals of the university authorities.
Signed & Sealed for Director General of Domestic Students Affairs

True Translation Certified. 2009-12-19
Pm-4088

Official English Translator The Judiciary
بدرزمان نیک فطرت
Badrezaman Nikfetrat

Department of official Translators Affairs of the Judiciary of the Islamic Republic of Iran
۱۰۰۱۰۰/م/۲۰۰/۱

Only the authenticity of the seal and signature of the Official Translator is certified. This certification does not include confirmation of the accuracy of the translation and of the translated document the authenticity of the translated document Department of Official Translators' Affairs of the Judiciary of the islamic Republic of Iran

In The Name Of God

University of Tehran

Transcript of University Grades

Student No :610183021	**Faculty** :SCIENCE
First Name :BABAK	**Department** :PHYSICS
Last Name :NADIRI NIRI	**Major** :
SSNO :6039883553	**Total Passed Units** :33
Date of Birth :08/15/1981	**GPA** :15.16
Graduate Date :09/21/2007	**Level** :Master

Academic Year 2004-2005 1st. Semester

Semester Status : Normal

Course Title	Credit	Grade
Advanced Quantum Mechanics I	3	13
Electrodynamics I	4	12
Computational Physics	2	16

Semester Gpa	Registered Unit(s)	Semester Passed Unit(s)	Total Passed Unit(s)	Cumulative Gpa
13.89	9	9	9	13.89

Academic Year 2004-2005 2nd. Semester

Semester Status : Normal

Course Title	Credit	Grade
Advanced Nuclear Physics I	3	18.75
Advanced Quantum Mechanics 2	3	11.5
Many body systems I	3	15.5

Semester Gpa	Registered Unit(s)	Semester Passed Unit(s)	Total Passed Unit(s)	Cumulative Gpa
14.58	9	6	15	14.24

Academic Year 2005-2006 1st. Semester

Semester Status : Normal

Course Title	Credit	Grade
Seminar	2	18
Advanced Statistical Mechanics 1	3	12
Thesis	6	IC
Quantum Field Theory 1	4	17

Semester Gpa	Registered Unit(s)	Semester Passed Unit(s)	Total Passed Unit(s)	Cumulative Gpa
15.56	15	9	24	14.68

Academic Year 2005-2006 2nd. Semester

Semester Status : Normal

Course Title	Credit	Grade
Advanced Quantum Mechanics 2	3	12
Thesis	6	IC

Semester Gpa	Registered Unit(s)	Semester Passed Unit(s)	Total Passed Unit(s)	Cumulative Gpa
12.00	3	3	27	14.41

Academic Year 2006-2007 1st. Semester

Semester Status : Normal

Course Title	Credit	Grade
Thesis	6	IC

Semester Gpa	Registered Unit(s)	Semester Passed Unit(s)	Total Passed Unit(s)	Cumulative Gpa
	6	0	27	14.41

Academic Year 2006-2007 2nd. Semester **EXCELLENT IN TERM**

Semester Status : Normal

Course Title	Credit	Grade
Thesis	6	18.9

Semester Gpa	Registered Unit(s)	Semester Passed Unit(s)	Total Passed Unit(s)	Cumulative Gpa
18.90	6	6	33	15.16

Academic Status

Full mark is 20

Last Status : Graduate Date : 09/21/2007

NOTE:

In "Grade" column the following abbreviations are used

R	Reported
IC	Incomplete

Director General of Postgraduate Studies, University of Tehran

GHOLAMREZA ZEHTABIAN Ph.D

signed and sealed

Date : 05/10/2011 **NOT VALID WITHOUT SIGNATURE AND SEAL OF REGISTER** END OF TRANSCRIPT

TEHRAN UNIVERSITY GRADUATE STUDY DEPARTMENT

بدر زمان نیک فطرت مترجم رسمی زبان انگلیسی
خیابان میرزای شیرازی - نبش کوچه شهدا
پلاک ۲۲۹ طبقه دوم - تلفن:۹- ۸۸۷۰۲۴۷۸
Badrezaman Nikfetrat, Official English Translator
No. 229, 2nd Floor, Shohada St.
Corner, Mirzaye Shirazi Ave. Tehran
Official Translation

شماره: ۱۲۴۷
ردیف دفتر ثبت

جمهوری اسلامی ایران
قوه قضائیه - اداره مترجمین رسمی

Emblem of Iran

University of Tehran

DIPLOMA OF MASTER'S DEGREE

Mr. BABAK NADIRI NIRI

Holder of Birth Certificate No. 46 issued in Ardebil, born in 1981 successfully completed the complementary educational course of Sciences campus on 22.09.2007 and is eligible to be awarded the Master' Degree in the field of Nuclear Physics, by virtue of University of Tehran Foundation Act passed on May 29, 1934, this Diploma of Master's Degree is conferred upon him to enable him to benefit from all honors and privileges thereto appertaining.

ISLAMIC REPUBLIC OF IRAN MINISTRY OF FOREIGN AFFAIRS
The authenticity of the seal & signature marked (X) is certified without any consideration to the contents.

Signed & Embossed Sealed:
Dean of Faculty
Chancellor of Sciences Campus
Seen for authentication of the seal & signature of university authorities
Signed & sealed by Director General of home students Affairs
Embossed seal of Ministry of Science, Research & Technology

0 8 JAN 2011 -30246

This diploma is registered in the Graduates & Issuance of Academic Degrees Dept. of Academic Services Gen. Dept. of University of Tehran under No. 9974 dated 01.01.2011.

True Translation Certified. 2011-01-03
AS-6502

Official English Translator The Judiciary
بدرزمان نیک فطرت
Badrezaman Nikfetrat

Department of official Translators Affairs of the judiciary of the Islamic Republic of Iran
اداره امور مترجمان رسمی قوه قضائیه

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Department of Official Translators' Affairs of the Judiciary of the Islamic Republic of Iran

001300

ETS TOEFL.

PAPER-BASED TEST EXAMINEE'S SCORE RECORD

REGISTRATION NUMBER	NAME (Family or Surname, Given, Middle)
3525909	NADIRI NIRI BABAK

TEST OF ENGLISH AS A FOREIGN LANGUAGE

SECTION 1	SECTION 2	SECTION 3	TOTAL SCORE
56	56	58	567

TOEFL SCALE SCORES

TEST OF WRITTEN ENGLISH

TWE SCORE: 3.0

TEST DATE (Month Year)	INST. CODE	DEPT. CODE	DATE OF BIRTH (Month/Day/Year)	SEX
JAN 09	6929 0757 0935 0999	76 76 76 76	08/17/82	M

CENTER NUMBER	SPONSOR CODE	NATIVE COUNTRY	NATIVE LANGUAGE
G700	XXXX	IRAN	FARSI

DEGREE	REASON FOR TAKING TOEFL	TOEFL TAKEN BEFORE
1	2	0

EXAMINEE'S ADDRESS:

377 G700 3525909
NADIRI NIRI BABAK
#9,BULAKHLAR ALLEY
IMAM KHOMEINI ST
NIR-ARDEBIL 564161414
IRAN

0

YOUR SIGNATURE

NAME OF COUNTRY ISSUING PASSPORT OR IDENTIFICATION: IRAN

NUMBER OF IDENTIFICATION DOCUMENT: 46

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11

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3525909	NADIRI NIRI BABAK	08/17/82	JAN 09	G700

INSTITUTION	ADDRESS	INSTITUTION CODE	NAME OF DEPARTMENT	DEPT. CODE
1.				
2.				
3.				
4.				
5.				
6.				
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JUN 23 2011
signature:

I authorize ETS to release my TOEFL and TWE scores, under the conditions set forth in the *Information and Registration Bulletin* for TOEFL paper-based and computer-based testing, to the institutions designated above.

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Print your family name (surname), given name, then middle name if you have one. Leave a blank box between names.

NAME

MAILING OR STREET ADDRESS

CITY, STATE, OR PROVINCE

ZIP/POSTAL CODE

COUNTRY

586

00328-09872 TELA05 07/05/05

ETS GRE

REPORT OF SCORES

M

Your GRE scores have been sent to the authorized recipient at each institution or fellowship sponsor listed below. Institutions that receive scores on CD-ROM are sent scores twice a month.

INSTITUTION OR FELLOWSHIP SPONSOR	INST. CODE	DEPT. CODE	SCORES REQUESTED
GI MCGILL UNIV	0935	0899	S
GI MCMASTER UNIVERSITY	0936	0899	S
GI UNIV BRITISH COLUMBIA	0965	0899	S
GI WASHINGTON UNIVERSITY	6929	0899	S

This score report includes all of your General Test and Subject Test scores earned from July 1, 2004, to the present.

Please check this report for completeness and contact ETS if you have any questions. See the reverse side for an explanation of terms.

For information about interpreting your scores, consult *Interpreting Your GRE Scores*, which is enclosed with this report.

GI = Graduate Institution or Fellowship Sponsor
UI = Undergraduate Institution
G = General Test
S = Subject Test

* No scores were sent. Either the UI does not receive scores or the GI is no longer active.
** No scores were sent. Your record does not include scores for the requested test.

GENERAL TEST

TEST DATE	VERBAL		QUANTITATIVE		ANALYTICAL WRITING	
MMYY	SCORE	% BELOW	SCORE	% BELOW	SCORE	% BELOW

NS: No Score. Indicates that no questions were answered in this section.

SUBJECT TEST

TEST DATE MMYY	TEST NAME/SUBSCORE NAME	SCORE	% BELOW	CORRECT	INCORRECT	OMITS	FORMULA SCORE
10/09	PHYSICS	620	37	039	018	043	035

THIS REPORT IS NOT VALID FOR TRANSMISSION OF SCORES TO AN INSTITUTION.

Test scores are not duplicated on subsequent pages of this report.

NAME: BABAK NADIRINIRI
ADDRESS: 204 KARIMKHAN NOET
TEHRAN IRAN

IRAN

REGISTRATION #: 9399-038

MOST RECENT TEST DATE: 10-09

DATE OF BIRTH: 08/15/82

PRINT DATE: 11/07/09

77593.011210.GREROF.ljg.071609

ETS GRE.

REPORT OF SCORES

M

Your GRE scores have been sent to the authorized recipient at each institution or fellowship sponsor listed below. Institutions that receive scores on CD-ROM are sent scores twice a month.

INSTITUTION OR FELLOWSHIP SPONSOR	INST. CODE	DEPT. CODE	SCORES REQUESTED
GI MCGILL UNIV	0935	0899	G
GI U KANSAS	6871	0899	G
GI UNIV MISSOURI COLUMBIA	6875	0899	G
GI WASHINGTON UNIVERSITY	6929	0899	G

This score report includes all of your General Test and Subject Test scores earned from July 1, 2004, to the present.
Please check this report for completeness and contact ETS if you have any questions. See the reverse side for an explanation of terms.
For information about interpreting your scores, consult *Interpreting Your GRE Scores*, which is enclosed with this report.

GI = Graduate Institution or Fellowship Sponsor
UI = Undergraduate Institution
G = General Test
S = Subject Test

* No scores were sent. Either the UI does not receive scores or the GI is no longer active.
** No scores were sent. Your record does not include scores for the requested test.

GENERAL TEST

TEST DATE	VERBAL		QUANTITATIVE		ANALYTICAL WRITING	
MMYY	SCORE	% BELOW	SCORE	% BELOW	SCORE	% BELOW
10/09	310	10	680	66	2.0	01

NS: No Score. Indicates that no questions were answered in this section.

SUBJECT TEST

TEST DATE MMYY	TEST NAME/SUBSCORE NAME	SCORE	% BELOW	CORRECT	INCORRECT	OMITS	FORMULA SCORE
10/09	PHYSICS	620	37	039	018	043	035

THIS REPORT IS NOT VALID FOR TRANSMISSION OF SCORES TO AN INSTITUTION.

Test scores are not duplicated on subsequent pages of this report.

NAME: BABAK NADIRINIRI
ADDRESS: 204 KARIMKHAN NOET
TEHRAN IRAN

IRAN

REGISTRATION #: 9503-035

MOST RECENT TEST DATE: 10-09

DATE OF BIRTH: 08/15/82

PRINT DATE: 12/02/09

77593.011210.GREROF.ljg.071609

Research Proposal

Gravitational radiation is of general interest to many researchers. It is the hot topic that experimental and theoretical astrophysics intersect. The topic has a wide variety of application from high-energy physics (quantum gravity, extra dimensions…) to Newtonian physics.

I finished my Ph. D thesis entitled "Classical Gravitational Bremsstrahlung in f(R)-gravity" mainly focused on geometrical approach. Besides, I want to develop the field theoretical approach to gravitational radiation in the context of f(R)-gravity. I have applied the results to calculation of gravitational luminosity of a hot plasma as a test bed in this context. The agreement of our results with available data is notable.

In the M. Sc. thesis entitled "Finite nuclear size effect on energy level shift of atomic states $s_{1/2}$, $p_{1/2}$", I explored QED scales. Furthermore, I studied QED corrections to the atomic energy level shift, Lamb shift, at leading order. Due to doing research in both of quantum and gravity arena, I am in a road to ultimate theory of Quantum Gravity.

My main interest is studying the formalism of physical theories. In addition exploring the fundamentals of physics and finding out the symmetries of nature is ultimate pleasure to me.

Questions like: "why nature behaves close to complete symmetry?" drives me to the road that mathematical physics is the last remedy to the unification scheme. Moreover, decoding the concepts like mass, charge, etc. is very attractive to me.

So, I enjoy working in many theoretical physics area that is available in prestigious "***Collaborative Research Center TRR 257, Karlsruhe Institute of Technology*** ".

In The Name Of God

University of Tehran
Transcript of University Grades

Student No :610183021
First Name :BABAK
Last Name :NADIRI NIRI
SSNO :6039883553
Date of Birth :08/15/1981
Graduate Date :09/21/2007

Faculty :SCIENCE
Department :PHYSICS
Major :
Total Passed Units :33
GPA :15.16
Level :Master

Academic Year 2004-2005 1st. Semester
Semester Status : Normal

Course Title	Credit	Grade
Advanced Quantum Mechanics I	3	15
Electrodynamics I	4	12
Computational Physics	2	16

Semester Gpa	Registered Unit(s)	Semester Passed Unit(s)	Total Passed Unit(s)	Cumulative Gpa
13.89	9	9	9	13.89

Academic Year 2004-2005 2nd. Semester
Semester Status : Normal

Course Title	Credit	Grade
Advanced Nuclear Physics I	3	16.75
Advanced Quantum Mechanics 2	3	11.5
Many body systems I	3	15.5

Semester Gpa	Registered Unit(s)	Semester Passed Unit(s)	Total Passed Unit(s)	Cumulative Gpa
14.58	9	6	15	14.24

Academic Year 2005-2006 1st. Semester
Semester Status : Normal

Course Title	Credit	Grade
Seminar	2	18
Advanced Statistical Mechanics I	3	12
Thesis	6	IC
Quantum Field Theory I	4	17

Semester Gpa	Registered Unit(s)	Semester Passed Unit(s)	Total Passed Unit(s)	Cumulative Gpa
15.56	15	9	24	14.68

Academic Year 2005-2006 2nd. Semester
Semester Status : Normal

Course Title	Credit	Grade
Advanced Quantum Mechanics 2	3	12
Thesis	6	IC

Semester Gpa	Registered Unit(s)	Semester Passed Unit(s)	Total Passed Unit(s)	Cumulative Gpa
12.00	3	3	27	14.41

Academic Year 2006-2007 1st. Semester
Semester Status : Normal

Course Title	Credit	Grade
Thesis	6	IC

Semester Gpa	Registered Unit(s)	Semester Passed Unit(s)	Total Passed Unit(s)	Cumulative Gpa
	0	0	27	14.41

Academic Year 2006-2007 2nd. Semester **EXCELLENT IN TERM**
Semester Status : Normal

Course Title	Credit	Grade
Thesis	6	18.9

Semester Gpa	Registered Unit(s)	Semester Passed Unit(s)	Total Passed Unit(s)	Cumulative Gpa
18.90	0	6	33	15.16

Academic Status

Full mark is 20
Last Status : Graduate Date : 09/21/2007

NOTE:

In "Grade" column the following abbreviations are used:

R	Reported
IC	Incomplete

Director General of Postgraduate Studies, University of Tehran
GHOLAMREZA ZEHTABIAN Ph.D

signed and sealed

Date : 05/10/2011 **NOT VALID WITHOUT SIGNATURE AND SEAL OF REGISTER** END OF TRANSCRIPT

To whom it may concern

I am pleased to recommend Mr. Babak Nadiri for your postdoctoral program. He was a PhD candidate here at RIAAM and I know him for more than 6 years.

He has a general knowledge in physics with a main interest in quantum field theory and mathematical physics. I have published three joint works with him in journals *Modern Physics Letters A*, *European Journal of Physics C* and *Gravitation & Cosmology*. The subjects of these papers were his suggestions. He is a talented person and I have been always impressed by his talents in computing lengthy and huge terms.

Therefore, with a great confidence I recommend him for your program. I am sure that he will continue to grow his talents and abilities.

Finally, let me say that Dr. Nadiri is a very nice guy with a gentle personality and was a beloved one here at RIAAM.

Sincerely,

Dr. Akbar Jahan
Assistant Professor
Research Institute of Astronomy and Astrophysics of Maragha (RIAAM)
P. O. Box: 55134 - 44
Maragha
Iran
Email: Jahan@riaam.ac.ir

Commented [v1]:
Commented [v2R1]:
Commented [v3R1]:

University of Tabriz
Faculty of Physics
Tabriz- Iran

1326
University of Tabriz
Faculty of Physics

To whom it may concern,

I would like to introduce my Ph.D. student Mr. B.Nadiri Niri to your University's Graduate Admissions Committee as an applicant to thePost-Doc's Program.

It has been about several years that he is doing researches under my supervision. During this researches interaction with he, I have found he a highly enthusiastic student capable of doing research and pursuing graduate studies very successfully. During his graduate studies, he was among the top 5% of his class showing his academic capabilities. He also has obtained the first rank in his class during his graduate studies which again is a good indication of his high potentials.

I have found he as an intelligent and hardworking student, capable of performing parallel tasks. He is a well-organized and highly-motivated graduate student who can conduct his projects and who is eager to face new challenges. In addition,he is polite and sociable with a nice personality.

Considering all the facts, I believe that he will make very good accomplishments and he will be eminently successful in his future academic endeavors. I, therefore, strongly recommend he for your post-doc program. He deserves to be awarded any kind of assistantship, scholarship or fellowship.

Thank you for the opportunity to recommend such a special and impressive young man.
Please do not hesitate to contact me to provide you with further information.

Sincerely Yours,

Ali Ajabshirizadeh,
Professor of Physics and Astrophysics,
Department of Theoretical & Astrophysics,
Faculty of Physics,
University of Tabriz, Iran
Emails: Ali_ajabshir@yahoo.com, a-adjab@tabrizu.ac.ir

Recommendation Letter for Dr. Babak Nadiri Niri

To whom it concerns.

I well know Dr. Babak Nadiri Niri, who is a collaborator of mine. I consider him an excellent researcher, with a very good competence in physics and maths. At the present time, we are developing a research project in gravitational physics, which concerns gravitational waves in extended theories of gravity. In such a research project Dr. Nadiri Niri shows himself like an hard-working man who does his best under my supervision and the supervision of his Ph.D Supervisors Dr. Akbar Jahan and Prof. Ali Ajabshirizadeh. I am sure that such a research project will permit us to obtain various joined research papers that will be published in famous and important peer reviewed international journals. In fact, we rstarted with the paper B. Nadiri Niri, A. Jahan, C. Corda, "Gravitational luminosity of a hot plasma in R^2 gravity", published in Eur. Phys. J. C (2016) 76: 692.
I also know that Dr. Nadiri Niri published, together with his Ph.D Supervisors but also included some sole authored, various interesting papers in prestigious journals like, Nuclear Physics B, Modern Physics Letters A and Iranian Journal of Science & Technology, while other papers, have been recently submitted by him to other prestigious journals.
As I have a great confidence on the scientific competence of Dr. Nadiri Niri, I often ask him to review papers submitted to the journals for which I serve as Editor.
In my opinion, Dr. Nadiri Niri will have an high level career in Science. In particular, I am sure that:
a) He has great capacity and motivation for carrying on advanced study and research.
b) He has a very creative talent for Science.
c) He will have an extremely successful career.
d) He has a very good potential for work as a teaching or research assistant.
e) He has a remarkable ability for doing research independently as well as a part of a research group and in collaboration with others.
f) Although Dr. Nadiri Niri's native language is other than English, he has a very high level English proficiency and a remarkable ability of communication in English.

Thus, I strongly recommend him for every position in every university and/or research centre in the world.

Roma, September 4, 2018,

Christian Corda

Registered office : Via Severino Delogu, 6 - 00144 Roma Eur, ITALY.

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Email: cordac.galilei@gmail.com; Telephone: 00393803416037.

Prof. Dr. Christian Corda, PhD.
Professor of Theoretical Physics and Astrophysics at the Dipartimento di Fisica e Scienza dei Sistemi, Scuola Superiore Internazionale di Studi Universitari di Ricerca e Formazione " Unisrita", Via Severino Delogu, 6 - 00144 Roma Eur, ITALY.
Contract Professor of Theoretical Physics and Astrophysics at the Research Institute for Astronomy and Astrophysics of Maragha, Iran, http://riaam.ac.ir/.
Editor in Chief of Theoretical Physics,
http://www.isaacpub.org/AboutThisJournal.aspx?ids=25.
Editor in Chief of "Journal of High Energy Physics, Gravitation and Cosmology",
http://www.scirp.org/journal/jhepgc/.
Past Editor in Chief of "The Open Astronomy Journal".
Past Editor in Chief of "The Hadronic Journal".
Associate Editor of "Open Physics (former Central European Journal of Physics)",
http://www.degruyter.com/view/j/phys.
Editor of "The International Journal of Mathematics and Mathematical Sciences",
http://www.hindawi.com/83262693.html.
Editor of "Journal of Dynamical Systems and Geometric Theories",
http://www.tarupublications.com/journals/jdsgt/editorial-board.htm.
Editor of "Open Journal of Microphysics", http://www.scirp.org/journal/ojm/.
Honorable Mention Winner at the 2009 and 2012 Gravity Research Foundation Awards,
http://www.gravityresearchfoundation.org/.
Dr. Corda's web-page within the site of the International Society of General Relativity and Gravitation:
http://hyperspace.uni-frankfurt.de/author/cordacgalileigmailcom/.

Registered office : Via Severino Delogu, 6 - 00144 Roma Eur, ITALY.

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Email: cordac.galilei@gmail.com; Telephone: 00393803416037.

Nagasaki, Koichi

Address		**Email** koichi.nagasaki24@gmail.com (update 2018/12/26)	
University of Electronic Science and Technology of Chengdu, N/A China		**Home Phone** **Office Phone** **Skype Name** K. Nagasaki	

Current Title / Dates	Post Doctor		
Current Institution	Department of physics, Chung Yuan Christian University	**Department**	Physics
Location	University of Electronic Science and Technology of, Chengdu, N/A , China		
Highest Degree	Ph.D.	**Institution** Osaka University	**Date** 2014/03
Thesis Advisor	Satoshi Yamaguchi		
Thesis Title	Test of AdS/CFT correspondence by non-local operators		
Research Interests	**Primary** AdS/CFT correspondence		
Secondary	Supersymmetric gauge theory; Particle Physics		

Current Research Interests: *I am interested in AdS/CFT correspondence and thinking of confirming its correspondence. I have been researching string theory, focusing on the holographic dictionary of the non-local operators. A non-local operator is an operator which has non-zero spatial dimension. Such a non-local plays a crucial role in the study of AdS/CFT correspondence. These operator generally introduces a new parameter into the theory. This parameter allows one to compare the calculation in two different theories which are expected to be equivalent --- gauge theory and string theory.*

Discipline(s)	High Energy Physics; Mathematical Physics; Natural Sciences; Physics
Position(s) applied	PHD

1. Satoshi Yamaguchi, Department of physics, Osaka University, yamaguch@het.phys.sci.osaka-u.ac.jp (teaching) (2018/12/20)	file (PDF, PDF, 2018/12/21)
2. Wen-Yu Wen, Chung Yuan Christian University, steve.wen@gmail.com (teaching) (2018/12/20)	file (PDF, PDF, 2018/12/20)
3. Kim Sung-Soo, University of Electronic Science and Technology of China, sungsoo.kim@uestc.edu.cn (teaching) (2018/12/26)	file (PDF, PDF, 2019/01/02)

Received Materials	**PHD**	**Cover Letter:** file (PDF, PDF 2018/09/28) **Curriculum Vitae:** file (PDF, PDF 2018/09/28) **Research Statement:** file (PDF, PDF 2018/04/24) **Copies of grades transcripts:** file (PDF,

		PDF 2019/02/06)

University of Electronic Science and Technology of China (UESTC)
No.4, Section 2, North Jianshe Road, Chengdu, China, 610054

Tel: +86-28-8320-2316 email: koichi.nagasaki24@gmail.com

September 29, 2018

To Whom It May Concern,

I am writing to you inquiring about a possible position for a post-doctoral fellow in your Theory Group for the next academic year starting from the autumn of 2019. If there is any position available, I would like to apply for the position.

So far I have been working on string theory and supersymmetric gauge theories, especially I am interested in the test of the AdS/CFT correspondence.

My recent interest is based on Complexity - Action conjecture. This conjecture asserts the equality between the complexity which is a quantity measuring the hardness of the calculation and the action which is calculated from spacetime geometry. For this reason this research influences broad area of physics from computer science to cosmology.

Let me explain some of my other works. First, I have recently researched a kind of black hole called “BTZ black hole.” It is a black hole solution in (2+1) dimensional spacetime. This solution exists in (2+1) dimensional spacetime but it has a very similar property that of in (3+1) dimensional spacetime. Studying this system, many interesting correspondence are expected. Its entropy can be calculated by the Cardy formula and I researched its generalization to Noncommutative geometry.

Second, I am also interested in the calculation of the partition functions of the super Yang-Mills theory (SYM) defined on curved spacetime. Especially, in my current work, I calculated the partition function of 4-dimensional SYM compactified on Riemann surfaces which possibly has a boundary. The property of this system is characterized by the geometry of the Riemann surface. My past research revealed that the central charge of the 2-dimensional conformal field theory obtained by this compactification is expressed by the Euler number of this Riemann surface. Further my research revealed the boundary conditions for preserving supersymmetry for such theories. So the method for calculation of path integral, “localization,” is valid in this system. Because this is a very useful tool which enables us to calculate the path integral exactly, I am considering some applications for this method. The black hole entropy stated the above is one of them.

A more detailed listing of my research projects is given separately. I would be very happy to take part in the research activities of your Group.

I have already asked recommendation letters to the following professors which will be sent directly to you:

- Prof. Sung-Soo Kim (UESTC, China)
- Prof. Wen-Yu Wen (Department of physics, CYCU, Taiwan)
- Prof. Satoshi Yamaguchi (Department of physics, Osaka University, Japan)

If there is any further document necessary for the application, please let me know.

Sincerely yours,

Koichi Nagasaki

Curriculum Vitae

Personal data

Name:	Koichi Nagasaki
Sex:	male
Date of birth:	December, 24, 1985
Age:	32
Place of birth:	Japan
Marital status:	Unmarried
Nationality:	Japanese
Present Affiliation:	School of Physical Electronics, University of Electronic Science and Technology of China (UESTC)
Address:	No.4, Section 2, North Jianshe Road, Chengdu, China, 610054
Phone:	+86-28-8320-2316
E-mail:	koichi.nagasaki24@gmail.com
Home address:	No.4, Section 2, North Jianshe Road, Chengdu, China, 610054

Academic degrees

year-month	degree, subject	place
2011-03	Master of Science, physics	Osaka University, Japan
2014-03	Doctor of Science, physics	Osaka University, Japan

Education

period	Institution	place
2005-04 to 2009-03	Department of Physics	Osaka University, Japan
2009-04 to 2014-03	Graduate School of Science	Osaka University, Japan

Positions

period	position	place
2013-04 to 2014-03	JSPS Fellow	Osaka University, Japan
2014-04 to 2015-03	JSPS Fellow	Kavli IPMU, Japan
2015-04 to 2015-09	Postdoc	KEK, Japan
2015-10 to 2017-07	Postdoc	Chung Yuan Christian University, Taiwan
2017-08 to present	Postdoc	UESTC, China

Teaching Experiment

Teaching Assistant

Period	lecture title	Instructor
2009-04 to 2009-09	Physics 1	Yutaka Hosotani
2009-10 to 2010-03	Exercise in Electricity and Magnetism 2	Tetsuya Onogi、Masakiyo Kitazawa
2010-10 to 2011-03	Mechanics II	Naoyuki Haba
2010-10 to 2011-03	Basic Experiments of Physics	Setsuko Tajima, Rikio Settai, Chihiro Yamanaka,, Sadao Takaoka, Izumi Ogawa, Shin-ya Yoshioka
2012-10 to 2013-03	Mechanics 1	Satoshi Yamaguchi

Research Assistant

Period	Research title
2011-04 to 2013-03	D3/D5 brane system and holographic interface CFT

Awards

- Kashiyama Shogakukai Fellow, 2005
- Koekizaidanhojin Ono Shogakukai Fellow, 2009

Talks in International conferences

1. "Wilson loop in D3/D5 system and AdS/CFT correspondence"
   @Asian Winter School on Strings,Particles and Cosmology
   2012-01-14, Kusatsu, Japan.
2. "D3/D5 system and holographic interface CFT"
   @Progress in Quantum Field Theory and String Theory
   2012-04-05, Osaka City Univ. Osaka, Japan.
3. "Bubbling D5-brane"
   @KIAS-YITP joint workshop 2013 "String Theory, Black Holes and Holography"
   2013-07-03, Yukawa Institute for Theoretical Physics, Kyoto, Japan

4. "'t HOOFT OPERATORS ON AN INTERFACE AND BUBBLING D5-BRANES"
   @PASCOS 2013
   2013-11-24, National Taiwan University, Taipei, Taiwan

5. "Gauge theory on Riemann surfaces"
   @7th Taiwan String Workshop
   2014-11-25, National Taiwan University, Taipei, Taiwan

6. "Construction Of 4d SYM Compactified On Open Riemann Surfaces By The Superfield Formalism"
   @Annual Meeting of the PSROC, 2016
   2016-01-27, National Sun Yat-sen University, Kaohsiung, Taiwan

Talks in Japanese Physical Society Meeting

1. "Identification of a new physics from measurement of helicity at LHC"
   @JPS 65th Annual Meeting
   2010-05-23, Okayama Univeristy, Okayama, Japan.

2. "The exact solution by localization of supersymmetric gauge theory in curved space-times"
   @JPS 66th Annual Meeting
   2011-03-26, Niigata Univeristy, Niigata, Japan.

3. "Wilson loops in a D3-D5 system and AdS/CFT correspondence"
   @JPS Autumn meeting
   2011-09-19, Hirosaki Univeristy, Aomori, Japan

4. "D3-D5 system and Holographic interface CFTs"
   @JPS 67th Annual Meeting
   2012-03-27, Kwansei Gakuin University, Hyogo, Japan

5. "Bubbling D5 branes and AdS/CFT correspondence"
   @JPS 68th Annual Meeting
   2013-03-27, Hiroshima University, Hiroshima, Japan

6. "The correspondence between Young diagrams and bubbling D5-branes"
   @JPS Autumn meeting
   2013-09-21, Kochi University, Kochi, Japan

7. "Compactification on Riemann surfaces with a boundary and 2-dimensional CFT"
   @JPS 70th Annual Meeting
   2015-03-24, Waseda University, Tokyo, Japan

8. "CFTs obtained from compactification on Riemann surfaces with a boundary"
   @JPS Autumn meeting
   2015-09-25, Osaka City University, Osaka, Japan

9. "CFT obtained from compactification on Riemann surface and localization"
   @JPS 71th Annual Meeting
   2016-03-21, Tohoku Gakuin University, Miyagi, Japan

10. "Partition functions on Riemann surfaces with a boundary by localization method"
    @JPS Autumn Meeting
    2016-09-24, Miyazaki University, Miyazaki, Japan

11. "Complexity of AdS_5 blackholes with a rotating string"
    @JPS 73th Annual Meeting
    2018-03-23, Tokyo University of Science, Chiba, Japan

12. "Complexity growth of rotating black holes with a probe string"
    @JPS Autumn meeting
    2018-09-17, Shinshu University, Nagano, Japan

Talks in Seminars

1. "Bubbling D5-brane"
   2013-08-06, National Taiwan University, Taiwan

2. "'t Hooft operators and D5-brane"
   2014-02-18, Osaka City University, Japan

3. "Compactification on Riemann surfaces with a boundary and 2d CFT"
   2015-04-22, Tokyo Institute of Technology, Japan

4. "Compactification on Riemann surfaces with a boundary and 2d CFT"
   2015-11-26, Chung Yuan Christian University, Taiwan

5. "Localization on Riemann surfaces with boundaries and Partition function"
   2017-04-21, National Taiwan University, Taiwan

Contact details of referees

- Prof. Sung-Soo Kim
  mail: sungsoo.kim@uestc.edu.cn
  Institute: UESTC, China

- Prof. Wen-Yu Wen
  mail: wenw@cycu.edu.tw
  Institute: Center for High Energy Physics and Department of Physics, Chung Yuan Christian University, Taiwan
  Leung Center for Cosmology and Particle Astrophysics, National Taiwan University, Taiwan

- Prof. Satoshi Iso
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  Institute: Department of physics, Osaka University, Japan

Expected starting date

April, 2019

Research Statement

Koichi Nagasaki
University of Electronic Science and Technology of China (UESTC)

This research statement is organized as follows: Section 1 explains the background of my research. Section 2 discusses my past works. Section 3 discusses the plan of my future plan and the expected result and contribution.

1 Background of my research field

String theory has been studied as a candidate of the unified theory which describes quantum gravity. Now the AdS/CFT correspondence [1] is a good tool for promoting our understanding of this theory. This correspondence asserts the equivalence between a gravitational theory and a lower dimensional non-gravitational theory and this conjecture is expected to be true through many evidences. I have been researching and tried to test this conjecture mainly by finding new examples of the correspondence. I show these results in the below.

2 My past works

2.1 Localization on curved spaces

Localization is often used for calculating quantities of theories with supersymmetry. This method enables us to obtain the exact result of the path integral. By the localization method path integrals are simplified to finite dimensional integral, or in more simple case, to summation of contributions from finite numbers of points. Pestun calculated the expectation values of the partition function and Wilson loops in super Yang-Mills defined on a four-sphere S^4 by localization [2]. In this case the instanton contribution is localized at the two point on the sphere — north and south poles.

I tried to generalize the result of his result in my past work [3]. I consider to apply localization on the general curved manifolds. More specifically, this study focused on the localization of super Yang Mills theory on AdS_4 and $\mathrm{AdS}_2 \times S^2$. In the same way as Pestun's study, I revealed that there are instantons localized at the specific points of these manifolds. In the first case, AdS_4, the path integral is localized on the center of space. In the second case, $AdS_2 \times S^2$, the path integral is localized the center of the AdS_2 and the two opposite points of S^2. Gathering these contributions I attained to obtain the partition function of these theories. This is the main result of this work.

2.2 AdS/CFT correspondence of non-local operators

AdS/CFT correspondence is thought as a reliable conjecture but there is no proof so far. To confirm this conjecture, I studied a new example of this conjecture by focusing object which have hardly been studied in past studies [4, 5, 6]. Such objects are called "non-local operators." Wilson operators and 't-Hooft operators are well known examples of such kind of operators.

Among many non-local operators, I studied a kind of non-local operator called an "interface." This is a 3-dimensional non-local operator extending (2+1) spacetime dimension. This operator divides 4-dimensional spacetime into two regions and gives the boundary condition for these theories. In the gauge theory side, this describes a wall between two gauge theories with different gauge groups. On the other hand, in the gravity side, this interface is described by a probe D5-brane. Considering type IIB superstring, D3-branes can end on this D5-brane. When k of N D3-branes end on this D5-brane, the different gauge groups $N-k$ and N are realized and the probe D5-brane is located between these theories.

Inserting another object, I calculated the potential energy between them. In [4] I consider the Wilson line operator. The potential energy can be calculated by both side. These results agreed in the leading order. In [5] an inserted object is a chiral primary operator. It is a local operator located located in some distance from the interface. Calculating the correlation function between this local operator and the interface, I also confirmed the results from gauge and gravity sides agree.

In [6] I considered an additional branes, the D1-branes, as well as the D5-brane and D3-branes. The inserted D1-branes embedded on the D5-brane become the gauge flux on the D5-brane. I examine the condition for preserving appropriate amount of supersymmetry and derived a set of differential equations which are the sufficient and necessary condition for preserving specified supersymmetry.

2.3 Compactification on Riemann surfaces

Recently, the compactification of gauge theories is studied in many works. Alday, Gaiotto and Tachikawa [7] considered compactified gauge theory from 6-dimensional theories. They found an interesting relation between Nekrasov's partition function of 4-dimensional $\mathcal{N}$=2 gauge theory and 2-dimensional Liouville theory on Riemann surfaces. This is described as an M5-brane wrapping around a Riemann surface. Using c-extremization, Benini and Bobev obtained the central charge of compactified gauge theories on Riemann surfaces [8].

Inspired by these works, I considered gauge theories compactified on Riemann surfaces with boundaries. The introduction of the boundary is a new ingredient of my research. I studied the condition for preserving supersymmetry on these compactified gauge theories. The theories I studied are gauge theories defined on flat 2-dimension times the Riemann surface with a boundary. My research revealed the condition for preserving some supersymmetry on such boundary theories. Some of supersyjmmetries break when the boundary is introduced and half of the original supersymmetries can survive. Especially, $\mathcal{N} = (2, 2)$ supersymmetry can be realized by adding the boundary to $\mathcal{N} = (4, 4)$ theories on the closed Riemann surfaces. One of my main results is the boundary conditions. And the other is to obtained the central charge in the $\mathcal{N} = (2, 2)$ supersymmetry case.

My recent work [9] achieved to construct the super Yang-Mills theory on Riemann surfaces by using the 2-dimensional superfields. This represents the remaining supersymmetry manifestly. Then, the method of localization is valid for this theory. Supersymmetric quantities can be calculated by the localization. This method will have many applications.

2.4 Noncommutative geometry

Recently my research considered the noncommutative geometry [10]. This theory can be derived from the usual commutative theory by a technical transformation called "the Seiberg Witten map." Using Chern-Simons formulation of $2 + 1$ dimensional gravity and the Seiberg-Witten map, we have explored charged rotating BTZ black hole geometries and found that the deformation also induces nontrivial torsion, and the framework of Einstein-Cartan theory appears to be suitable to investigate the equations of motion.

3 Future Plans

In this section I explain the subjects of my recent interest.

3.1 Calculation of entropy by superconformal index

I am thinking of developing my past work by the method of Benini and Zaffaroni [11]. They calculated a kind of superconformal indices and this can be interpreted as the black hole entropy. The Witten Index is an example of such indices and it relates supersymmetry breaking. In their work, the superconformal index is written as a function of magnetic charge and chemical potential. The remarkable point is that the black hole entropy is obtained by extremising the superconformal index with respect to the chemical potential. It is analogous to c-extremization in two-dimensions and a-maximization in four dimensions.

My past works which studied localization on Riemann surface and boundary conditions for Riemann surfaces can be applied to promote this kind of research. By supersymmetric construction, the localization method enables us to evaluate such conformal indices on the Riemann surfaces exactly.

3.2 AdS/CFT correspondence

The above studies of black holes is an example of the holographic principle. The most known example of this principle is the AdS/CFT correspondence. In my past research [4, 5], I tried to confirm the confirm the validity of the AdS/CFT correspondence by comparing the result of correlation function from gravity theory and gauge theory. I calculated the correlation function between the interface, a kind of non-local operator, and another operator inserted on gauge theory. On curved space like the Riemann surface such correlation functions between non-local operators have hardly been studied. Then, studying them is interesting as a new test of the AdS/CFT correspondence. For this purpose the localization is very powerful method. To use the localization, I suppose to use the formalism established in my past work [9], which accomplished a supersymmetric description of gauge theory on a curved space.

Many of application of localization can be considered. For example, we can introduce the non-local operator on the Riemann surface as well as the boundary. My past research [5] revealed the gauge/gravity correspondence for point function which is the correlation between the interface and a local operator. It considered in flat spacetime. Generalizing to the curved spacetime seems very hard but I think the analysis by supersymmetry and application of the localization is a powerful tool for studying it.

3.3 Holographic Complexity

My recent interest is holographic complexity. It is also relate to ER = EPR which is a conjecture that the Einstein-Rosen bridge is equivalent to the entangled states. That relation relates theories living on the boundary to the bulk theory.

Now there are two conjectures which gives holographic complexity from the bulk calculation. One is Complexity-Action (CA) conjecture and the other is Complexity-Volume (CV) conjecture. According to CA duality, the complexity in the dual boundary theory is calculate by the action of the Wheeler DeWitt patch [12]. This conjecture has many attractive features compared with the old conjecture — CV conjecture. For example, the old conjecture, CV duality, contains an ambiguous parameter, while the new conjecture, CA duality, does not contain such a free parameter. There are many future works for this conjecture to be confirmed. For example, in order to obtain a finite result we have to regularize the action. Regularizations are recently studied in the boundary of the AdS. Furthermore, to make this conjecture complete, we need to take into account effects caused by stringy corrections in the bulk. This problem is closely related to quantum information science and so the research for holographic complexity is expected to give a highly progress in many area of science.

3.4 Relation to other research fields

The AdS/CFT correspondence has a possibility to promote the broad research area from experimental physics to purely theoretical area and mathematics. As stated above, my research is related to not only string theory but also quantum information science. Therefore, through my research, I would like to promote the interaction between theoretical, experimental area of physics and mathematics.

In recent research, the AdS/CFT correspondence is applied to many research fields of physics other than stated above, for example, nuclear physics or condensed matter physics, etc. Then through these contributions, I expect my research gives many influence and progress in these broad areas of physics.

References

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[11] F. Benini and A. Zaffaroni, "A topologically twisted index for three-dimensional supersymmetric theories," *JHEP* **07** (2015) 127, arXiv:1504.03698 [hep-th].

[12] A. R. Brown, D. A. Roberts, L. Susskind, B. Swingle, and Y. Zhao, "Complexity, action, and black holes," *Phys. Rev.* **D93** no. 8, (2016) 086006, arXiv:1512.04993 [hep-th].

No31855

CERTIFICATE OF GRADUATION

Name: NAGASAKI Koichi

Date of Birth: December 24, 1985

Graduate School: Course in Physics; Doctoral Program; Graduate School of Science

Date of Enrollment: April 1, 2011

Date of Graduation: March 25, 2014

Degree: Doctor of Philosophy

Date of Degree Conferment: March 25, 2014

This is to certify that the above record is true and correct.

NISHIO Shojiro

President of Osaka University

Official Seal of Osaka University

May 8, 2017

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中华人民共和国
驻大阪总领事馆
领事

2017年08月04日

A4885440

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December 21, 2018

To Whom It May Concern:

I am very happy to write a recommendation for Dr. Koichi Nagasaki who has applied for the postdoc position of your Group. I first became acquainted with Koichi when I came to Osaka University in 2009 and he was a graduate student there. Since then Koichi and I had a lot of discussion and wrote several papers together. I really enjoyed the collaboration with him. During the time we have spent together, I have formed a high opinion of his ability. He has an excellent mind, thinks quickly and rapidly grasps new facts and concepts. He works hard and has proved to be an efficient physicist. He really enjoys research. In addition, he is a warm, pleasant and courteous colleague who was well liked by those around him.

Koichi and I wrote several papers together. In the first paper arXiv:1106.4975, we try to extend the localization calculation by Pestun to a wider class of 4-dimensional manifolds. This work includes a rather tedious calculation. Koichi has shown his skill of calculation in this work and completed it. Through this work he has got the knowledge and the skill of localization calculation, which will be very useful in his future work. In the papers arXiv:1109.1927 and arXiv:1205.1674, we study AdS/CFT correspondence with an interface. Koichi has worked very hard and achieve remarkable results. Due to the introduction of the parameter k of the interface, we can compare the gauge theory side and gravity side, and find perfect agreement. He has also got the knowledge and the skill of the AdS/CFT correspondence, which is also useful in his future work. In arXiv:1309.3125, we consider the gravity dual of 't Hooft operators on an interface. Koichi has been leading in this project. He has calculated very fast and precisely, and what I have done is just following him. He has found miraculous relations among complicated formulas. I have been surprised with his ability of calculation.

One of my favorite work of Koichi and me is on 4-dimensional $\mathcal{N} = 4$ super Yang-Mills theory compactified on a Riemann surface with boundary and study the low energy conformal field theory in 2-dimensions [arXiv:1412.8302]. He finds a class of boundary conditions which preserve half of the supersymmetry. Among them $\mathcal{N} = (2, 2)$ theories in 2 dimensions are an interesting class of theories.

More recently, Koichi is working on the complexity in AdS/CFT correspondence. He published two papers in this topic: arXiv:1707.08376 and arXiv:1807.01088. His originality in these papers is to introduce a moving probe string in the eternal blackhole and see the change of the complexity evolution. He discovered that the complexity inclement is smaller when the string moves faster. I find it quite interesting since it is counter intuitive. These works should be important in the progress in this field.

Koichi is a strongly motivated young man and I have no hesitation in recommending him for the postdoc position of your Group. I know that if he joins your Group, he will make the very best effort.

I hope that you will seriously consider his application.

Sincerely,

Satoshi Yamaguchi
Associate Professor

Dec 19, 2018

Dear Selection Committee,

This letter is to recommend Dr. Koichi Nagasaki who would like to apply the advertised postdoc position in your institute. Dr. Koichi has been working with me as a postdoc for two years. We studied the correspondence between a noncommutative BTZ black hole after Seiberg-Witten map and a deformed CFT living on its boundary. He worked independently and has successfully shown that the thermal correlator can still enjoy the same analytic form and the noncommutativity can actually be removed by coordinate transformation, which was apparently not aware in the literature. In the abovementioned projects, Koichi has shown his solid training in String theory and quantum field theory.

Dr. Nagasaki has a quiet personality but he is very friendly and ready to help others in need. He also participated in the regular seminar and group meeting with other postdocs and students, and very often he was quick to show details and mistakes occurred in the blackboard calculation. I believe it would be a good opportunity for him to explore various research topics in an international stage. Therefore I am glad to recommend him to your institute.

Sincerely yours,

Wenyu Wen

Wen-Yu Wen
Professor
Department of Physics and Center for High Energy Physics
Chung Yuan Christian University
Taoyuan city, Taiwan

电子科技大学
University of Electronic Science and Technology of China

December 29, 2018

Prof. Sung-Soo Kim
School of Physics
University of Electronic Science and Technology of China
North Jianshe Road, Chengdu 610054, China
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Dear colleagues,

It is a letter for reference for Dr. Koichi Nagasaki who applied for a postdoc position in your institute.

He is a postdoc at School of Physics, University of Electronic Science and Technology of China (UESTC), from December 2017. Though he has worked for UESTC about a year, due to some VISA issue and his personal matter, he did not stay at UESTC as much as we wished him to, and so I have not had much chance to interact with him. While away, he worked independently and has written two papers on black hole complexity, where his finding on a nonlocal operator, interface, with flux, supports the Complexity-Action conjecture.

Dr. Koichi Nagasaki is a solitary researcher who is silent and works independently. Though his communication skill seems less than perfect, in better circumstances, his genuine interests in high energy physics would make better engagement and outputs.

Sincerely,

Sung-Soo Kim

Naghdi, Mohammad

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Ilam, Esfahan Iran, The Islamic Republic of		**Home Phone** **Cell Phone** (+98) 9183446697 **Office Phone**	
Current Title / Dates	-----, 2012- to now		
Current Institution	Ilam University	**Department**	Physics Department
Location	Ilam, N/A , Iran, The Islamic Republic of		
Highest Degree	Ph.D.	**Institution** Tarbiat Modarres University	**Date** 2011/09
Thesis Advisor	Ali Imaanpur		
Thesis Title	Instantons and their non-perturbative effects in AdS/CFT duality		
Research Interests	**Primary** String Theory and its applications: gauge/gravity dualities and their applications		
Secondary	Gravity and Cosmology: inflationary cosmology, the origin of the universe; Nuclear structure, Many-body systems		
Current Research Interests: *AdS/CFT correspondence: formal and its applications (To Cosmology, Condense Matter, Nuclear and Particle Physics)*			
Discipline(s)	Applied Mathematics; Applied Physics; Astronomy; Astrophysics; Atmospheric Science; Biophysics; Condensed Matter Physics; Cosmology/Particle Astrophysics; Experimental Neutrino Physics; Fiber Optics; Geophysics; High Energy Physics; High-Energy Theory; histories of science; History of Science; Mathematical Physics; Mathematics; Nuclear astrophysics; Nuclear Physics; Physical; Physical Chemistry; Physical Education; Physics; Plasma Physics; Quantum Gravity; quantum gravity/quantum cosmology; Quantum Information Science; Quantum Optics; quantum statistical physics; tectonophysics; Theoretical Physics		
Position(s) applied	PHD		
Also Consider For	**Temporary:** Postdoc 2 Year		
1. Ali Imaanpur, Tarbiat Modares University (TMU), aimaanpu@theory.ipm.ac.ir (2017/10/18)			file (PDF, PDF, 2017/10/25)
2. Mohsen Alishahiha, Institute for Research in Fundamental Sciences (IPM), alishah@ipm.ir (2017/10/25)			file (PDF, PDF, 2017/10/29)
Received	**PHD**	**Cover Letter:** file (PDF, PDF 2018/07/19) **Curriculum Vitae:** file (PDF, PDF 2018/10/27)	

Materials		**Research Statement:** file (PDF, PDF 2018/07/19) **Copies of grades transcripts:** file (same, PDF 2018/07/19)

Cover Letter

M. Naghdi

I have Ph.D. Degree in Physics, covering a wide range of studies from Nuclear-Particle physics to Gravitation and my last specialization is on “String Theory”. We now live in Ilam city in Iran and are Kurd. I have been an academic staff at Ilam University for more than four years, but because of unscientific atmosphere here (and, in general, at most places of Iran), limited branches to work/researches, and that there are not many powerful scientists for scientific collaboration with, to follow/accomplish my researches/studies sooner, I think that a scientific place, along with the connection with outstanding physicist in my working branch, with be better/useful for me.

Meanwhile, I have been taught various undergraduate and some graduate courses in physics, and am able to teach almost all physics courses (B.Sc. , M.Sc. and Ph.D.) with high standards.

In researches, besides those I have made so far, nuclear-particle and solid-state physics applications of AdS/CFT duality and string theory in general. Nuclear forces, superconductivity, fractional quantum Hall effects, early universe cosmologies, extra dimensions, flux compactification, standard models, and building new models/ideas/proposals in context of superstring theories are my goals and interests in physical studies/researches.

Curriculum Vitae

Updated: July 18, 2018

PERSONAL INFORMATION:

Full Name: **Mohammad Naghdi,**
Born in Karazan-Sirvan Branch, Ilam, November 1980;
Married, one Daughter.
Nationality: Kurd-Iranian.
Currect Address: Ilam City, Iran,
E-Mail: naghdi.m@gmail.com .
Study and Research Field:
Theoretical Nuclear-Particle Physics and Gravitation,
Specialization: String Theory.
Personal Home Page:
https://sites.google.com/site/astrophy001/home

EDUCATION:

- **B.Sc. in Applied Physics (Nuclear and Solid State Physics), Lorestan University**, Khoramabad, Iran, Sept. 1999 up to May. 2003.
- **M.Sc. in Nuclear Physics**, **University of Tehran**, Tehran, Iran, Sept. 03 -Sept. 05.
- **Ph.D. in Elementary Particle Physics & Gravitation**, **Tarbiat Modares University** (TMU), Tehran, Iran, Oct. 2005 up to Sept. 2011. This almost long period for Ph.D. was because I have changed three phases of studies for researches: High Energy Phenomenology and QCD; Classical Gravitation and Cosmology; and now study/research in Supersymmetry and String Theory.

Some Passed Specialist Courses:
In B.Sc.: Nuclear Physics I, II (Krane & Cohen Books), Reactor Physics (Lamarsh Book), Solid State Physics (Kittle Book), Electronics (Malvino Book), Laser (no special Book).

In M.Sc.: Advanced Nuclear Physics (Samuel Wong Book), Many-Body Physics I, II (Fetter & Walecka Book).

In Ph.D.: Self-Studying the Following Books:

Elementary Particle Physics (Halzen & Martin), Quantum Field Theory (Mandel & Shaw and Peskin & Schroeder), Group Theory (Wybourne Book), General Relativity I, II (Sean Carroll & Hans Stephani Books), Cosmology (Liddle; -Ta-Pi Cheng: “Relativity, Gravitation and Cosmology”; and some parts of the books by - Coles & Lucchin; - Mukhanov: “Physical Foundation of Cosmology”), Supersymmetry and String and M-Theory (at least four books by - B. Zwiebach: “A First Course in String Theory”; - J.

Wess, J. Bagger: "Supersymmetry and Supergravity"; - M. Dine: "Supersymmetry and String Theory"; - K. Becker, M. Becker, J. H. Schwarz: "String Theory and M-Theory").

- My M.Sc. Thesis was on Nucleon-Nucleon (NN) Interaction in phase of Theoretical and Computational Nuclear Physics under supervision of Dr. Majid Modarres (Professor of Theoretical Nuclear and Particle Physics) at University of Tehran.
- **M.Sc. Thesis Title: "Study and Comparison of Various Nucleon-Nucleon (NN) Potential Models and Forms".**

- My Ph.D. Thesis was on Non-Perturbative effects (Instantons & Solitons) in Field and String theory, in both sides of AdS/CFT Correspondence, with guiding of Dr. Ali Imaanpur (Associate Professor of Elementary Particle Physics) at T.M.U.
- **Ph.D. Thesis Title:** "**Instantons and their Non-Perturbative Effects in AdS/CFT Correspondence**".

RECORDS:

Work Indicators & Honor:

- Rank one Graduated Student in B.Sc. at Lorestan University (2003); Rank one Among Graduated Students in Nuclear Physics in M.Sc. at University of Tehran (2005).
- Accepted with Rank One for Ph.D. at Two Universities: Isfahan University of Technology: Nuclear Physics and Tarbiat Modares University (fully graduated university): All Branch in Physics, and awarded.

Jobs and Special Schools and Teaching:

- Invited and Participated in the excellent last year B.Sc. Students one week School at Institute for Advanced Studies in Basic Sciences (IASBS), Zanjan, Iran, (2002).
- Scholarship Student of Ministry of Science, Research and Technology (MSRT) for Ilam University from 23 September 2005 to 22 September 2009.
- Participating in Several National and International Physics Conferences in Iran particularly those hold at Institute for Research in Fundamental Sciences (IPM).
- A Six Month Research Period, During Ph.D., as a Visitor at "String Theory Group" of the Physics Department at University of Rome II "Tor Vergata", Rome, Italy, May-Oct. 2009- I Requested and Invited by Professor "Massimo Bianchi".
- After graduating from Ph.D., according to the rules, I came to Ilam University to work as an Academic Staff, from September 2011.
- The Courses taught at Ilam University up to now: **Physics I (Mechanics), Physics II (Electricity and Magnetics), Analytical Mechanics (I, II), Mathematical Physics (I, II), Nuclear Physics (I, II), Elementary Particle Physics (undergraduate), Relativity's Theory (undergraduate), (Advanced Particle Physics 1 (Graduate), Special Topics in Physics (Graduate).**

- Refereeing for "International Journal of Theoretical Physics" (IJTP) ISI journal.
- Refereeing three "Applied Research Projects" for "Science and Technology Park of Ilam".
- Member of Scientific Committee of a National Physics Conference and Refereeing 15 Papers there (2016).

RESEARCH INTERESTS:

All Branches of Physics, Especially:

- **Theoretical Nuclear & Particle Physics**, and **Nuclear Structure**,
- **Quantum Field Theory** (QFT, Especially Non-Perturbative QCD),
- **Many-Body Systems**, **Gravitation and Cosmology** (Especially Quantum Gravity and Inflationary Cosmology),
- **String Theory** (**Especially (A)dS/CFT & QCD Correspondence**).

Current Researches:

- **Non-Perturbative effects in gauge and gravity theories: Formal Aspects and Applications of AdS/CFT.**

Talks/Lectures:

- Three Talks on QCD at Physics Department of TMU, 2008. Talk I: "*Scattering Reactions, Internal Structure of Baryons, Gauge Theories and QCD*"; Talk II: "*Perturbative QCD (Deep Inelastic Scattering, Drell-Yan Processes, and Small-x Physics)";* Talk III: "*Nonperturbative QCD (Lattice Calculations, QCD Sum Rules, and Phenomenological Models)".* The lectures are prepared in Power Point.

- A Special Talk on "*Instanton in AdS_4/CFT_3 Correspondence*" at the string theory group, INFN, June 2009, Italy- Participating in the special Annual International "Strings 2009" conference there.

- Talk (invited) on "*Instantons of AdS_4/CFT_3 Duality*" at Physic Department, Sharif University of Technology, Tehran, Iran, March 10, 2015.

- Conference Talk titled: "*Non-Supersymmetric Instantons in CFT_3 from Massive and Tachyonic Pseudoscalars in AdS_4*" , National Conference on Physics and Its Applications, Malayer University, Hamedan, Iran, 28 Jan (2016).

- Conference Talk titled: " *Unstable Massive (pseudo)Scalars in AdS_4 with Backreaction and Dual Solutions in the Boundary $U(N)/O(N)$Vector Models* " , The 8th National Conference on Physics, Payame Noor University (PNU) , Shiraz, Iran, 10-11 May (2017).

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Conference Proceedings (in Farsi):

- M. Naghdi, "*An $U(1)$ Instanton in the ABJM Model*", 19th Spring Physics Conference, IPM, Tehran, Iran, 16-17 May (2012).
- M. Naghdi, "*Solitons and Instantons in a Model of AdS_4/CFT_3 Correspondence*", Annual Physics Conference of Iran, Yazd University, Yazd, Iran, 27-30 August (2012).
- M. Naghdi, "*Pseudo-Scalar States in AdS_4 from Branes Winding CP^3* ", 20th Spring Physics Conference, IPM, Tehran, Iran, 22-23 May (2013).
- M. Naghdi, "*Localized States in AdS_4 for Marginal Operators on CFT_3*", Annual Physics Conference of Iran, Birjand University, Birjand, Iran, 26-29 August (2013).
- M. Naghdi, "*Localized Objects From M-Branes over $AdS_4 \times S^7/Z_k$*", 22th Spring Physics Conference, IPM, Tehran, Iran, 20-21 May (2015).
- M. Naghdi, "*Strong Nuclear Force: Various Models and Shapes of Nucleon-Nucleon Potential*", National Conference on Physics and Its Applications, Malayer University, Hamedan, Iran, 28 Jan (2016).
- M. Naghdi, "*A Model for Likening Phenomenological Nucleon-Nucleon Potentials*", National Conference on Physics and Its Applications, Malayer University, Hamedan, Iran, 28 Jan (2016).
- M. Naghdi, "*A Truncation of 11-Dimensional Supergravity, Massive Modes in AdS_4, $SO(4)$- Invariant Instantons in CFT_3 and Vacuum Instability*", The 8th National Conference on Physics, Payame Noor University (PNU) , Shiraz, Iran, 10-11 May (2017).

PUBLICATIONS:

Books:

- Solutions to Questions of the Exam for entering to M.Sc. Level in Physics at Iran Universities (the Questions are from Classical Mechanics, Electromagnetism, Special Relativity & Quantum Mechanics, and English Language), Preprint (in Farsi).

Research Projects:

- The theoretical research project "*Solitary Objects in AdS Space, Holography and Applications*", at Ilam University, June 2015 (in Farsi).

Journal Papers:

- M. Naghdi, "*Nucleon-Nucleon Interaction: a Typical/Concise Review*", Phys. Part. Nucl. v. 45 N 6, (2014), (85 pages, Journal IF: 0.619: A Leading Russian Journal), [arXiv: nucl-th/0702078].
- A. Imaanpur, M. Naghdi, "*Dual Instantons in Anti-membranes Theory*", Phys. Rev. D 83, 085025 (2011), (14 pages, Journal IF: 4.964: The Leading Journal in the Field), [arXiv: 1012.2547 [hep-th]].
- M. Naghdi, "*A Monopole Instanton-Like Effect in the ABJM Model*", Int. J. Mod. Phys. A 26, 3259 (2011), (15 pages, Journal IF: 1.799: A High Quality Journal in the Field), [arXiv: 1106.0907 [hep-th]].
- M. Naghdi, "*New Instantons in AdS_4/CFT_3 from D4-Branes Wrapping Some of CP^3*", Phys. Rev. D 88, 026013 (2013), (21 pages, Journal IF: 4.964: The Leading Journal in the Field), [arXiv: 1302.5294 [hep-th]].
- M. Naghdi, "*Marginal Fluctuations as Instantons on M2/D2-Branes*", Eur. Phys. J. C 74, 2826 (2014), (21 pages, Journal IF: 5.436: An European High Quality Journal in the Field), [arXiv: 1302.5534 [hep-th]].
- M. Naghdi, "*Comparing Some Nucleon-Nucleon Potentials*", Phys. Part. Nucl. Lett. v. 11, N4 (2014), (33 pages, Journal IF: 0: A Q2 Russian Journal), [arXiv: 1306.5687 [hep-th]].
- M. Naghdi, "*Dual localized objects from M-branes over $AdS_4 \times S^7/Z_k$*", Class. Quant. Grav. 32, 215018 (2015), (20 pages, Journal IF: 3.168: An IOP (England) High Quality Journal in the Field), [arXiv: 1502.03281 [hep-th]].
- M. Naghdi, "*Non-Minimally Coupled Pseudoscalars in AdS_4 for Instantons in CFT_3*", Class. Quant. Grav. 33, 115005 (2016), (20 pages, Journal IF: 3.168: An IOP (England) High Quality Journal in the Field), [arXiv: 1505.00179 [hep-th]].
- M. Naghdi, "*Massive (pesudo)Scalars in AdS_4, SO(4) Invariant Solutions and Holography* ", Eur. Phys. J. Plus 133, 307 (2018), (20 pages, Journal IF: 2.24: A High Quality Journal in The Field), [arXiv: 1703.02765 [hep-th]].
- M. Naghdi, "A Truncation of 11-Dimensional Supergravity for Fubini-Like Instantons in AdS_4/CFT_3", Accepted in *Fortschritte der Physik/ Progress of Physics*, (19 pages, Journal IF: 3.26: A High Quality Journal in The Field), [arXiv: 1708.02530 [hep-th]].

…………………………… will come as soon as possible ………………………………

Research Statement

M. Naghdi

In 2003 I started studies and researches in theoretical nuclear physics in University of Tehran mainly along with my M.Sc. thesis with Professor Majid Modarres-- Actually, my M.Sc. thesis was on new Nucleon-Nucleon (NN) Interaction potentials and models in phase of theoretical and computational nuclear physics. Recently, I have developed them in the papers:

1. M. Naghdi, "Nucleon-Nucleon Interaction: a Typical/Concise Review", Phys. Part. Nucl. v. 45 N 6, (2014), [arXiv: nucl th/0702078];
2. M. Naghdi, "Comparing Some Nucleon-Nucleon Potentials", Phys. Part. Nucl. Lett. v. 11, N4 (2014), [arXiv: 1306.5687 [hep-th]].

After graduating from M.Sc. and entering Ph.D., I continued my studies in particle physics and gravity. In this way, I self-studied some books on QCD, general relativity and cosmology. My curiosity made me familiar with string theory and in this way I studied some books on group theory, supersymmetry, superstring theory and related topics. Then, I started my researches in the latter phase in Tarbiat Modares University, as my Ph.D. thesis was on non-perturbative effects (solitons and instantons) in field and string theory, in both sides of AdS_4/CFT_3 Correspondence, with the following publications:

3. Imaanpur, M. Naghdi, "Dual Instantons in Anti-membranes Theory", Phys. Rev. D 83, 085025 (2011), [arXiv: 1012.2547 [hep-th]];
4. M. Naghdi, "A Monopole Instanton-Like Effect in the ABJM Model", Int. J. Mod. Phys. A 26, 3259 (2011), [arXiv: 1106.0907].

After that and so far, I have continued that phase with

5. M. Naghdi, "New Instantons in AdS_4 from D4-Branes Wrapping Some of CP^3", Phys. Rev. D 88, 026013 (2013), [arXiv: 1302.5294];
6. M. Naghdi, "Marginal Fluctuations as Instantons on M2/D2-Branes", Eur. Phys. J. C 74, 2826 (2014), [arXiv: 1302.5534 [hep-th]];
7. M. Naghdi, "Dual localized objects from M-branes over $AdS_4 \times S^7/Z_k$", Class. Quant. Grav. 32, 215018 (2015), (20 pages) [arXiv: 1502.03281 [hep-th]].
8. M. Naghdi, "Non-Minimally Coupled Pseudoscalars in AdS_4 for Instantons in CFT_3", Class. Quant. Grav. 33, 115005 (2016), (21 pages) [arXiv: 1505.00179 [hep-th]].
9. M. Naghdi, "Massive (pesudo)Scalars in AdS_4, SO(4) Invariant Solutions and Holography ", Preprint-Under Review, (20 pages) [arXiv: 1703.02765 [hep-th]].
10. M. Naghdi, "A Truncation of 11-Dimensional Supergravity for Fubini-Like Instantons in AdS_4/CFT_3", Preprint-Under Review, (19 pages) [arXiv: 1708.02530 [hep-th]].

Nowadays, I have some related researches at hand, to be completed of course. They include:

-Fundamental string instantons and solutions in Type IIA supergravity on AdS_4/CP^3; Indeed, I have obtained some (unpublished) solutions on gravity sides in this line that need to be explored more.

-M- and D-branes solutions/vacua for the ABJM model; and partially localized objects in AdS_4 from various brane wrapping in S^7/Z_k and CP^3; For these I have many palnned setups and ansatzs at hand.

- A cosmological application of my studies (inflation, quantum tunneling, bounce and so on) is planned to be developed/completed; Indeed, from the 11D truncation I have used, a spontanous symmetry breaking scheme for a (pseudo)scalar in AdS_4 is emerged interstingly; and so it has definite applications to the inflationary/cosmological problems such as bubble nucleating, bouncing, tunneling and other related issues.

-Proposing new truncations of high-dimensional supergravities, and relations between our truncations and Vasiliev's higher spin theories with their dual boundary theories are among my planned studies/researches.

-Going through application of AdS/CFT to superconductry (and Fractional Quantum Hall Effect realization in AdS_4/CFT_3), related to my studies, is of my research interest to be done in a near future.

In General, among my future plans are to work on nuclear-particle and solid-state physical applications of AdS/CFT duality, and string theory in general. Nuclear forces, superconductivity, fractional quantum Hall effects, early universe cosmologies, extra dimensions, flux compactification, standard models, and the building of new models/ideas/proposals in context of superstring theories are my main interests in physical studies/researches.

Faculty of Science
Department of Physics
University of Tarbiat Modares University
Tehran, Iran

Dear Madam/Sir,

This letter is in support of Dr. Mohammad Naghdi's application for the postdoctoral position in your Department. Mohammad was my Ph.D. student back in 2010, and now he is an assistant professor at Ilam University, Ilam, Iran. He has passed graduate courses in quantum field theory, gravitation, and particle physics. In these courses he has ranked well above the average, and in some getting the best score in the class. Mohammad has also taken a course in quantum field theory II with me where he did quite well.

For his thesis he has worked on aspects of AdS/CFT correspondence in the ABJM model. He has studied dual instantons and their nonperturbative effects on the boundary field theory and in the supergravity bulk theory. His work resulted in two papers published in PRD and Int.J.Mod.Phys. A. Mohammad is a very enthusiastic and hard working person, and I strongly recommend his application for getting this position.

Sincerely yours,

Ali Imaanpur
Associate professor of theoretical physics

To whom it may concern,

It is my pleasure to write this letter in support of Dr. Mohammad Naghdi's application.

Mohammad was a PhD student in Tarbiat-Modarres University, Tehran, Iran whom received his PhD on 2011 under supervision of Prof. Ali Imaanpur. I know him due to his participations in activities of my institute (IPM) during the period he was a PhD student.

Actually I should say as far as I know him, he is very serious, hard worker and well motivated. Of course I should admit that his education was not as good as a world class PhD student. Nevertheless he has been able to gradually increase his knowledge mainly due to his hard working. I think so far he has made very good progress though he needs more time to compete good researchers in Europe or US. Actually I must say that whatever he has achieved so far is, indeed, indebted to himself.

You might already notice that his PhD has taken about 6 years that is little bit longer than that of a typical student in Iran, This is many because he had to learn several subjects almost himself. He could learn several areas in higher energy physics such as QG plasma, gravity, gauge/gravity duality and topological field theory. This in turns proved that he could learn and follow different areas in our field.

So far he has published eight papers and two preprints, nine of them is single author. This in turns shows that he could work independently though it might also indicate that he couldn't collaborate with people. I should say he was working alone mainly because he couldn't find collaborators in the place he is, otherwise he could really collaborate with other people.

Personally he is really a nice guy and has an extremely pleasant personality with a friendly relationship.

As the conclusion I think he has a potential to be a reasonably good physicist and therefore I would like to recommend him for a postdoc position at your institute.

Yours sincerely,
Mohsen Alishahiha

Professor of Physics,
Deputy Director
Institute for Studies in
Theoretical Physics and Mathematics (IPM),
P. O. Box 5531,
Tehran 19395, IRAN

Ogundare, Rasheed Toyin

Address		**Email** ogundarerasheed23@gmail.com (update 2018/05/15)	
250, Ope ilu Road, Agbado Railway Station, Ogun St Lagos, Lagos 110001 Nigeria		**Home Phone** (234) 07034677640 **Cell Phone** (234) 07034677640 **Office Phone** (234) 07034677640	
Current Title / Dates	Graduate Assistant		
Current Institution	Department of Physics, University of Lagos, Akoka.	**Department**	Physics
Location	Lagos, Lagos 110001, Nigeria		
Highest Degree	MS	**Institution** University of Lagos, Akoka	**Date** 2018/05
Research Interests	**Primary** Theoretical Physics		
Secondary	Condensed Matter Physics; Nuclear Physics		
Discipline(s)	Astrophysics; Atmospheric Dynamics; Atmospheric Sciences; Biophysics; Biotechnology; Computational Biophysics; Computational Bioscience & Engineering; Computational Science and Engineering; Condensed Matter and Statistical Physics; Condensed Matter Physics; Cosmology/Particle Astrophysics; Geophysics; Geosciences or Atmospheric Sciences; High Energy Physics; High-Performance Computing; Materials Science; Mathematical Physics; Natural Sciences; Nuclear Physics; photonics; Physics; Quantum Computing; quantum gravity/quantum cosmology; Quantum Information Science; Quantum Optics; quantum statistical physics; Statistical and Biological Physics; tectonophysics; Theoretical Physics; Thermal-Fluid Sciences; Applied Physics		
Position(s) applied	PHD		
1. Prof. Amidu O. Mustapha, Federal University of Agriculture, Abeokuta, amidumustapha92@gmail.com (2018/05/15) ‡			
2. Dr Vitalis C. Ozebo, University of Lagos, Akoka, chidiozebo29@gmail.com (2018/05/15) ‡			
Received Materials	**PHD**	**Curriculum Vitae:** file (PDF, PDF 2019/01/02) **Research Statement:** file (PDF, PDF 2019/01/02) **Copies of grades transcripts:** file (PDF, PDF 2019/01/02)	

CURRICULUM VITAE

Name: **OGUNDARE, RASHEED TOYIN**
Gender: Male
Date of Birth / Place of Birth: 23rd March, 1989 / Agbado Station
Nationality: Nigerian
State of Origin / Local Government: Ogun State / Ifo L.G.A.
Marital Status: Single
Current Postal Address: Department of Physics, Faculty of Science, UNILAG
Telephone: +234(0)7034677640, +234(0)7015511257
E-mail Address: ogundarerasheed23@gmail.com
Permanent Home Address: 250, Ope-ilu Road, Agbado Station, Ogun State, Nigeria

CAREER OBJECTIVES

I will strive relentlessly for excellence towards achieving the organization set goals that gives opportunity for creativity, team work & personal development. This helps to exhibit every quality embedded in me through my sense of empathy, persuasiveness and responsibility where human effort is well appreciated.

INSTITUTIONS ATTENDED WITH DATE

- University of Lagos, Akoka, Lagos State (UNILAG) **2017**
- Federal University of Agriculture, Abeokuta, Ogun State (FUNAAB) **2014**
- Agbado District Comprehensive High School, Ogun State **2008**
- Golden Child Private School, Idi-Ope, Ogun State **2001**

EDUCATIONAL QUALIFICATIONS

- M.Sc.(Hons.) in Physics, **Distinction** **December, 2017**
- B.Sc.(Hons.) in Physics, **Second Class Upper** **January, 2014**
- Senior School Certificate Examination **December, 2008**
- Primary School Leaving Certificate **July, 2001**

OTHER CERTIFICATES

- National Youth Service Corps (NYSC)
- Certificate of Excellence Awarded by Impact
- Certificate of Participation Awarded by Ignite 180
- Microsoft Office Packages (Word, Excel, Corel draw and Power point)

RESEARCH SEMINAR TALKS

- November, 2013 **Applied Physics Seminar**, *Federal University of Agriculture, Abeokuta, Nigeria:* Theoretical Approach for the Optimization of Thermal Conductivity of Clay Using Some Selected Metals as A Case Study

DETAILS OF PUBLICATIONS

I. Thesis/Dissertation

1. **Ogundare, R.T. (2014).** Determination of Thermal Conductivity of Clay, B.Sc. Project, Federal University of Agriculture, Abeokuta, Nigeria
2. **Ogundare, R.T. (2017).** Adaptive Control for Synchronization of Chaotic and Hyperchaotic Lorenz System Using a Single Variable Control, M.Sc. Project, University of Lagos, Akoka, Nigeria

II. Publication in Learned Journals

1. Bello R. and **Ogundare R.T. (2018),** Determination of thermal conductivities of some metal materials and clay, **Physical Science 19(3): 1-8, 2018;** Published by Physical Science International Journal(PSIJ), DOI: 10.9734/PSIJ/2018/42962

III. Journals accepted for publications

1. Synchronization in Nonlinear Oscillators Using a Single Variable Control: Theory and Experiment, ***NONLINEAR DYNAMICS*** **Under Review**

WORK EXPERIENCE WITH DATE

- Joint Universities Preliminary Examination Board (JUPEB), UNILAG Chapter
  Post Held: Physics Practical Instructor **August, 2016 - June, 2018**
- Distance Learning Institute, University of Lagos
  Post Held: Assistant Invigilator **2016/2017 Session**
- Olumowayo College, Agbado Railway Station, Ogun State
  Post Held: Physics and Furthermathamatics Teacher **August, 2015-December, 2015**
- Imo State University, Owerri (N.Y.S.C.)
  Post Held: Graduate Assistant **March, 2014 - February 2015**
- Top Grade High School, Al-Maruof Bus Stop, Ogun State
  Post Held: Physics & Mathematics Teacher **September, 2013 - February, 2014**

PUBLIC WORK & VOLUNTARY SERVICE

- Tutorial Coord. for Postgraduate Physics Student, UNILAG **Jan. 2016- June, 2017**
- Tutorial Coordinator for NAPS, FUNAAB Chapter **Sept., 2010-Dec., 2013**
- A/Presiding Officer, Independent National Electoral Commission **2015 Election**
- Member of Red Cross, Imo state Chapter **March 2014 - January 2015**

MEMBERSHIP OF PROFESSIONAL BODIES

- ***Member*** of Nigerian Institute of Physics (NIP) **Since October, 2016**
- ***Member*** of The Institute of Physics (IOP) **Since March, 2013**

ACADEMICS AND LEADERSHIP EXPERIENCE

- ***Class Governor*****,** Postgraduate Physics Students, UNILAG **2015/2016 Session**
- ***Librarian***, National Association of Physics Student, FUNAAB **2013/2014 Session**
- ***Social Prefect***, Oke-Aro Comprehensive High School **2006/2007 Session**

- ***Head Boy***, Golden Child Private School, Ogun State **2000/2001 Session**

LEADERSHIP TRAINING /CONFERENCES /SEMINAR /WORKSHOP ATTENDED

- Certificate of participation at the Nigerian Institute of Physics (39th Annual Conference) held at Crawford University, Nigeria **10th-14th October, 2016**
- Certificate of participation in Active Learning in Optics and Photonics (ALOP) by International Centre for Theoretical Physics (ICTP), Nigeria **25th-29th April, 2016**
- Conference on the role of Light and Light-Based Technologies **March, 2016**
- Certificate of participation of Leadership Training Programmes/Convention by MCAN, South-East Zone, Nigeria **October, 2014**
- 3rd General Assembly/Conference of Nigerian Young Academy held at University of Ibadan, Nigeria **2nd-4th July, 2013**
- Workshop on Industrial/Oilfield Health, Safety & Environmental Management by MMC Management Consulting **April, 2012**

EXTRA-CURRICULAR ACTIVITIES: Reading & Research, Surfing the internet and Sports

AWARDS AND PRIZES AT THE UNIVERSITY

- Best Postgraduate Physics Student, UNILAG Chapter **2015/2016 Session**
- Best Jambite Student Awarded by NAPS, FUNAAB Chapter **2009/2010 Session**
- Brain and Brawn Student Awarded by NAPS, FUNAAB Chapter **2010/2011 Session**

SOFTWARES

MATLAB, LATEX, C++ (Intermediate)

REFEREES

PROF. AMIDU O. MUSTAPHA
Federal University of Agriculture, Abeokuta
Professor and Dean, College of Physical Sciences
E-mail: amidumustapha92@gmail.com **Tel.**: +2348069314602

DR. VITALIS C. OZEBO
University of Lagos, Akoka, Lagos
Reader, Department of Physics
E-mail: chidiozebo29@gmail.com **Tel.**: +2348066515057

DR. OLASUNKANMI I. OLUSOLA
University of Lagos, Akoka, Lagos
Reader, Department of Physics
E-mail: olasunkanmii2000@gmail.com **Tel.**: +2348034778641

MOTIVATION LETTER FOR GRADUATE STUDIES BY OGUNDARE RASHEED T.

I am a candidate applying for Ph.D. in your reputable institution. My research and teaching experiences have helped in building my interest in academics. I was awarded B.Sc. (Hons.) degree in Physics by the Department of Physics at the Federal University of Agriculture, Abeokuta (FUNAAB), Nigeria in January 2014. I have had a very strong aspiration and inclination for learning new things, since my childhood days. This ultimately became a routine for me and not only as a conventional practice but also affecting my point of view towards a lot of issues. This has motivated me to continually improve my academic competences. I completed my Master degree at the University of Lagos, Akoka, Nigeria (also known as University of first choice, Nation's pride) in December 2017, where I graduated as the best student with a Distinction grade (CGPA 4.5 of 5.0) and I was elected as the Graduate Class Governor of my department during my studies. In this regard, getting this Ph.D. admission offer is a right step towards my future goal of personal-development in academia.

I have applied for my Ph.D. degree program in your institution, not only because of my strong interest in research but because we have little time for research work and lack of adequate facilities here in my country. In my graduate study in Theoretical and Computational physics, I developed a range of skills. My research experience includes using LATEX and MATLAB (Matrix Laboratory) for simulation methods. I am currently learning Python and also wish to continue my studies in your great institution in order to learn more.

As a member of the Institute of Physics, I also attended the Nigerian Institute of Physics conference organized annually. I similarly have extensive teaching experience in the Department of Mathematics at the Imo State University, Owerri, Imo State, Nigeria, through the various assistance which I rendered to the Lecturers and the Head of Department.

Notwithstanding, the self-satisfaction I received from this challenging experience of organizing and teaching several non-profit tutorial classes as well as spear-heading research deliberations amidst the students has further bolstered my resolve for a Postgraduate study. The day-to-day interactions I had with my team members coupled with my tenure as Librarian of the Departmental Society also helped with my interpersonal and communication skills. Having also been appointed right from my third year during my Undergraduate years as the departmental Librarian and also Director of studies, a specialized committee of 20 members designated for academics and research amidst the students, my desire to learn by teaching and research has strengthened over the years.

Ordinarily, I cultivated an intense interest in Mathematics and Sciences in my elementary school days. Sometimes termed as the "gymnastics of logical thinking", they all naturally became my central focus of study as I achieved consistently exceptional scores in every final-term examination, earning the nickname of "Science prodigy".

During my Undergraduate and Master years, I offered and had 'A and B' grades in each of the following specialized courses; Mathematical Physics, Computational Physics, Introductory to Computer Programming, Quantum Mechanics, Advanced Electrodynamics, Classical Mechanics, Statistical Physics, Nuclear Physics, Electromagnetism, Theory of Remote Sensing, Electronics, Solid State Physics, Geophysics, etc. I won the best student prize in Physics at graduation. Here, I belong to the Theoretical Physics Research Group at the University of Lagos. One of the reasons I like this area of research is that it involves Advanced Computational and Theoretical Method which I did in my degrees.

Moreover, I am aware that I am bound to encounter a series of challenges and difficulties in my future academic pursuit abroad. I have to learn a great variety of theories, experiments, and knowledge in my chosen field on one hand, and face fierce competitions on the other. It is conceivable that I will come under significant psychological pressure. But I am equally convinced that, by availing myself of the excellent intellectual environment and laboratory facilities of your esteemed University, closely following and grasping the most sophisticated computer technology, I will be able to achieve constant improvement of my abilities on both the theoretical and experimental levels. I have the implicit belief that the efforts that I undertake today will "resound" with lasting echoes in my future endeavors. Having decided that I will engage in the pursuit of a career in research, I am fully aware of the required dedication, resilience and resolve it calls for. I am confident that I have the necessary drive, intellectual competence, and requisite skills to succeed in the programme.

Consequently, I believe that by putting my analytical skills and previous work and research experience into optimal use, I will be a valuable addition to the on-going advancement of industrial remediation technologies in such a prestigious university where the best minds from around the world collaboratively tackle the biggest problems. Being an international student, I also hope to learn about new cultures and increase the diversity of the student body and also improve my country.

Finally, I promise to work very hard so as to be grounded and excel in modeling and computation. I strongly believe that this Ph.D. programme will avail me the opportunity to contribute to the realization of the University's mission and my country through scientific research and publications and become a skilled professional Postgraduate student and to strive relentlessly for excellence towards achieving the organization set goals that gives opportunity for creativity, teamwork and personal skills and being able to exhibit every quality embedded in me to help the organization build a diversified global Technology through my sense of doggedness, persuasiveness, and responsibility where human effort is well appreciated as required. I would be happy to continue my academics programme and research in your great institution. I will be delighted if my application is favorably considered and timely attention is paid to it.

Yours faithfully,

Ogundare Rasheed Toyin

FEDERAL UNIVERSITY OF AGRICULTURE, ABEOKUTA

P.M.B 2240, ABEOKUTA

OFFICE OF THE REGISTRAR

STUDENT'S TRANSCRIPT: 2009/2010 Academic Session

NAME: **OGUNDARE,** Rasheed Toyin
(Surname First)

DATE OF BIRTH: 23rd March, 1989 **NATIONALITY:** Nigerian

STATE OF ORIGIN: Ogun **MATRICULATION NO:** 2009/1932

DEGREE OPTION: Bachelor of Science (Physics)

FIRST SEMESTER: 2009/2010 Academic Session **LEVEL:** 100

Course Code	*Course Title*	*Unit Value*	*Grade Obtained*
PHS 101	General Physics I	3	C
PHS 191	Physics Laboratory I	1	C
MTS 101	Algebra	3	A
MTS 103	Vectors and Geometry	2	A
BIO 101	General Biology I	2	B
BIO 103	Introductory Physiology	2	B
BIO 191	Practical Biology I	1	D
CHM 101	Chemical Principles	3	A
CHM 191	Practical Chemistry I	1	B
GNS 101	Use of English	2	C
GNS 102	Introduction to Nigerian History	1	B
GNS 103	Introduction to Social Problems	2	C

CONFIDENTIAL

Total Semester Units Obtainable - 23
Number of Units Obtained - 23
Grade Point Average (G.P.A.) - 3.91

SECOND SEMESTER

Course Code	*Course Title*	*Unit Value*	*Grade Obtained*
PHS 102	General Physics II	3	A
PHS 192	Physics Laboratory II	1	A
MTS 102	Calculus and Trigonometry	3	A
MTS 104	Mechanics	3	A
BIO 102	General Biology II	2	A
BIO 192	Practical Biology II	1	B
CHM 102	Introduction to Organic Chemistry	2	B
CHM 104	Introduction to Inorganic Chemistry	2	A
CHM 192	Practical Chemistry II	1	D
AEM 102	Principles of Economics	2	C

Total Semester Units Obtainable - 20
Number of Units Obtained - 20
Grade Point Average (G.P.A.) - 4.50
Cummulative Grade Point Average (C.G.P.A.) - 4.19

M. O. Ayanda
Principal Assistant Registrar (Directorate of Academic Affairs, Examinations and Records)

Interpretation of Grade

OLD

Mark	Letter	Grade Point	Mark	Letter	Grade Point
80 and above	A+	5.0	70 - 100%	A	5
75% - 79.9%	A	4.5	60 - 69.9%	B+	4
70% - 74.9%	A--	4.0	50 - 59.9%	B	3
65% - 69.9%	B+	3.5	45 - 49.9%	C	2
60% - 64.9%	B	3.0	40 - 44.9%	D	1
55% - 59.9%	B--	2.5	30 - 39.9%	E	0
50% - 54.9%	C+	2.0	Below 30%	F	0
45% - 49.9%	C	1.5			
40% - 44.9%	C--	1.0			
35% - 39.9%	D	0.5			
30% - 34.9%	E	0.0			
-0% - 29.9%	F	0.0			

NEW

Mark	Letter	Grade Point
70 - 100	A	5
60 - 69	B	4
50 - 59	C	3
45 - 49	D	2
40 - 44	E	1
Below 40	F	0

N.B Any amendment/erasure on this transcript renders it null and void.

FIRST SEMESTER: 2010/2011 Academic Session **LEVEL:** 200

Course Code	*Course Title*	*Unit Value*	*Grade Obtained*
AGE 321	Workshop Practice	2	C
PHS 291	Experimental Physics I	1	B
PHS 251	Introductory Nuclear Physics	3	A
PHS 231	Waves and Optics	3	B
MTS 223	Real Analysis I	3	A
PHS 211	Classical Physics I	2	B
CSC 201	Computer Programming I	3	C
PCP 201	Principles of Crop Production	3	B
STS 201	Elementary Statistics	3	A

CONFIDENTIAL

Total Semester Units Obtainable - 23
Number of Units Obtained - 23
Grade Point Average (G.P.A.) - 4.17

SECOND SEMESTER

Course Code	*Course Title*	*Unit Value*	*Grade Obtained*
PHS 292	Experimental Physics II	1	D
MTS 242	Mathematical Methods I	3	C
PHS 242	Electricity	3	B
PHS 222	Thermal Physics	3	A
GNS 204	Logic and History of Science	2	E
GNS 203	Use of Library	1	B
APH 202	Introduction to Animal Agriculture	3	C
CSC 202	Computer Programming II	3	D
GNS 202	Elements of Politics and Government	1	C
GNS 201	Literature in English	1	D

Total Semester Units Obtainable	-	21
Number of Units Obtained	-	21
Grade Point Average (G.P.A.)	-	3.05
Cummulative Grade Point Average (C.G.P.A.)	-	3.91

FEDERAL UNIVERSITY OF AGRICULTURE
P.M.B. 2240, ABEOKUTA

08 SEP 2014

M. O. Ayanda
Principal Assistant Registrar (Directorate of Academic Affairs, Examinations and Records)

Interpretation of Grade

OLD

Mark	Letter	Grade Point	Mark	Letter	Grade Point
80 and above	A+	5.0	70 - 100%	A	5
75% - 79.9%	A	4.5	60 - 69.9%	B+	4
70% - 74.9%	A--	4.0	50 - 59.9%	B	3
65% - 69.9%	B+	3.5	45 - 49.9%	C	2
60% - 64.9%	B	3.0	40 - 44.9%	D	1
55% - 59.9%	B--	2.5	30 - 39.9%	E	0
50% - 54.9%	C+	2.0	Below 30%	F	0
45% - 49.9%	C	1.5			
40% - 44.9%	C--	1.0			
35% - 39.9%	D	0.5			
30% - 34.9%	E	0.0			
-0% - 29.9%	F	0.0			

NEW

Mark	Letter	Grade Point
70 - 100	A	5
60 - 69	B	4
50 - 59	C	3
45 - 49	D	2
40 - 44	E	1
Below 40	F	0

N.B Any amendment/erasure on this transcript renders it null and void.

FIRST SEMESTER: 2011/2012 Academic Session **LEVEL:** 300

Course Code	*Course Title*	*Unit Value*	*Grade Obtained*
PHS 391	Advanced Physics Laboratory I	1	A
PHS 383	Physical Theory of Remote Sensing	3	A
PHS 361	Introductory Solid State Physics	3	C
PHS 357	Health Physics I	3	A
PHS 341	Electromagnetism	3	A
MTS 342	Mathematical Methods II	3	A
PHS 321	Statistical and Thermal Physics	3	A
PHS 311	Analytical Mechanics I	3	B

CONFIDENTIAL

Total Semester Units Obtainable - 22
Number of Units Obtained - 22
Grade Point Average (G.P.A.) - 4.59

SECOND SEMESTER

Course Code	*Course Title*	*Unit Value*	*Grade Obtained*
PHS 392	Advanced Physics Laboratory II	1	C
PHS 364	Energy and Environment	1	A
PHS 362	Introductory Materials Sciences	3	B
PHS 354	Introductory Nuclear Physics	3	B
PHS 352	Quantum Physics	3	A
PHS 344	Electronics	3	A
PHS 342	Electromagnetic Waves and Optics	3	A
MTS 322	Vectors and Tensors Analysis	2	C

Total Semester Units Obtainable - 19
Number of Units Obtained - 19
Grade Point Average (G.P.A.) - 4.37
Cummulative Grade Point Average (C.G.P.A.) - 4.09

08 SEP 2014
EXAMINATIONS AND RECORDS UNIT
ACADEMIC TRANSCRIPT

M. O. Ayanda
Principal Assistant Registrar (Directorate of Academic Affairs, Examinations and Records)

Interpretation of Grade

OLD

Mark	Letter	Grade Point	Mark	Letter	Grade Point
80 and above	A+	5.0	70 - 100%	A	5
75% - 79.9%	A	4.5	60 - 69.9%	B+	4
70% - 74.9%	A--	4.0	50 - 59.9%	B	3
65% - 69.9%	B+	3.5	45 – 49.9%	C	2
60% - 64.9%	B	3.0	40 - 44.9%	D	1
55% - 59.9%	B--	2.5	30 - 39.9%	E	0
50% - 54.9%	C+	2.0	Below 30%	F	0
45% - 49.9%	C	1.5			
40% - 44.9%	C--	1.0			
35% - 39.9%	D	0.5			
30% - 34.9%	E	0.0			
-0% - 29.9%	F	0.0			

NEW

Mark	Letter	Grade Point
70 - 100	**A**	5
60 - 69	**B**	4
50 - 59	**C**	3
45 - 49	D	2
40 - 44	E	1
Below 40	F	0

N.B Any amendment/erasure on this transcript renders it null and void.

FIRST SEMESTER: 2012/2013 Academic Session **LEVEL:** 400

Course Code	*Course Title*	*Unit Value*	*Grade Obtained*
PHS 473	Computational Physics	3	A
PHS 471	Methods of Mathematical Physics	3	A
PHS 463	Material Science	3	C
PHS 461	Solid State Physics	3	B
PHS 451	Nuclear Physics	3	A
PHS 411	Quantum Mechanics I	3	A

CONFIDENTIAL

Total Semester Units Obtainable - 18
Number of Units Obtained - 18
Grade Point Average (G.P.A.) - 4.50

SECOND SEMESTER

Course Code	*Course Title*	*Unit Value*	*Grade Obtained*
PHS 499	Project	6	A
PHS 472	Methods of Mathematical Physics II	3	B
PHS 468	Semi-Conductor Devices	3	E
PHS 460	X-ray Crystallography and Structural Analysis	3	D
PHS 412	Quantum Mechanics II	3	B
PHS 312	Analytical Mechanics II	3	E

Total Semester Units Obtainable	-	21
Number of Units Obtained	-	21
Grade Point Average (G.P.A.)	-	3.14
Cumulative Grade Point Average (C.G.P.A.)	-	4.02

PASSED, WITH SECOND CLASS UPPER DIVISION

08 SEP 2014

EXAMINATIONS AND RECORDS UNIT

M. O. Ayanda,
Principal Assistant Registrar (Directorate of Academic Affairs, Examinations and Records)

Interpretation of Grade

OLD

Mark	Letter	Grade Point	Mark	Letter	Grade Point
80 and above	A+	5.0	70 - 100%	A	5
75% - 79.9%	A	4.5	60 - 69.9%	B+	4
70% - 74.9%	A--	4.0	50 - 59.9%	B	3
65% - 69.9%	B+	3.5	45 – 49.9%	C	2
60% - 64.9%	B	3.0	40 - 44.9%	D	1
55% - 59.9%	B--	2.5	30 - 39.9%	E	0
50% - 54.9%	C+	2.0	Below 30%	F	0
45% - 49.9%	C	1.5			
40% - 44.9%	C--	1.0			
35% - 39.9%	D	0.5			
30% - 34.9%	E	0.0			
-0% - 29.9%	F	0.0			

NEW

Mark	Letter	Grade Point
70 - 100	A	5
60 - 69	B	4
50 - 59	C	3
45 - 49	D	2
40 - 44	E	1
Below 40	F	0

N.B Any amendment/erasure on this transcript renders it null and void.

UNIVERSITY OF LAGOS
LAGOS, NIGERIA

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07044607904; 07010738836;
07010738800, 012802420, 012802421

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E-mail: records@unilag.edu.ng

Ref No.: 8 / 0 0 0 1 7

RECORDS OFFICE

Date:

IN DEED AND IN TRUTH

ACADEMIC TRANSCRIPT

MATRIC NO:	159076001
NAME:	OGUNDARE, RASHEED TOYIN
DATE OF BIRTH:	23, March 1989
NATIONALITY:	Nigerian
SEX:	Male
FACULTY:	SCIENCE
DEPARTMENT:	PHYSICS
MODE OF STUDY:	Full Time
YEAR OF ADMISSION:	2015/2016
YEARS OF ATTENDANCE:	2015/2016-2015/2016
SCHOLARSHIP/FELLOWSHIP:	
DEGREE AWARDED:	Master of Science in Physics with Distinction
YEAR OF AWARD:	2015/2016

EXAMINATION RESULTS

COURSE CODE	COURSE TITLE	CREDIT UNIT	GRADE	GRADE POINT	CUMMULATIVE GPA
SESSION:2015/2016	Master of Science in Physics				
PHS803	Advanced Electrodynamics	4	A	5.0	
PHS804	Instrumentation	3	C	3.0	
PHS841	Quantum Theory I	3	A	5.0	
PHS871	Geophysics I	2	A	5.0	
PHS801	Advanced Electronics And Experimental Me .	4	B	4.0	
PHS802	Computational Methods In Physics	4	B	4.0	
PHS881	Seminar I	2	A	5.0	
PHS882	Research Project	6	A	5.0	
					4.50

Mr. Abolade A. Akinwunmi
Principal Assist. Registrar (RECORDS OFFICE)

RECORDS OFFICER
UNIVERSITY OF LAGOS

076001 OGUNDARE, RASHEED TOYIN

KEY TO DEGREE CLASSIFICATION

4.5 & Above	Distinction
2.4 - 4.49	Pass

KEY TO GRADES

1969 - 1996

80 & Above	A+	5.0
75 - 79	A	4.5
70 - 74	A-	4.0
65 - 69	B+	3.5
60 - 64	B	3.0
55 - 59	B-	2.5
50 - 54	C+	2.0
45 - 49	C	1.5
40 - 44	C-	1.0
35 - 39	D	0.5
Below 35	F	0.0

1997 to date

70 & Above	A	5.0
60 - 69	B	4.0
50 - 59	C	3.0
45 - 49	D	2.0
40 - 44	E	1.0
0 - 39	F	0.0

8/00017

Seifi, Aslan

Address		**Email** aslan.seifi@gmail.com (update 2019/01/12)	
Azadi Ave, Sharif University Of Technology Tehran, Tehran 19166 Iran, The Islamic Republic of		**Home Phone** (+98) 9168546508 **Cell Phone** (+98) 9167546508 **Office Phone**	
Current Institution	Sharif University of Technology	**Department**	
Location	Azadi Ave, Sharif University Of Technology, Tehran, Tehran 19166, Iran, The Islamic Republic of		
Highest Degree	MS	**Institution** Sharif University of Technology	**Date** 2019/01
Thesis Advisor	Mahdi Torabian		
Thesis Title	Modern approaches to scattering amplitude		
Research Interests	**Primary** Higgs physics		
Secondary	Top quark, electroweak gauge bosons and QCD; Flavour physics		
Discipline(s)	Physics; quantum gravity/quantum cosmology; Quantum Gravity; Particle and Astroparticle Phenomenology		
Position(s) applied	PHD		
1. Mahdi Torabian, Sharif University of Technology, mahdi@physics.sharif.ir (2019/01/12)			file (PDF, PDF, 2019/01/12)
2. Hessamoddin Arfaei, Sharif University of Technology, arfaei@sharif.edu (2019/01/12)			file (PDF, PDF, 2019/01/15)
Received Materials	**PHD**	**Cover Letter:** file (PDF, PDF 2019/01/15) **Curriculum Vitae:** file (PDF, PDF 2019/01/15) **Research Statement:** file (PDF, PDF 2019/01/15) **Copies of grades transcripts:** file (PDF, PDF 2019/01/15)	

Aslan Seifi

Sharif University of Technology
(+98)922-789-712-3
aslan.seifi@gmail.com

Dear Sir or Madam,

I am writing to apply for the Ph.D. position in theoretical particle physics, Karlsruhe Institute of Technology. I am currently an MSc student at the department of physics, Sharif University of Technology. I am working on a dissertation under the supervision of Dr. Mahdi Torabian. I believe that my research experience and background make me an appropriate candidate for the position.

As an M.Sc. student, I obtained valuable experiences in theoretical and high energy physics. First, I study UV completion of massive gravity. Throughout this project, I learned how we could gain information about UV physics by analyzing scattering amplitudes of different modes of massive gravity. There are powerful constraints which stem from unitarity and analyticity of S-matrix. These constraints determine the regime of validity of free parameters of Lagrangians. In addition, I really perceived the tedious calculations of quantum field theory by traditional off-shell methods. This was my main reason to start learning about modern approaches to scattering amplitudes.

Contemporary methods of scattering amplitudes are based on on-shell calculations. This scenario is very useful because we just deal with real particles not virtual as in field theory. Furthermore, in the modern approaches, we just work on the final observable_ S-matrix_ which just depends on the Mandelstam variables. Then, some notions such as fields and gauges are considered as redundancies in this new method. Recently, besides the developing mathematical structure of scattering amplitude, its applications have got many attentions in effective field theories, astrophysics, and cosmology. During this experience, I have learned the techniques for calculating both tree and loop amplitudes. I also became familiar with the color-kinematics duality which relates the scattering amplitudes of gauge theory to gravity.

Based on these two research experiences, I have an eagerness to learn and research more on the high energy and theoretical physics. Specifically, I am interested in particle physics phenomenology, theoretical cosmology, physics beyond the Standard Model, and black hole physics. I like to do my Ph.D. in one of these research areas. I believe a theoretical physicist should have research experiences in all those areas to achieve a general point of view for solving theoretical problems. Hence, I believe I have to go beyond master's degree to achieve my goals. I believe the world-leading theoretical researchers at the KIT can provide me with a fantastic opportunity to deepen my knowledge in high energy and theoretical physics and do world-class research.

Sincerely,

Aslan Seifi

Aslan Seifi

Birth Date: 13/10/1993
Address: Sharif University of Technology, Azadi Ave.

E-mail : aslan.seifi@gmail.com
aslan.seifi@physics.sharif.edu
Cell No.: +98-916 754 6508

Education

- **M.Sc. in High Energy Physics** — Tehran, Iran
  Sharif University of Technology — *2016-2018*
  - Expected Graduation Date: **September 2018**
  - Grade Point Average (to date): **17.61/20**
- **B.Sc. in Physics** — Tehran, Iran
  University of Tehran — *2014-2016*
  - Grade Point Average : **17.07/20**
- **Starting the studying of mechanical engineering and changing my major to physics** — Tehran, Iran
  University of Tehran — *2012-2014*
  - Grade Point Average : **17.80/20**
- **High School Diploma in Mathematics and Physics** — Behbahan, Iran
  Rasoul Akram High School — *2011-2012*
  - Grade Point Average : **19.90/20**

Research and Scientific interests

- **Scattering Amplitude**, On-shell calculation of scattering amplitude and its mathematical structure.
- **Quantum gravity and black hole thermodynamics**, Understanding quantum gravity by black hole entropy.
- **Quantum Field Theory and Physics beyond the Standard Model**, Phenomenology of particle physics and building consistent theories with the framework of QFT.
- **Modified Gravity**, Modification of General Relativity and consequences to Cosmology

Research Experiences

- **Effective Field Theory and Scattering Amplitude** — M.Sc. in High Energy Physics
  supervised by Prof. M. Torabian — *Dec. 2017-Present*

Summary

- Calculation the velocity and loop corrections to the classical counterpart of Sommerfeld enhancement by means of the contemporary tools of S-matrix theory.
- Tackling the vDVZ discontinuity in massive gravity by deriving the massive gravity amplitude from color-kinematic duality.
- calculation the coupling constant in the EFT of extenden objects by the S-matrix theory.

–

Studying the Loranz invariant massive gravity and its UV completion.
Supervised by ***Prof. M. Torabian*** *Dec. 2016-Nov. 2017*

Summary

- Improving the high-energy cut-off of the scalar mode of massive gravity (Galileon) by the expansion of the refrence metric from $(m^2 M_{pl})^{1/3}$ to $(mM_{pl})^{1/2}$.

–

Reviewing Key Concepts in String Theory
B.Sc. thesis, supervised by ***Prof. H. Ebrahim*** *Jun. 2015-Jan. 2016*

–

Research Assistance at Superconductivity Lab
Supervised by ***Prof. M. Mohammadizadeh*** *Sep. 2014-Feb. 2015*

Summary

- Makin the high-temperature superconductor, YBa2Cu3O7, in the superconductivity lab to demonstrate the quantum locking effect.

Teaching and Working Experiences

–

Teaching assistance, QFT II (Ph.D. cource)
Prof. M. Torabian *Fall 2017*

–

Teaching assistance, Group Theory (M.Sc. cource)
Prof. L. Memarzadeh *Fall 2017*

–

Teaching assistance, Mathematical Physics II
Prof. L. Memarzadeh *Spring 2017*

–

Teaching assistance, General Physics I
Prof. M. Mohammadizadeh *Fall 2014*
During this course I was responsible to set up funny experiments for students like the work of Walter Lewin at MIT.

–

Managing a Workshop for World Science Day 2014
Prof. M. Mohammadizadeh *Fall 2014*
I set up an experiment for the demonstration of quantum levitation and quantum locking- a cheap version of [https://www.ted.com/talks/boaz_almog_levitates_a_superconductor
] in the Ted talks.

Selected Course Projects

- **Advanced general relativity project**
  Supervised by ***Prof. S. Baghram*** *Spring 2017*
  Solving perturbatively Einstein equation in FRW background with the presence of gravitational waves.

- **Advanced cosmology project**
  Supervised by ***Prof. A. A. Abolhassani*** *Fall 2016*
  Reviewing important articles about cosmological constant problem and some suggested solutions.

- **Computer in physics**
  Supervised by ***Prof. M. Vaez*** *Spring 2015*
  Using VMD software for visualization molecular dynamic.

Selected Courses

Advanced courses

- QFT I 20/20
- QFT II 18.5/20
  I studied for the above courses The Quantum Theory Of Fields By Steven Weinberg (Vol I and some chapters of II).
- General Relativity 19/20

B.Sc. courses

- Mathematical Physics II 20/20
- Quantum Mechanic III 18/20
- Computer in Physics 18/20
- Special Relativity 17.5/20
- Quantum Mechanic I 17.75/20

Talks and Lectures

- **Cosmology Seminar**
  Nov. 2018
  Application of the modern approaches in scattering amplitude in cosmology and astrophysics. (http://physics.sharif.edu/$\sim$ $cosmology/?p = 1743$)

–

High Energy Journal Club

Oct. 2018

Color-Kinematic duaity and its applications in gravitational radiation

–

High Energy Journal Club

Jun. 2018

Introduction to the modern scattering amplitude II (massive amplitudes, generalized unitarity and loop amplitudes, supersymmetry, Higgs mechanism in the language of the scattering amplitude)

–

High Energy Journal Club

Jun. 2018

Introduction to the modern scattering amplitude I (massless amplitudes, recursion relations).

–

High Energy Seminar

May 2018

Scattring amplitude in massive gravity (http://physics.sharif.edu/$\sim$ *hep/Seminars.html*).

Papers and Publications

- "**Sommerfeld Enhancement and Scattering Amplitude**", to be submitted.
- "**Derivation the coefficients of an effective field theory of extended objects by the scattering amplitude**", in preparation.
- "**vDVZ discontinuity and color-kinematic duality**", in preparation.

Honors and Awards

–

Aug. 2016

Ranked **13rd** in the Nationwide University Qualification Test for Master Degree in Physics, among more than 13,000 participants.

–

Jun. 2016

Ranked **third** among 50 physics student of the class of 2012, Department of physics, University of Tehran.

–

Aug. 2012

Ranked **226th** in the Nationwide University Qualification Test, among more than 360,000 participants (Ranked **84th** among more than 100,000 participants in educationally underprivileged region).

–

Ranked **first** among about 50 students of major ”Math and Physics”, Rasoul Akram Pre-University, Behbahan, Iran. *Jun. 2012*

Computer Skills

Programming Languaues

– C++
– Mathematica

Software Skill

– Matlab & Simulink
– xAct package
– LaTeX
– Microsoft Office
– VMD

Language Proficiency and GRE exams

– Persian (native)
– English (fluent)
– TOEFL iBT : 101/120, **R**:30, **L**:27, **S**:19, **W**:25
– GRE General: Analytical Writing 3/6, Verbal 140/170, Quant. 167/170
– GRE Subject: 920/990 (87%)

Hobbis

– Football
– Ping-Pong
– Swimming
– Watching movie
– Gym
– Watching Soccer (specifically England Premier League)

Refrences

- Professor **M. Torabian**, Assitance Professor of Physics, Sharif University of Technology, Tehran, Iran. e-mail: mahdi@physics.sharif.ir
- Professor **H. Arfaei**, Professor of Physics, Sharif University of Technology, Tehran, Iran. e-mail: arfaei@.sharif.edu
- Professor **S. Baghram**, Assistant Professor of Physics, Sharif University of Technology, Tehran, Iran. e-mail: baghram@sharif.edu
- Professor **M. Mohammadizadeh**, Associate Professor of Physics, University of Tehran, Tehran, Iran. e-mail: zadeh@ut.ac.ir
- Professor **F. Shojai**, Associate Professor of Physics, University of Tehran, Tehran, Iran. e-mail: fshojai@ut.ac.ir

Research Statement

Aslan Seifi

Upon succeeding in the *Nationwide University Qualification Test (Konkur),* I started my studies at the *University of Tehran* as an undergraduate Mechanical Engineering student. My primary interest was physics, not engineering. Since it is common in Iran for the students who get a good score in the Konkur to choose an engineering major, I did the same. However, after three semesters, I wasn't satisfied with mechanical engineering. My real passion had always been physics. In my view, physics is so challenging than engineering and needs more creativity. Although my family persisted that it would be better for my future to stay in engineering, I was determined to study physics.

As a physics student, I could immediately tell that I really enjoyed physics. At the time, I didn't know in which area of physics I was really interested in. So, I passed many courses ranging from cosmology, optics, condensed matter, solid state lab, programming in physics. My first research experience was in the superconductivity lab. I worked there for six months and made a high-temperature superconductor (YBa2Cu3O7) under the supervision of Prof. Mohammadizade. We wanted to set up an experiment to demonstrate quantum locking, but since the superconductor was too expensive, we started to make it in our lab by the Solid State Method. I got valuable experiences such as working with liquid nitrogen, synthesizing a mixture of metals by heating. At the same time, under the supervision of Prof. Mohammadizade, I was responsible for setting up fun experiments for the freshmen like the work of Walter Lewin at MIT. In the last year of my undergraduate studies, I gradually got interested in theoretical physics after passing some intriguing courses, such as group theory, relativistic quantum mechanics, and cosmology. I also read the first part of the string theory book by Zweibach under the supervision of Prof. Ebrahim as my undergraduate project. But, I was still confused in which area of theoretical physics I wanted to do research.

After completing my undergrad, I participated in the Nationwide Graduate Qualifying Exam and ranked 13th among more than 10 000 students in Iran. In my first semester as a graduate student, I took the QFT course. I decided to study the QFT from an advanced textbook since I was already familiar with it. I chose ''The Quantum Theory of Field'' by Steven Weinberg. This book was a turning point in my life and impressed me a lot. For example, it was so exciting that with some simple assumptions such as causality and group theory, one can derive fundamental equations in physics such as Dirac's equation. I was then convinced to become a theoretical physicist. I started my research as an M.Sc. student under the supervision of Prof. M. Torabian.

My first research experience as a graduate student was about massive gravity. We studied a model that if it breaks spontaneously, it generates the Lagrangian's terms of massive gravity plus a new degree of freedom (dof). We expected that this dof – like the Higgs boson in weak interaction- raises the cut-off of massive gravity (the cut-off is $\Lambda_3=(m^2M_{pl})^{1/3}$, where m is the mass of massive gravity and M_{pl} is the Planck mass). I started to calculate the tree-level amplitudes for different modes of massive gravity at the present of a new dof. To simplify our calculations, instead of going to the unitarity gauge, we interpreted the Stuckelberg fields in massive gravity as Goldston boson and derived the tree-level amplitudes. But, we found that it is impossible by just a dof to raise the cut-off. There is always an interaction that keeps the Λ_3. However, we discovered one non-trivial thing. The Lagrangian of massive gravity is constructed from two metric, dynamical and reference metric. We found that if we expand the reference metric around a background, say flat background; we can improve the cut-off just for the scalar mode of massive gravity. In this case, by using the xAct package of Mathematica, I calculated the tree-level scattering amplitude.

My second research experiment is about the modern approaches in the scattering amplitude. I began to take an interest in this field after reading the article "Scattering Amplitudes for All Masses and Spins" by Arkani-Hamed and Huangs. The philosophy of on-shell calculation is simple and nice. For instance, imposing some simple assumptions such as Lorentz invariance, Locality, and little group scaling, we can fix the three-point amplitudes up to a coupling constant. If a non-relativistic particle passes close to a source of potential, by an effective field theory, we can calculate the bending of that particle from its first trajectory. In the language of effective field theory, we consider the source as a massive particle with a specific angular momentum. For example, if we want to calculate gravity potential between the Sun and Earth, we consider each of them a massive scalar particle. The amplitude of scattering a non-relativistic particle of a potential requires a ladder of Feynman diagrams. Accumulating these Feynman diagrams is equal a coefficient that multiplies to the amplitude of just one Feynman diagram. This coefficient depends on the velocity of the scattered object and is called the enhancement factor, and this process of enhancement is called the Sommerfeld enhancement. Using the methods of modern S-matrix theory, I calculated the velocity and loop corrections to the classical counterpart of Sommerfeld enhancement. Our results were agreement with the results that are calculated with the common methods of Field Theory.

Last summer, Cheung, Rothstein and Solon published a paper "From Scattering Amplitudes to Classical Potentials in the Post-Minkowskian Expansion''. In this paper, they showed how we can determine the coefficients of an effective Lagrangian by on-shell techniques. On-shell results are model-independent, and the results of effective field theory should agree with that. I applied the method of these authors to calculate the constant coefficients of "effective field theory of extended objects." The effective field theory of extended objects virtually was proposed a decade ago by Goldberger and Rothstein. This effective field theory is constituted from the action of point particle plus some functions of Riemann tensor that are proposed to consider the effect of the finite size of objects. At the first level of correction, there are two new terms with two coefficients. I compared the potential between two massive objects up to the one-loop correction with the potential terms in the action. In consequence, I could successfully determine one coefficient in the effective field theory of extended objects. But, another coefficient was not determined, and we are working on it to find why it is not determined through this approach.

Recently, I was interested in the color-kinematic duality. For example, it states that if in the amplitude of the four-gluon, we replace the color factors of the amplitude with the kinematic part, we'll reach the amplitude of four gravitons. It means gravity is a double copy of Yang-Mills theory. In recent years, this duality has applied for numerous problems in the cosmology such as gravitational radiation. We have started to solve a problem in the massive gravity called vDVZ discontinuity that in the language of the on-shell methods, there isn't any solution for that. The origin of the vDVZ discontinuity is the extra scalar mode of massive gravity. This scalar mode contributes to the Newtonian potential, but, it doesn't have any effect on the bending of light. This causes a dilemma. The gravitational coupling is not universal! To solve this dilemma, we put color-kinematic duality as our assumption for the case of massive gravity. We started to calculate the amplitude of massive gluons, then, by color-kinematic duality, we derived the amplitudes of massive gravity. We reached two important results. First, the discontinuity disappeared. Second, the cut-off of the massive gravity was Λ_3, as expected. Actually, the color-kinematic duality puts this constraint on the amplitude, in consequence, the terms that cause this discontinuity don't have any contribution at the high energy limit. However, there is still an unanswered question. As in the paper 1711.03901, we expected that other modes such as dilaton and axion appear after applying the color-kinematic duality, but it didn't and we don't know why and we are working on it to find the reason for the absence of dilaton and axion.

I would like to thank you for considering my application for a Ph.D. position and I am looking forward to becoming a member of your great community.

Sincerely,

Aslan Seifi

In The Name Of God

University of Tehran

Transcript of University Grades

Unofficial

Student No : 610192141
First Name : Aslan
Last Name : Seifi
ID.No : 1850251177
Date of Birth : 1993/10/14

Faculty : SCIENCE
Major : Physics
Total Passed Units : 137
GPA : 17.08
Level : Bachelor
Graduate Date : 2016/07/21

ATLAS 0054979

Transfer Courses Semester — EXCELLENT IN TERM
Semester Status : Normal

Course Title	Credit	Grade	Effect
General Mathematics I	4	19.12	
General Mathematics II	4	19.12	
General Chemistry I	3	18.75	
Basic Physics I	4	18.8	
Basic Physics II	4	18.8	
Differential Equations	3	19.5	
Analytical Mechanics I	4	13.2	
Computer Programming	3	17.5	
Islamic Thought 1 (Beginning and Resurrection)	2	18.5	
Islamic Ethics (Principles and Concepts)	2	19	
Islamic Revolution in Iran	2	15	
Analytical history of beginning Islam	2	20	
Thematic interpretation of the Quran	2	18	
Physical Education	1	17.5	
Persian Language	3	20	
Statics	3	16.27	
Materials Science	3	16.36	

Semester GPA	Registered Unit(s)	Semester Passed Unit(s)	Total Passed Unit(s)	Cumulative GPA
17.96	49	49	49	17.96

Academic Year 2013-2014 2nd. Semester — EXCELLENT IN TERM
Semester Status : Normal

Course Title	Credit	Grade	Effect
Mathematical physics II	4	20	
Thermodynamics	3	16.12	
Analytical Mechanics II	4	16.25	
Thermodynamics and Waves Laboratory	1	18.25	
General Physics Lab II	1	18	
Physical Education II	1	18	
Islamic Thought 2 (Prophethood and Imamat)	2	17.5	

Semester GPA	Registered Unit(s)	Semester Passed Unit(s)	Total Passed Unit(s)	Cumulative GPA
17.66	16	16	65	17.88

Academic Year 2014-2015 1st. Semester
Semester Status : Normal

Course Title	Credit	Grade	Effect
Optics	3	16	
Basic Physics Laboratory I	1	10	
Waves and Vibrations	3	15.75	
Electromagnetism I	4	16	
Mathematical Physics I	4	14.75	
Foreign Language	3	17	
Quantum Mechanics I	4	17.75	

Semester GPA	Registered Unit(s)	Semester Passed Unit(s)	Total Passed Unit(s)	Cumulative GPA
15.92	22	22	87	17.39

Academic Year 2014-2015 2nd. Semester — EXCELLENT IN TERM
Semester Status : Normal

Course Title	Credit	Grade	Effect
Modern Physics Laboratory	2	17.5	
Electromagnetism II	4	9	3
Computer Applications in Physics	3	18	
Quantum Mechanics II	4	17.25	
Relativity	3	17.5	
Fundamental of Standards and Measurements	2	16	

Semester GPA	Registered Unit(s)	Semester Passed Unit(s)	Total Passed Unit(s)	Cumulative GPA
17.32	18	14	101	17.38

Academic Year 2015-2016 1st. Semester
Semester Status : Normal

Course Title	Credit	Grade	Effect
Project	3	19.5	
Technical English	2	16.75	
Statistical Mechanics	3	15	
Fluid Mechanics	3	14.25	
Group Theory	3	14.9	
Quantum Mechanics III	3	18	

Semester GPA	Registered Unit(s)	Semester Passed Unit(s)	Total Passed Unit(s)	Cumulative GPA
16.38	17	17	118	17.23

Academic Year 2015-2016 2nd. Semester
Semester Status : Normal

Course Title	Credit	Grade	Effect
Solid State Physics Laboratory	2	18.75	
Electromagnetism II	4	14.72	
Solid State Physics I	3	11.75	
Optics Laboratory	2	16	
Cosmology	3	17.5	
Introduction to Elementary Par	3	16.9	
Family Schematization and Population	2	20	

Semester GPA	Registered Unit(s)	Semester Passed Unit(s)	Total Passed Unit(s)	Cumulative GPA
16.15	19	19	137	17.08

University of Tehran
UNOFFICIAL

In The Name Of God

University of Tehran

Transcript of University Grades

Unofficial

Academic Status	NOTE:
Full mark is 20 **Last Status : Graduate Date : 2016/07/21**	In "Effect" column: "1", Indicates that the total passed unit(s) is not affected by this course. "2", Indicates that the cumulative gpa is not affected by this course. "3", Indicates that the total passed unit(s) and cumulative gpa are not affected by this course. In "Grade" column the following abbreviations are used: **R** Reported **PD** Permitted drop

GENERAL DIRECTOR OF ACADEMIC AFFAIRS
MOHAMMADALI SHARIFI Ph.D

signed and sealed

NOTE : S/He has commitments with the government of the Islamic Republic of Iran.Should S/He want to continue her/his Studies, S/He is required to obtain an official permission from the Iranian government

Date : 2017/11/15 **NOT VALID WITHOUT SIGNATURE AND SEAL OF REGISTER** END OF TRANSCRIPT

University of Tehran
UNOFFICIAL

SHARIF UNIVERSITY OF TECHNOLOGY

UNOFFICIAL TRANSCRIPT

ISSUED ON: 12-11-2018

LAST NAME: SEIFI
FIRST NAME: ASLAN
B. Y.:1993
B. C. NO.: 1850251177

STUDENT NUMBER: 95203478
DEPT: PHYSICS
PROGRAM: M.Sc. /PHYSICS
MAJOR: -

COURSE NO	COURSE TITLE	UNIT	GRADE
	FALL SEM 2016-2017		
24-343 +	INTRO QUANT FIELD THEO	4	20.0
24-929 *	COSMOLOGY 1	4	17.0
	SEMESTER UNITS, AVERAGE	8	18.50
	TOTAL UNITS GAINED,CUM AV	8	18.50
	SPRING SEM 2016-2017		
24-148 *	GRAV & GEN RELATIVITY 1	4	19.0
24-156 +	THERMODYN & STAT MECH 3	4	15.5
24-341 *	QUANT FIELD THEO PART 1	4	18.5
	SEMESTER UNITS, AVERAGE	12	17.67
	TOTAL UNITS GAINED,CUM AV	20	18.00
	FALL SEM 2017-2018		
24-032 +	MSC THESIS	3	N
24-089 *	DOCTORAL SEMINAR 8	1	20.0
24-216 +	ELECTROMAGNETICS 3	4	15.9
	SEMESTER UNITS, AVERAGE	8	16.72
	TOTAL UNITS GAINED,CUM AV	25	17.74
	SPRING SEM 2017-2018		
24-032 +	MSC THESIS	3	N
24-403 +	ADV PHYS LAB 1	2	16.0
	SEMESTER UNITS, AVERAGE	5	16.00
	TOTAL UNITS GAINED,CUM AV	27	17.61
	SUMMER 2017-2018		
24-032 +	MSC THESIS	0	N
	SEMESTER UNITS, AVERAGE	--	--
	TOTAL UNITS GAINED,CUM AV	27	17.61
	FALL SEM 2018-2019		
24-032 +	MSC THESIS	0	N

COURSE NO	COURSE TITLE	UNIT	GRADE
	FALL SEM 2018-2019 (CONT.)		
	SEMESTER UNITS, AVERAGE	--	--
	TOTAL UNITS GAINED,CUM AV	27	17.61
	TOTAL UNITS GAINED & GPA EXCLUDING COURSES FAILED AND PASSED AFTERWARDS	27	17.61

NO ENTRY BELOW THIS LINE

Abv:	W: Withdraw	J: In Progress	P_EX: Excellent	CR: Credit Received
	P: Pass	I: Incomplete	P_VG: Very Good	NC: No Credit/Project Complete
	F: Fail	N: Not Available	P_GD: Good	EP: Examination Postponed
	D: Dishonesty	\: Make Up Course	P_FA: Fair	=: B Sc./M.Sc. Course
	X: Audited	+: M.Sc.	NP: Not Passed	&: Optional M.Sc./Ph.D. Course
	*: Ph.D.	S: Satisfied	①: Courses of First Major	②: Courses of Second Major
	U: Unsatisfied	WP: Withdraw (Passed State)	WF: Withdraw (Failed State)	R: Research in Progress
	RR: Repeated Course	P_MR: Minimal Requirment		

NOTES:
1- Numerical Grades Range from 0 to 20, Passing Grade is 12
2- Univ & Dept Avg. Based on Last Recorded Sem. are Respectively 16.24,16.24. Dept GPA for this class of students is 16.53.

This unofficial transcript has been issued solely for the student information and possible use for provisional admission to the graduate school. The official transcript will be provided upon the applicant direct request to: ACADEMIC VICE CHANCELLOR, SHARIF UNIVERSITY OF TECH.

NOT VALID WITHOUT SIGNATURE AND EMBOSSED SEAL OF THE REGISTRAR

Sharif University of Technology
Department of Physics

Mahdi Torabian
Assistant Professor
Department of Physics, SUT, Tehran, Iran &
25 December 2018

To the Review Committee:

I am pleased to write a letter of recommendation for Mr. Aslan Seifi to support his application to the graduate school. I have known him for about two years. Aslan has taken three advanced courses with me on Particle Physics and Quantum Field Theory. In all these courses he distinguished himself as an intelligent student, received full mark and thus I would rank her in the top 5% of students that I have thought in the past five years.

Aslan is highly alert, well educated and very hard working. Under my supervision, he is currently studying on-shell methods in scattering theory and application to effective field theories. In a short period, he has made a substantial progress in learning the subject and doing tough computations.

I believe that Aslan is an exceptional candidate for graduate study in theoretical physics. He has proven himself to have required courage and intellectual creativity to successfully complete a PhD program. Therefore, I would strongly recommend him as a PhD candidate in the graduate school.

If I can be of any further assistance, inquiry and detailed information, please do not hesitate to contact me through mahdi@physics.sharif.edu.

Sincerely Yours,
Mahdi Torabian.

Azadi Avenue, Tehran, Iran
P.O.Box: 11155-9161
Postal Code: 1458889694
Tel: 0098-21-66005410, 66029161, 66164501-2
Fax: 0098-21-66022711
E-mail: info@physics.shari.edu

SHARIF UNIVERSITY OF TECHNOLOGY

DEPARTMENT OF PHYSICS,
PO Box 11155-9161,
Azadi Avenue,
Tehran 14588-89694,
Iran

HESSAMADDIN ARFAEI
PROFESSOR OF PHYSICS

Phone: (+98) 21 6616 4505
FAX: (+98) 21 6600 0021
E-mail: arfaei@sharif.edu

Dear members of the selection committee,

I am writing this letter with pleasure and enthusiasm for Mr. Aslan Seifi who is applying to continue his studies towards PhD in your group. First of all I would like to express my strong support for his case. I recommend him very strongly with no hesitations.

I have known Aslan since a year ago as a MSc student , when he started attending my group weekly journal club meetings. He was very active and impressively contributed to our journal club. It was during these meetings that I came to realize his depth of physical knowledge and ability to grasp and analyze new ideas. We have also had several discussions concerning modern developments on the scattering theory and the revival of S-matrix theory. I was very impressed to see how deep and thorough he has learned the subject given that he has had very short time to learn such advanced subject. During my discussions I also had the occasion to observe his depth of understanding of advanced topics in high-energy physics and gravity. He also has strong mathematical ability and skills to excel highly sophisticated theoretical problems.

He is doing research on the S-Matrix theory with our colleague Professor Mahdi Torabian. He has obtained interesting results on Sommerfeld enhancements. They have written an article and I expect it will soon be put on the arXiv.

He is much stronger than our very good students and would rate him among the top five per cent of the students whom I have had.

I have found him a very hard working, highly talented with much enthusiasm for theoretical physics. I am absolutely certain that given the opportunity to join a internationally active group like yours, he will become a strong and well achieved physicist.

I recommend him very strongly with absolutely no hesitations. I am certain that he will be a successful physicist and a strong member in your group.

Hessamaddin Arfaei,

Professor of Physics, Sharif University of Technology,

Shokouhi Targhi, Mohammad Reza

Address		**Email** Mohammadrezashokohi@gmail.com (update 2019/02/01)	
Unit 18- No.90- Central payambar.St- Sattari.Highw Tehran, Tehran 13185/768 Iran, The Islamic Republic of		**Home Phone** (21) 44044915 **Cell Phone** (98) 9124497619 **Office Phone**	
Current Institution		**Department**	
Location	, Esfahan , Iran, The Islamic Republic of		
Highest Degree	MS	**Institution** Islamic Azad University (Central Tehran Branch)	**Date** 2015/07
Thesis Advisor	Dr.Mohammad Reza Tanhayi		
Thesis Title	Entanglement entropy & entangles states & Holographic Entanglement entropy in Quantum Field Theory (QFT)		
Research Interests	**Primary** general relativity, gravity in the field of curved space time, Riemannian geometry		
Secondary	quantum dot or quantum bits, Black hole gravity & event horizon phenomenon; LIBS (laser-induced breakdown spectroscopy), Laser Physics, Quantum Optics, Optics Structure, Laser-induced Plasma		
Current Research Interests: *During my master program, I worked on entanglement entropy and entangled state along with Quantum Information Theory (QIT) and holography theory regarding black hole in my project. During my master period, I worked on many details about event horizon and apparent horizon. I studied how to form a black hole using the laws of gravity and I did many calculations about von-Neumann entropy and radiant energy from the black hole is known as Hawking radiation. On the other hand, my experts and masters during the period on an article about a Quantum Computer and how to build them using quantum dot or quantum bits with title:" Calculating the eigenvalues of the quantum dot operator method and exact diagonalization method "the article is preparing for publication get along with Mahdiyeh Ghasemi under Dr. Mohammad Reza Tanhayi guidance from IPM.*			
Discipline(s)	Quantum Information Science; Quantum Gravity; quantum gravity/quantum cosmology; Quantum Computing; Particle and Astroparticle Phenomenology; Physics; Applied Physics; Accelerator Science		
Position(s) applied	PHD		
Also Consider For	**Temporary:** 1 Year		
1. Mohammad Reza Tanhayi, Thesis Advisor, mtanhayi@ipm.ir (2019/01/27)			
2. Dr.Hossein Mehraban, Thesis Advisor, hmehraban@semnan.ac.ir (2019/01/27)			
Received Materials	**PHD**	**Cover Letter:** file (PDF, PDF 2019/01/27) **Curriculum Vitae:** file (PDF, PDF 2019/01/27) **Research Statement:** file (PDF, PDF 2019/01/27)	

		Copies of grades transcripts: file (PDF, PDF 2019/01/27)

Mohammadreza Shokouhi
Department of Physics, faculty of basic science, Islamic Azad University (Central Tehran Branch)
Email: Mohammadrezashokohi@gmail.com

Motivation Letter

I graduated in particle physics and Quantum Field Theory (QFT). I'm writing you to apply for current PhD position under your supervisory and I am 27 years old.

Because in the past years, many of the world's prestigious universities have been conducted to identify and recognize the black hole and gravitational waves, and even in 2017 by LIGO group, these waves have caused huge recognition of black holes and the nature of time. In the past few years, scientists have tried to create or build a black hole in the laboratory scale.

The findings indicate that this discussion of the Earth's Day is of great importance. So, during my studies in segment and ads / CFT theory, I have collected many studies and studied the event of a black hole in the event of horizon and ads / CFT, and using the Ryu - Takayanagi method for an element description of the event horizon, the equations relating to quantum entanglement and entangled entropy theory have achieved a black hole. Finally, I describe the theory of holography and presented in the form of my thesis. I also have a great interest in working in the field of entanglement with hyperscaling, with its effects on a black hole. In this case, I presented an article at the National Institute of Physics in Tabriz, Iran.

During my master program, I worked on entanglement entropy and entangled state along with Quantum Information Theory (QIT) and holography theory regarding black hole in my project. During my master period, I worked on many details about event horizon and apparent horizon. I studied how to form a black hole using the laws of gravity and I did many calculations about von-Neumann entropy and radiant energy from the black hole is known as Hawking radiation. On the other hand, my experts and masters during the period on an article about a Quantum Computer and how to build them using quantum dot or quantum bits with title:" Calculating the eigenvalues of the quantum dot operator method and exact diagonalization method "the article is preparing for publication get along with Mahdiyeh Ghasemi under Dr. Mohammad Reza Tanhayi guidance from IPM.

Because of advances in physics theory and especially the tendency of particle physics theoretical physics and due to the fact that the ability to use a quantum field theory in particle physics tend to use accelerators hadron and high-energy (LHC, LEP, HERA, TEVATRON). As I found this opportunity as an excellent fit to my background besides my enthusiasm to your outstanding works, I would like to apply for this position under your supervisory.

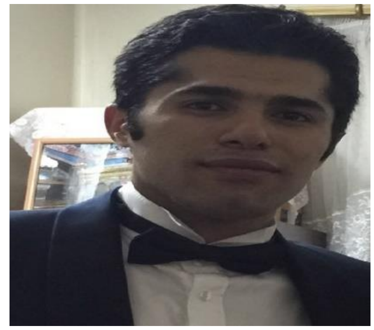
I believe that according to my team working, motivated, self-studying, hard-working and ambitious characteristics; I can fulfill your expectations as a PhD candidate. I have a desire to work in the physics of fundamental particle physics, the relativity quantum mechanics to describe time in a black hole, because of the lack of suitable facilities and ideal conditions in my country, I would prefer to continue studying at your university.

Thank you very much for taking the time to consider our application.

Mohammadreza Shokouhi
7^{th} November 2018

EXTENDED RESUME

Mohammadreza Shokouhi



Mailing Address: Islamic Azad University (Central Tehran Branch)
POBOX: 13185/768
Phone: (98) 9124497619
Living Address: Unit 18- No.90- Central payambar.St- Sattari.Highway- Tehran- Iran

Email:
Mohammadrezashokohi@gmail.com

Education

- **Master of Science in Fundamental particle physics and field theory** *July.2015*
  Islamic Azad University of Central Tehran Branch, *Tehran, Iran.*
  M.Sc. Thesis: "**Entanglement entropy & entangles states & Holographic Entanglement entropy in Quantum Field Theory (QFT).** "
  (Supervisor: Prof.M.R.Tanhayi)
  GPA: 3.94

- **B.Sc. Degree in physics** *September.2013*
  Islamic Azad University of North Tehran Branch, Tehran, *Iran.*
  B.S Project: "**Calculating the eigenvalues of the quantum dot operator method & Exact Diagonalization method.** "
  (Supervisor: Prof.H.Ghadiri)

Interests: (Fundamental particle physics & Particle accelerators
& Large Hadron Collider (LHC) & Proton-Proton encounters in Theory State)
& (Mathematics of Quantum Field Theory & the Gravitational Calculations & Feynman Graphs in Experimental State)

Publications

Articles:

1. Working on **“Calculating the eigenvalues of the quantum dot operator method and exact diagonalization method “** from 2016 till now and the article is preparing for publication.

National Research Activities

- Participate in the National Physics Olympiad in Shiraz, Iran and thank as scientific talent, 2003.
- Attended in the National Physics Olympiad in Mashhad, Iran and earned a letter of thanks for mathematical calculations, 2005.
- Accepted in Pure-Math at Isfahan University of Technology, 2009.
- Accepted as first apprentice in physics, 2010-2011.
- Solve the equation of advanced fundamental particles related to Dirac and appreciation of my ability, 2014.

Seminars and Workshops:

- ✓ A graduate degree in Math-Physics as first apprentice, 2008.
- ✓ A graduate degree in Math-Physics as first apprentice, 2008.
- ✓ A M.Sc. degree as first apprentice in Fundamental particle physics and field theory, Islamic Azad University of Central Tehran Branch,2015.

Research project

- ✓ I did a research project on quantum computers and quantum dots (QD) and quantum calculations, 2012.
- ✓ I did a research project on Entanglement entropy & Entangles states & Holographic Entanglement entropy in Quantum Field Theory (QFT).

International Activities

- ✓ Attended in physics international conference in Tabriz with article :
“Thermalization in hyper scaling violating background “&
Achieved appreciation as the premier article, July, 2016.

Research Experience

- ✓ Quantum computers
- ✓ The theory of Quantum Dots (QD)
- ✓ Programming MATLAB for the theory of Quantum Dots (QD) & Quantum computers
- ✓ Programming Mathematical for the theory of Quantum Dots (QD) & Quantum computers

Language Skills

- ✓ **English:** Good in speaking, Listening, Reading, and Writing
- ✓ **German:** Good in speaking, Listening, Reading, and Writing
- ✓ **Persian:** Maternal
- ✓ **Turkish:** dominant

Computer Background

- ✓ **Programming Software:** Fortran, MATLAB, Mathematical, Latex
- ✓ **General Software:** Office collection
- ✓ **Equipment Software:** HighScore X'pert, Sigma-plot

Social Activities

- ✓ **Active member of Simultaneous Interpretation Preparatory (SIP) courses, 2015-Now.**
- ✓ **Active member of grammar classes in Simultaneous Interpretation Preparatory (SIP) courses, 2015.**

Sports and Hobbies

- ✓ **Active member of Football team in Islamic Azad University of North Tehran Branch, 2011.**
- ✓ **Volleyball**
- ✓ **Handball**
- ✓ **Kung Fu**
- ✓ **Active in Swimming**

- ✓ **Mountain Climbing**
- ✓ **Cycling**

زهرا عباسعلی، مترجم رسمی انگلیسی قوه قضائیه
شماره پروانه ۴۲۰، دفتر ترجمه رسمی شماره ۴۲۰ تهران
آدرس: ضلع جنوب شرقی فلکه دوم صادقیه،ابتدای جناح، مجتمع افق، طبقه اول، واحد ۱۰۱
Zahra Abbasali, Official English Translator to the Judiciary
License No.420, Translation Office No.420 – Tehran
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southeast corner of Sadeghieh 2nd Sq., Tehran – Iran
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Email: info@tahaot.com

شماره ۳۷۴۱۲۵

ردیف دفتر ثبت ۱۴۷,۲۱۷۹

جمهوری اسلامی ایران
قوهٔ قضائیه - اداره مترجمین رسمی

In the Name of God
Islamic Republic of Iran
ISLAMIC AZAD UNIVERSITY
Tabriz Branch
1ST NATIONAL CONFERENCE OF PHYSICS
20-21 JULY 2016

This is to certify that:

Mr. MOHAMMAD REZA SHOKOUHI TARGHI

Presented a paper in form of speech titled" The Study of Bilateral Information Warming Phenomena in Lifshitz Hyperscaling Violating Background" in cooperation with Mr. Moein Mirza Amraji and Mr. Mohammadreza Tanhaei Ahari.

-Executive Secretary of the Conference: Signed
-Scientific Secretary of the Conference: Signed& Sealed
-President of the Conference: Signed

Certified to be a true and accurate translation of the original and the translator is competent to translate.
Tehran, date: July.29,2018

ZAHRA ABBASALI 420 OFFICIAL TRANSLATOR TO THE JUDICIARY, IRI Tehran
زهرا عباسعلی
مترجم رسمی انگلیسی
قوه قضائیه – تهران
دفتر مترجمی ۴۲۰

عباسعلی

بسمه تعالی

اولین همایش ملی فیزیک دانشگاه آزاد اسلامی

۳۰ و ۳۱ تیر ماه ۱۳۹۵ - واحد تبریز

اولین همایش ملی فیزیک دانشگاه آزاد اسلامی واحد تبریز

1st National Conference of Physics

20-21 JULY 2016

بدینوسیله گواهی می شود جناب آقای محمدرضا شکوهی طرقی

در اولین همایش ملی فیزیک دانشگاه آزاد اسلامی واحد تبریز شرکت و مقاله ای را با عنوان :

« بررسی پدیده گرمایش اطلاعات دوجانبه در پس زمینه‌ی لیفشیتز با نمای [illegible] »

به صورت سخنرانی با همکاری معین میرزا امرجی و محمدرضا تنهایی [illegible] [illegible] نمودند.

Certified Copy

ZAHRA ABBASALI — OFFICIAL TRANSLATOR TO THE JUDICIARY, I.R.I Tehran

زهرا عباسعلی

مترجم رسمی انگلیسی

دفتر مترجمی ۴۲۰

رئیس همایش	دبیر علمی همایش	دبیر اجرائی همایش
دکتر ناصرمدیر شهلا	دکتر صمد سبحانیان	دکتر علی واحدی

زهرا عباسعلی، مترجم رسمی انگلیسی قوه قضائیه
شماره پروانه ۴۲۰، دفتر ترجمه رسمی شماره ۴۲۰ تهران
آدرس: ضلع جنوب شرقی فلکه دوم صادقیه،ابتدای جناح، مجتمع افق، طبقه اول، واحد ۱۰۱
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Tel: +98 21 44270014 Fax: +98 21 44275625
Email: info@tahaot.com

شماره ۳۷۴۳۱۱
ردیف دفتر ثبت

جمهوری اسلامی ایران
قوهٔ قضائیه _ اداره مترجمین رسمی

In the Name of God
Islamic Republic of Iran

ISLAMIC AZAD UNIVERSITY

DIPLOMA OF COMPLETION OF NON-CONTINUOUS MASTER'S DEGREE COURSE

(Holder's Photo Affixed Bearing the Embossed Seal)
This diploma shall be invalid if lacking the hologram.
(Hologram affixed)

Serial No.	: 455841
Central Organization Verification No.	: 179410102420
Date of Verification	: April.19,2016

On the strength of University Charter passed by Supreme Council of Cultural Revolution on Nov. 3, 1987 and Single Act enacted by the Islamic Consultative Assembly on May 4, 1988,

Whereas,

MR. MOHAMMAD REZA SHOKOUHI TARGHI

Son of HOJJAT, holder of National No. 0013688006, ID Card issued in Tehran, born in 1991, has fulfilled the requirements of **Physics**, Major: **Fundamental Particles & Fields Theory** on July.12,2015 at Central Tehran Branch and is eligible to receive the **Master's Degree**; therefore, this Diploma is conferred upon him to benefit from its privileges.

- Chancellor of the University Branch: Signed
- For, President of Islamic Azad University: Signed

Certified to be a true and accurate translation of the original and the translator is competent to translate.
Tehran, date: July.29,2018

ZAHRA ABBASALI
زهرا عباسعلی
مترجم رسمی انگلیسی
قوه قضائیه – تهران
دفتر مترجمی ۴۲۰
OFFICIAL TRANSLATOR TO THE JUDICIARY, IRI Tehran 420

Department of official Translators Affairs of the Judiciary of the Islamic Republic of Iran
Only the authenticity of the seal and signature of the Offical Translator is certified. This certification does not include confirmation of the accuracy of the translation and the authenticity of the translated document. Department of Official Translators' Affairs of the Judiciary of the Islamic Republic of Iran.

محمد رضایی - کارشناس
M.REZAEI
LEGALIZATION OFFICER

مبلغ ۲۰ ریال بابت تعرفه
خدمات کنسولی دریافت گردید.

ISLAMIC REPUBLIC OF IRAN
MINISTRY OF FOREIGN AFFAIRS
REGISTRATION AND PERSONAL STATUS DEPARTMENT
The authenticity of the seal & signature marked (X) is certified without any consideration to the contents.

31 JUL 2018 - 700095

455841

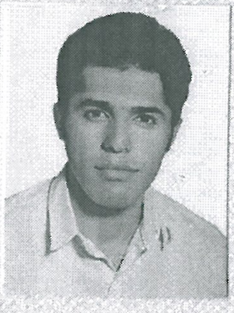
یرفع الله الذین آمنوا منکم والذین اوتوا العلم درجات

جمهوری اسلامی ایران

دانشگاه آزاد اسلامی

دانشنامه پایان تحصیلات دوره کارشناسی ارشد ناپیوسته

به استناد اساسنامه دانشگاه مصوب ۶۶/۸/۱۲ شورای عالی انقلاب فرهنگی و ماده واحده مصوب ۶۷/۲/۱۴ مجلس شورای اسلامی



نظر به اینکه آقای محمدرضا سکوتی طرقی فرزند حجت دارای شماره ملی ۰۰۱۳۶۸۸۰۰۶ و شناسنامه صادره از تهران متولد ۱۳۷۰

دوره تحصیلات رشته فیزیک- ذرات بنیادی و نظریه میدانها را در تاریخ ۱۳۹۴/۰۴/۲۱ در واحد تهران مرکزی به پایان رسانده و شایستگی

دریافت درجه کارشناسی ارشد را احراز نموده است، این دانشنامه به نامبرده اعطا می شود تا از امتیازات آن بهره مند گردد.

شماره تایید سازمان مرکزی

۱۷۹۴۱۰۱۰۲۴۲۰

تاریخ تایید سازمان مرکزی

۹۵/۰۱/۳۱

Certified Copy

ZAHRA ABBASALI 924
زهرا عباسعلی
مترجم رسمی انگلیسی
قوه قضائیه - تهران
دفتر مترجمی ۴۲۰
OFFICIAL TRANSLATOR TO THE JUDICIARY, I.R.I Tehran

عباسعلی

دکتر حمید میرزاده
رئیس دانشگاه آزاد اسلامی
از طرف
دکتر سید طه هاشمی

دکتر مهرداد نوابخش
رئیس واحد دانشگاهی

زهرا عباسعلی، مترجم رسمی انگلیسی قوه قضائیه
شماره پروانه ۴۲۰، دفتر ترجمه رسمی شماره ۴۲۰ تهران
آدرس: ضلع جنوب شرقی فلکه دوم صادقیه،ابتدای جناح، مجتمع افق، طبقه اول، واحد ۱۰۱
Zahra Abbasali, Official English Translator to the Judiciary
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شماره ۳۷۴۳۱۸
ردیف دفتر ثبت

جمهوری اسلامی ایران
قوهٔ قضائیه ـ اداره مترجمین رسمی

In the Name of God
Islamic Republic of Iran

ISLAMIC AZAD UNIVERSITY
CENTRAL TEHRAN BRANCH

Transcript of Academic Records
(Holder's Photo Scanned)

This is to certify that **Mr. MOHAMMAD REZA SHOKOUHI TARGHI**, son of HOJJAT, holder of National No.0013688006, issued in Tehran, born in 1991, graduated in field of **Physics**, Major: **Fundamental Particles & Fields Theory** in full-time academic system on July.12,2015 and received diploma of **Non-continuous Master's Degree** in the said field.
List of courses passed and grades gained by him during the course of studies is as follows.
Translator's Abbreviations: O= Obligatory, E= Elective, R= Remedial, M= Major- based, CO= Common Obligatory, S= Seminar, T= Thesis.

1st Semester of Academic Year 2013-2014					
Title of Course	***Type of Course***	***Theoretical Credits***	***Practical Credits***	***Grade***	***Point***
Computational Physics	O	1	1	14.50	29.00
Electrodynamics I	E	4	-	16.00	64.00
Advanced Quantum Mechanics I	O	3	-	16.00	48.00
Mathematical Physics III	R	3	-	17.00	Not effective
Research Methodology	R	2	-	17.50	Not effective
2nd Semester of Academic Year 2013-2014					
Advanced Quantum Mechanics II	O	3	-	17.50	52.50
Advanced Statistical Mechanics I	O	3	-	18.00	54.00
Preliminaries of Fundamental Particles	M	3	-	19.50	58.50
1st Semester of Academic Year 2014-2015					
Electrodynamics II	CO	3	-	17.00	51.00
Advanced Physics of Fundamental Particles	M	3	-	19.50	58.50
2nd Semester of Academic Year 2014-2015					
Seminar	S	-	2	19.50	39.00
Thesis	T	-	6	18.00	108.00

Total Credits Passed:32
G.P.A: 17.58 (out of 20.00)

ZAHRA ABBASALI
OFFICIAL TRANSLATOR TO THE JUDICIARY, IRI Tehran 420
زهرا عباسعلی
مترجم رسمی انگلیسی
قوه قضائیه ـ تهران
دفتر مترجمی ۴۲۰

عباسعلی

زهرا عباسعلی، مترجم رسمی انگلیسی قوه قضائیه
شماره پروانه ۴۲۰، دفتر ترجمه رسمی شماره ۴۲۰ تهران
آدرس: ضلع جنوب شرقی فلکه دوم صادقیه،ابتدای جناح، مجتمع افق، طبقه اول، واحد ۱۰۱
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جمهوری اسلامی ایران
قوهٔ قضائیه _ اداره مترجمین رسمی

شماره ۳۷۴۳۱۹
ردیف دفتر ثبت

-According to academic by-law of the university, each semester includes 16 hours of education for each theoretical credit, 32 hours for each practical credit and 48 hours of education for workshop operations.

-The evaluation standard of grades is from zero to 20. The minimum passing grade in Associate's Degree and Bachelor's Degree course is 10, in Master's Degree is 12 and in Ph.D. course is 14.

This transcript of records is issued without erasure and is registered under No.95012395 dated Oct.1,2016 in the Office of Graduates Affairs.

- Supervisor of Collegiate Deputy of Central Tehran Branch: Signed
- Chancellor of Central Tehran Branch of the Islamic Azad University: Signed & Embossed Seal
- Director General of Graduates Affairs of Islamic Azad University: Signed & Sealed

Name & Surname: **Mr. Mohammad Reza Shokouhi Targhi**

Certified to be a true and accurate translation of the original and the translator is competent to translate. Tehran, date: July.29,2018

ZAHRA ABBASALI
زهرا عباسعلی
مترجم رسمی انگلیسی
قوه قضائیه – تهران
دفتر مترجمی ۴۲۰
OFFICIAL TRANSLATOR TO THE JUDICIARY, I.R.I Tehran 420

Department of official Translators Affairs of the Judiciary of the Islamic Republic of Iran
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محمد رضایی - کارشناس
M.REZAEI
LEGALIZATION OFFICER

مبلغ ۱۲۰ ریال بابت تعرفه
خدمات کنسولی دریافت گردید.

ISLAMIC REPUBLIC OF IRAN
MINISTRY OF FOREIGN AFFAIRS
REGISTRATION AND PERSONAL STATUS DEPARTMENT
The authenticity of the seal & signature marked (X) is certified without any consideration to the contents.

31 JUL 2018 - 700095

باسمه تعالی
اطلبوا العلم من المهد الی اللحد

دانشگاه آزاد اسلامی واحد تهران مرکزی

تاریخ :
شماره :

گواهی می شود آقای محمدرضا شکوهی طرقی فرزند حجت دارای کد ملی ۰۰۱۳۶۸۸۰۰۶
صادره از تهران متولد سال ۱۳۷۰ در رشته فیزیک - ذرات بنیادی و نظریه میدانها
نظام آموزشی تمام وقت درتاریخ ۱۳۹۴/۰۴/۲۱ فارغ التحصیل شده است و به دریافت درجه کارشناسی ارشد ناپیوسته از رشته مذکور نایل شده است.
فهرست دروس و ریز نمرات نامبرده در طی دوره تحصیلی به شرح زیر می باشد .صفحه : ۱ از ۱

نیمسال تحصیلی	مشخصات درس				ارزشیابی		
	نام درس	نوع درس	تعداد واحد		نمره		امتیاز واحد
			نظری	عملی	به عدد	به حروف	
نیمسال اول ۹۳-۹۲	فیزیک محاسباتي	الزامي	۱	۱	۱۴/۵۰	چهارده و پنجاه صدم	۲۹
نیمسال اول ۹۳-۹۲	الکترودینامیک (۱).	اختیاري	۴		۱۶	شانزده تمام	۶۴
نیمسال اول ۹۳-۹۲	مکانیک کوانتومي پیشرفته (۱).	الزامي	۳		۱۶	شانزده تمام	۴۸
نیمسال اول ۹۳-۹۲	ریاضي فیزیک ۳	جبراني	۳		۱۷	هفده تمام	بدون تاثیر
نیمسال اول ۹۳-۹۲	روش تحقیق	جبراني	۲		۱۷/۵۰	هفده و پنجاه صدم	بدون تاثیر
نیمسال دوم ۹۳-۹۲	مکانیک کوانتومي پیشرفته (۲).	الزامي	۳		۱۷/۵۰	هفده و پنجاه صدم	۵۲/۵۰
نیمسال دوم ۹۳-۹۲	مکانیک آماري پیشرفته (۱).	الزامي	۳		۱۸	هجده تمام	۵۴
نیمسال دوم ۹۳-۹۲	مقدمات ذرات بنیادي	گرایشي	۳		۱۹/۵۰	نوزده و پنجاه صدم	۵۸/۵۰
نیمسال اول ۹۴-۹۳	الکترودینامیک (۲).	الزامي مشترک	۳		۱۷	هفده تمام	۵۱
نیمسال اول ۹۴-۹۳	فیزیک ذرات بنیادي پیشرفته (۱)	گرایشي	۳		۱۹/۵۰	نوزده و پنجاه صدم	۵۸/۵۰
نیمسال دوم ۹۴-۹۳	سمینار	سمینار		۲	۱۹/۵۰	نوزده و پنجاه صدم	۳۹
نیمسال دوم ۹۴-۹۳	پایان نامه	پایان نامه		۶	۱۸	هجده تمام	۱۰۸

جمع کل واحدهاي گذرانده شده : ۳۲
میانگین کل : ۱۷/۵۸

- براساس آیین نامه آموزشی دانشگاه در طول هر نیمسال تحصیلی برای هر یک واحد نظری ۱۶ ساعت ، عملی ۳۲ ساعت و عملیات کارگاهی ۴۸ ساعت آموزش ارائه میشود
- معیار ارزشیابی دروس از نمره صفر تا بیست می باشد و حداقل نمره قبولی در مقاطع کاردانی و کارشناسی ۱۰ و کارشناسی ارشد ۱۲ و دکترای تخصصی ۱۴ می باشد

ZAHRA ABBASALI
زهرا عباسعلی
مترجم رسمی انگلیسی
قوه قضائیه – تهران
دفتر مترجمی ۴۲۰
OFFICIAL TRANSLATOR TO THE JUDICIARY, I.R. Tehran

Certified Copy

- ریزنمرات فوق بدون هرگونه خط خوردگی و خدشه اعتبار دارد و به شماره ۹۵۰۱۲۴۹۵ مورخ ۹۵/۷/۱۰ در دفتر امور فارغ التحصیلان دانشگاه ثبت و تایید شده است

دکتر نصراله اسکندری	دکترمهرداد نوابخش	دکتر طهمورث آقاجانی
سرپرست معاونت دانشجویی	رئیس دانشگاه آزاداسلامی واحد تهران مرکزی	مدیر کل اداره دانش آموختگان دانشگاه

دکتر محمد اکوان
معاون امور آموزشی و تحصیلات تکمیلی
دانشگاه آزاد اسلامی واحد تهران مرکزی

اطلبوا العلم من المهد الی اللحد
دانشگاه آزاد اسلامی

زهرا عباسعلی، مترجم رسمی انگلیسی قوه قضائیه
شماره پروانه ۴۲۰، دفتر ترجمه رسمی شماره ۴۲۰ تهران
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شماره ۳۷۴۳۱۲
ردیف دفتر ثبت

جمهوری اسلامی ایران
قوهٔ قضائیه ـ اداره مترجمین رسمی

In the Name of God
Islamic Republic of Iran

ISLAMIC AZAD UNIVERSITY

DIPLOMA OF COMPLETION OF CONTINUOUS BACHELOR'S DEGREE COURSE

(Holder's Photo Affixed Bearing the Embossed Seal)
(Hologram affixed)
This diploma shall be invalid without the hologram.

Serial No.	: 2479852
Central Organization Verification No.	: 159215701110
Date of Central Organization Verification	: April.16,2014

On the strength of University charter passed by Supreme Council of Cultural Revolution on Nov.3, 1987 and Single Act enacted by the Islamic Consultative Assembly on May 4, 1988,
Whereas,

MR. MOHAMMAD REZA SHOKOUHI TARGHI

Son of HOJJAT, holder of National No. 0013688006 and ID Card issued in Tehran, born in 1991, has fulfilled the requirements of **Bachelor's Degree** course in the field of **Nuclear Physics**, in Full-time Academic System by passing **147** credits and gaining **G.P.A** of **15.38** (out of 20.00) on Oct.8,2013 at North Tehran Branch; this Diploma is conferred upon him.

- Chancellor of the University Branch: Signed
- For, President of Islamic Azad University: Signed

Certified to be a true and accurate translation of the original and the translator is competent to translate.
Tehran, date: July.29,2018

ZAHRA ABBASALI
OFFICIAL TRANSLATOR TO THE JUDICIARY, I.R.I Tehran 420
زهرا عباسعلی
مترجم رسمی انگلیسی
قوه قضائیه – تهران
دفتر مترجمی ۴۲۰

Department of official Translators Affairs of the judiciary of the Islamic Republic of Iran

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محمد رضایی - کارشناس
M.REZAEI
LEGALIZATION OFFICER

ISLAMIC REPUBLIC OF IRAN
MINISTRY OF FOREIGN AFFAIRS
REGISTRATION AND PERSONAL STATUS DEPARTMENT

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مبلغ ۶۰/ ریال بابت تعرفه
خدمات کنسولی دریافت گردید.

31 JUL 2018 - 700095

2479852

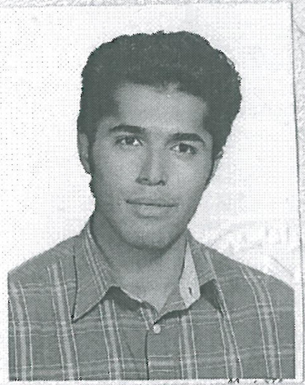
یرفع الله الذین آمنوا منکم و الذین اوتوا العلم درجات

جمهوری اسلامی ایران

دانشگاه آزاد اسلامی

دانشنامه پایان تحصیلات دوره کارشناسی

به استناد اساسنامه دانشگاه مصوب ۶۶/۸/۱۲ شورای عالی انقلاب فرهنگی و ماده واحده مصوب ۶۷/۲/۱۴ مجلس شورای اسلامی



نظر به اینکه آقای محمدرضا شکوهی طرقی فرزند حجت دارای شماره ملی ۰۰۱۳۶۸۸۰۰۶ و شناسنامه صادره از تهران متولد ۱۳۷۰

دوره تحصیلات کارشناسی رشته فیزیک هسته‌ای را در نظام آموزشی تمام وقت با گذراندن ۱۴۷ واحد درسی

و میانگین کل به عدد ۱۵/۳۸ به حروف پانزده و سی و هشت صدم در تاریخ ۱۳۹۲/۰۷/۱۶ در واحد دانشگاهی تهران شمال به پایان رسانده است.

این دانشنامه به ایشان اعطا می‌گردد

Certified Copy

ZAHRA ABBASALI 420 Tehran
زهرا عباسعلی
مترجم رسمی انگلیسی
قوه قضائیه - تهران
دفتر مترجمی ۴۲۰
OFFICIAL TRANSLATOR TO THE JUDICIARY, I.R.I Tehran

دکتر حمید میرزاده
رئیس دانشگاه آزاد اسلامی
از طرف
دکتر سعید کاردار

دکتر علی محمد صفانیا
رئیس واحد دانشگاهی

شماره تایید سازمان مرکزی
۱۵۹۲۱۵۷۰۱۱۱۰
تاریخ تایید سازمان مرکزی
۹۳/۰۱/۲۷

Soguel, Romain

Address		**Email** romain.soguel@gmail.com (update 2019/01/20)	
, Neuchatel Switzerland		**Home Phone** (21) 8000977 **Cell Phone** (41) 774128469 **Office Phone**	
Current Institution	Monsieur	**Department**	
Location	, Neuchatel , Switzerland		
Highest Degree	MS	**Institution** EPFL	**Date** 2018/10
Thesis Advisor	Riccardo Rattazzi		
Research Interests	**Primary** A3b		
Secondary	B1b; C3a		
Discipline(s)	High-Energy Theory; High Energy Physics		
Position(s) applied	PHD		
1. Riccardo Rattazzi, , riccardo.rattazzi@epfl.ch (2018/05/30)			file (PDF, PDF, 2018/11/01)
2. Luca Vecchi, , vecchi.alsz@gmail.com (2018/05/30)			file (PDF, PDF, 2018/05/31)
Received Materials	**PHD**	**Cover Letter:** file (PDF, PDF 2019/01/20) **Curriculum Vitae:** file (PDF, PDF 2019/01/20) **Research Statement:** file (PDF, PDF 2019/01/20) **Copies of grades transcripts:** file (PDF, PDF 2018/05/30)	

Romain Soguel
La Mottaz 22
1143 Apples
Switzerland

Institut für Theoretische Teilchenphysik
Campus Süd
Karlsruher Institut für Technologie (KIT)
D-76128 Karlsruhe

Cover letter for PhD positions in theoretical particle physics with the Collaborative Research Center “Particle Physics Phenomenology after the Higgs discovery"

Dear Kirill Melnikov

This motivation letter is referring to the opening of a Ph.D position offered in your group on Academic Job Online. I am seeking a challenging Ph.D position and convinced that my academic accomplishments will meet the necessary requirements of the position.

I am a graduate student from the Swiss Federal Institute of Technology of Lausanne (EPFL). I made my master in the area of theoretical physics in the laboratory of Theoretical Particle Physics laboratory (LPTP) of Prof. R. Rattazzi. My master project was on electroweak baryogenesis above electroweak scale. The idea was to couple a singlet scalar field to the Higgs boson in order to achieve a strong first order electroweak phase transition leading to baryon number violation. The transition proceeds in two steps via tunneling effect in the potential barrier. To achieve it, dimensional reduction was used in order to compute the 3d thermal effective potential of the Higgs-singlet system. I have also worked on Higgs physics, computing loop in QED+Yukawa and inferring results on Higgs decay channels via low energy theorem, as well as the pattern of symmetry breaking of SU(5) in a scalar 'phi^4' case.

I am matching this PhD position due to lectures followed in the domain of quantum field theory and conformal field theory, statistical physics and general relativity during my master. I have a background in gauge theories and some knowledge in group theory. I can offer a broad approach to the concerned problem based on a background in different areas of theoretical physics.
I would be delighted to have the opportunity to work with you and continue my path in the captivating world of theoretical physics. Please feel free to contact me or ask for more information.

I appreciate your time and consideration.
Sincerely yours

Romain Soguel

R. Soguel

La Mottaz 22
Apples, Switzerland
+41.(0)77/412.84.69
romain.soguel@gmail.com
02.06.1994

Romain Soguel

Curious and always ready for new discoveries. Passionate about winter sports. Fascinated about physics and mathematics since childhood. I achieved a transition to Physics section after a successful bachelor degree in Chemistry. With the knowledge acquired during my master, I can offer a broad approach to questions raised by Standard Model physics and beyond. I am looking for a challenging PhD position in the area of theoretical physics.

Education

Academic Qualifications

2016–2018 **Ecole Polytechnique Fédérale de Lausanne (EPFL)**, *Master of Science in physics*, Lausanne.

2015–2016 **Ecole Polytechnique Fédérale de Lausanne (EPFL)**, *Third year in physics bachelor of Science* , Lausanne.

2012–2015 **Ecole Polytechnique Fédérale de Lausanne (EPFL)**, *Bachelor of Science in chemistry and chemical engineering* , Lausanne.

2009–2012 **Gymnase de Marcelin**, *High school certificate with Biology-Chemistry option*, Morges.

Notable Projects

- **Master thesis** *'Electroweak Baryogenesis above electroweak scale'*

  I made my master project in the Theoretical Particle Physics Laboratory (LPTP). The core of the work was to modify the Higgs potential at high temperature by coupling it to a singlet scalar field. The purpose was to make a strong first order transition via electroweak physics, yielding baryon number non-conservation. The phase transition proceeds in two steps, by tunneling process at the critical temperature.
- **Semester project** *'Computation of absorption spectrum and population dynamics of pyrazine'*

  I performed a semester project (1day/week) in the field of computational chemistry in the Laboratory of Theoretical Physical Chemistry (LCPT) in order to predict vibronic spectrum of pyrazine molecule from nonadiabatic quantum molecular dynamics. The project was orally presented after having submitted a written report and rewarded by a excellent qualification.

Technical and Personal Skills

- **Languages:**
  - French: Mothertongue
  - English: Advanced, B2 certificate obtained in high school, practised intensively during my studies
  - German: Advanced, B2 certificate obtained in high school, but not practiced during my studies
- **IT Skills:** Basic skills in Latex and in Mathematica. Abilities with Microsoft Office
- **General Skills:** Developed analytic capacities, abstract and logical thinking, complex problems and technical issues solving. Work well either in a team or alone.

Additional Experiences

- Student assistant in general physics for first year students in mechanical engineering
- Jeunesse et Sport snowboard instructor level 1

- Water and weather responsible for Yadlo festival
- Food and beverage responsible in the association 'Baramine', whose purpose was to finance the third year bachelor of science of chemistry and chemical engineering study trip
- Summer job in Migros supermarket
- Summer stage in Osterwalder Group laboratory
- Summer stage in Banque Cantonale Vaudoise (BCV)

Interests and Extra-curricular Activities

- Practice hapkido and boxe
- Gastronomy and oenology amateur
- Snowboard, motorbike riding, freeline skate
- Reading Sci-Fi and comic strips, travels: India, Peru, New York, Budapest, Amsterdam, Greenland, Iceland

Personal Situation

I am a Swiss citizen, celibate. I own a car (B) and motorbike (A) driving license.

Romain Soguel
La Mottaz 22
1143 Apples
Switzerland

Institut für Theoretische Teilchenphysik
Campus Süd
Karlsruher Institut für Technologie (KIT)
D-76128 Karlsruhe

Reasearch statement for PhD positions in theoretical particle physics with the Collaborative Research Center “Particle Physics Phenomenology after the Higgs discovery"

Dear Kirill Melnikov

I am interested in physics beyond the Standard Model and the possibility to unify its approach with general relativity on a new basis. I am interested by issues related to sterile neutrinos, which could provide a solution to strong CP and dark matter problems if they are well tuned, and by dark matter related subjects. Also colour-kinematic duality, linking internal symmetries to spacetime symmetries, as well as the gauge-gravity relation, allowing to link conformal theories to anti-de Sitter space is captivating.
Higgs physics is the bridge to possibly new phenomenons and particles. Having a better understanding of the shape of the potential and an accurate knowledge of the coupling, trilinear and quartic, values would permit to interpret the experimental data in a rigorous way. A precise computation of mass dependences coming from doublet Higgs model of supersymmetric Standard Model can then be compared to data coming from the next LHC run.
In the same fashion, it is mandatory to have a precise description of top quark physics and phenomenology. Top quark being the heaviest quark, it has the biggest influence when looking for deviations from Standard Model predictions and possibly new physics.
Testing universality of favour interactions could also provide a way to access new physics. Thus building first toy models and then apply the new founded ideas to the Standard Model interests me a lot. Trying to have a flavour violating model at TeV scale instead of assuming flavour conservation provides a different path to access new physics.

I am willing to gain some insights in Higgs exotic phenomenology, to deepen my knowledge in top quark physics and to increase my understanding of flavour violation.

Romain Soguel

Vice-présidence pour
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ÉCOLE POLYTECHNIQUE
FÉDÉRALE DE LAUSANNE

Relevé des résultats (27.05.2018) pour / Statement of results (27.05.2018) for

Soguel Romain Nicolas

Master PH
Section:Physique
Section:Physics
Nom du master: Master of Science MSc en Physique
Name of the master: Master of Science MSc in Physics
Matricule fédéral : 12-824-793

Matières	Forme *Forms*	Langue enseign. *Teaching Language*	Session	Note ou (moyenne) *Grade or (average)*	Crédits ou (Coeff) *Credits or (Coeff)*	Crédits obtenus *Obtained credits*	
Master PH					**120**	**92**	**Résultat provisoire** ***Intermediate result***
Projet de Master ***Master project***					**30**	**0**	**Résultat provisoire** ***Intermediate result***
Projet de master en physique *Master project in Physics*	O	FR_EN			30		
Cycle master ***Master cycle***				**5.47**	**90**	**92**	**Réussi** ***Passed***
Bloc "Projets et TP"				**5.50**	**22**	**22**	**Réussi** ***Passed***
Laboratoire de physique IVa *Physics lab IVa*	PS	FR	02.2017	5.5	8	8	
Laboratoire de physique IVb *Physics lab IVb*	PS	FR	07.2017	5.5	8	8	
Philosophy, epistemology and history of science I	PS	EN	02.2017	5.5	3	3	
Philosophy, epistemology and history of science II	PS	EN	07.2017	5.5	3	3	
Groupe "Options" ***Group "options"***				**5.45**	**38**	**40**	**Réussi** ***Passed***
Particules élémentaires I *Elementary particle physics I*	O	FR	02.2017	6	4	4	
Particules élémentaires II *Elementary particle physics II*	O	FR	07.2017	5.75	4	4	
Quantum physics III	O	EN	02.2017	6	4	4	
Quantum physics IV	O	EN	07.2017	6	4	4	
Relativistic quantum fields I	O	EN	02.2017	5	4	4	
Relativistic quantum fields II	O	EN	07.2017	5.5	4	4	
Relativity and cosmology I	O	EN	02.2017	6	4	4	
Relativity and cosmology II	O	EN	07.2017	5.25	4	4	
Selected topics in nuclear and particle physics	O	EN	07.2017	5	4	4	
Statistical physics III	E	EN	02.2017	4	4	4	
Groupe pratique					**30**	**30**	**Réussi** ***Passed***
Travail de spécialisation pour master en physique *Specialisation semester*	PS	FR_EN	02.2018	Réussi *Passed*	30	30	

Voir les remarques présentes à la fin du relevé / *Please read the remarks at the end of this statements of results*

Suisse, Lausanne, le 27 mai 2018 / *Switzerland, Lausanne, 27th may 2018*

Matières	Forme *Forms*	Langue enseign. *Teaching Language*	Session	Note ou (moyenne) *Grade or (average)*	Crédits ou (Coeff) *Credits or (Coeff)*	Crédits obtenus *Obtained credits*

Remarques:
- Il se peut que des crédits et des moyennes ne soient pas calculés en fonction de la date d'impression du relevé de notes.
- Les notes et décisions sont masquées durant la période des examens. Les notes redeviennent visibles à la fin de la session d'examens et sont définitivement confirmées durant la Conférence des Examens, suite à laquelle les décisions apparaitront.
- Seul le bulletin original imprimé sur du papier blanc avec un filigrane central et signé par le Vice-Président pour les Affaires Académiques fournit les résultats définitifs.
- Formes d'examens : E=écrit, O=oral, PS=pendant le semestre, EO=écrit & oral, MULTI=multiple, M=mémoire, EX=exposé, TP=rapport de TP, ECH=hors plans
- Les branches sont notées de 1 à 6, la meilleure note étant 6. Une note en dessous de 4 sanctionne une prestation insuffisante. Les 1/4 de points sont admis. Lorsque la note de la branche est inférieure à 1 ou pour absence non justifiée, la branche est considérée comme non acquise et notée NA. La lettre D correspond à la dispense d'une épreuve. Les lettres R ou E correspondent à la réussite ou à l'échec d'une branche pour laquelle un résultat n'est pas fourni. Un M correspond à une absence justifiée.

Remarks:
- *It is possible that some credits and averages have not been calculated at the time this statement was printed.*
- *Marks of an exam session remain hidden until the end of the session and official decisions will only appear once the Conference for ratification of examination results has taken place and confirmed all results.*
- *Only the original mark sheet printed on white paper with central pale pink impression and signed by the Vice-President for Academic Affairs, is considered as the final result.*
- *Examination forms : E=written, O=oral, PS=during the semester, EO=written & oral, MULTI=multiple, M=term paper, EX=oral presentation, TP=project report, ECH=out of study plan*
- *Subjects are graded from 1 to 6, 6 being the highest grade. A grade below 4 indicates a fail. Quarter points are allowed. When the grade for a subject is below 1 or in case of non-attendance without valid justification, the subject is considered not acquired and graded NA. Letter D indicates an exemption ("dispense"). Letters R and E indicate a pass (R for "réussite") or fail (E for "échec") for subjects for which no grade is provided. M indicates non-attendance with valid justification.*

EIDGENÖSSISCHE TECHNISCHE HOCHSCHULE LAUSANNE
POLITECNICO FEDERALE DI LOSANNA
SWISS FEDERAL INSTITUTE OF TECHNOLOGY LAUSANNE

ÉCOLE POLYTECHNIQUE FÉDÉRALE DE LAUSANNE

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Professor Riccardo Rattazzi
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e-mail : riccardo.rattazzi@epfl.ch

November 1, 2018

Dear Colleague,

with this letter I would like to offer my evaluation of Romain Soguel, who applied for a doctoral student position.

I came to know Romain rather well during the last three years. Besides having taken my class on Classical Electrodynamics during his bachelor, he later followed a master program in theoretical particle physics, while being attached to my lab. The program includes the three courses I teach (Quantum Field Theory I & II and Gauge Theories and the Standard Model), two courses on Relativity and Cosmology taught by Shaposhnikov, the course Advanced QFT taught by Vichi and the course CFT and Gravity taught by Penedones. Moreover he also took a yearly reading course (denominated Travaux Pratiques, TP) that I organize for a handful of master students with the help of the postdocs in my group. During the TP, Romain studied Lie Algebras, the path integral and renormalization and carried out little projects on Grand Unification and Higgs phenomenology. Finally in the spring semester of this year he carried out his master project, being supervised by Luca Vecchi and myself. His master project concerned the electroweak phase transition, which he had to study in various modifications of the Standard Model. In particular he focussed on a particular scenario we are studying, where electroweak symmetry is not restored at temperatures above the weak scale.

Romain has a somewhat special CV, having first carried out a bachelor in chemistry and having later switched to physics. I have the impression his transition forced him to absorbe too many concepts in too short a time, which explains why his performace in my bachelor class on Classical Electrodynamics was somewhat poor, in spite of his great enthusiasm and motivation. During the master he had the time to develop a deeper understanding while mantaining the same enthusiasm. His results consequently became rather good. I would place him in the best 40% of his master class, which is quite good given our classes in theoretical subjects are already rather selected with the majority of the students later embarking in a PhD. In view of the above statistics and in view of direct knowledge of his ability and dedication I think Romain could do well in a PhD program, though I think he would have much better chances if he was closely mentored in the initial stages. Overall I support his application. Please feel free to contact me directly for any further question.

Best Regards,

Riccardo Rattazzi

Luca Vecchi
Scientist
Ecole Polytechnique Federale de Lausanne (EPFL)
BSP 732 (Cubotron UNIL)
Rte de la Sorge
CH-1015 Lausanne
Switzerland
luca.vecchi@epfl.ch

Lausanne, 31/05/2018

To whom it may concern,

I first met Romain Soguel at the end of last year. He was finishing his master courses and had to pass a “travaux pratiques” in Rattazzi’s Theoretical Particle Physics Laboratory at the Ecole Polytechnique Federale de Lausanne (EPFL), a reading course I am responsible of. I assigned him and his colleagues a series of Quantum Mechanics exercises on the concept of renormalization. Romain completed the task, with some help.

He later started his master thesis under the supervision of Prof. Riccardo Rattazzi and myself. Romain’s thesis deals with non-trivial topics such as quantum field theory at finite temperature, electroweak baryogenesis, and the large N expansion. These subjects are certainly challenging and Romain had to be (and currently has to be) assisted and guided quite often. But after some struggles he managed to achieve some original result.

One cannot truly appreciate Romain’s efforts and achievements without knowing that his bachelor degree is in chemistry, and that he turned to theoretical physics only during the master program. This explains, at least partially, the challenges he faced during his thesis and my reading course, but also tells us quite a bit about his perseverance and commitment.

I think Romain would be a very enthusiastic PhD student, if given the opportunity to continue a career in theoretical physics.

Best regards,
Luca Vecchi

Takka, Naimi

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Akbou, Bejaia 06048 Algeria		**Home Phone** **Cell Phone** (+213) 665663743 **Office Phone**	
Current Title / Dates	Part time physics teacher, Oct 2017		
Current Institution	University of Bejaia	**Department**	Faculty of Science and Technology (ST) - ST Department
Location	Targa Ouzemmour, Bejaia, Bejaia 06000, Algeria		
Highest Degree	Ph.D.	**Institution** University of Bejaia	**Date** 2018/04
Thesis Advisor	Prof. Ahmed Bouda		
Thesis Title	Non-commutative formalism in the theory of relativity		
Research Interests	**Primary** Particle Physics		
Secondary	Subatomic Physics; Nuclear Physics		
Discipline(s)	Physics		
Position(s) applied	PHD		
1. Ahmed Bouda /Professor, Depatement of Physics-University of Bejaia, bouda_a@yahoo.fr (2018/11/06)			file (PDF, PDF, 2018/11/07)
2. A. Mohamed Meziane /Lecturer Class A, Depatement of Physics-University of Bejaia, amohamed_meziane@yahoo.fr (2018/10/29)			file (PDF, PDF, 2018/10/30)
3. Foughali Taoufik /Lecturer Class A, Depatement of Physics-University of Bejaia, fougto_74@yahoo.fr (2018/10/29)			file (PDF, PDF, 2018/11/01)
4. Abdelhakim Gharbi /Lecturer Class A, Depatement of Physics-University of Bejaia, hakimgharbi74@gmail.com (2018/11/12)			file (PDF, PDF, 2018/11/15)
Received Materials	**PHD**	**Cover Letter:** file (PDF, PDF 2019/02/15) **Curriculum Vitae:** file (PDF, PDF 2019/02/15) **Research Statement:** file (PDF, PDF 2019/02/15)	

February 15, 2019

Akbou,06048-Algeria
Phone: +213 (0) 665 66 37 43
Email: takka.naimi@gmail.com

Dear Members of the Search Committee,

I am writing to show my interest by applying for Postdoctoral Research Position. I am a Ph.D. candidate in Theoretical Physics from the university of Bejaia-Algeria.

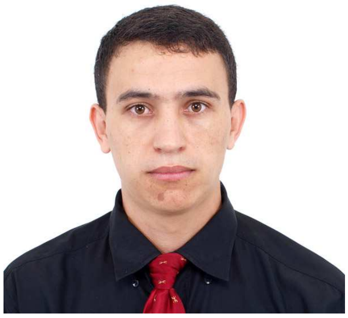
Generally speaking, my research interests include quantum mechanics, relativity and their eventual reconciliation as an ambitious perspective. During my first few years in the research area, I have ventured into a field dealing with fundamental physics, little known in the literature and I came out confident with a powerful moral by producing my first original ideas. To this end, I went through different phases summarized by finding a new scientific problem, solving it with an original solution and its acceptance by the scientific community without any modification. This maturity has been the result of years of sacrifice that I reset every time as a new starting point for a better future. Statistically speaking, I have published three papers, submitted the fourth and I am preparing the fifth one for publication.

You will find attached my curriculum vitae and research statement. Please contact me if you need any further information. Thank you for your consideration.

Sincerely,

Naimi Takka

Curriculum Vitae



Personal Data

Name:	Naimi Takka
Birth day:	November 14, 1990
Address:	Taslent 06048, Bejaia
Phone:	+213 (0) 665 663 743
Email:	takka.naimi@gmail.com
Nationality:	Algerian

WORK EXPERIENCE

Current Oct 2017 — Part time physics teacher, University of Bejaia, Algeria
Faculty of Science and Technology (ST) - ST Department
Modules: *Point Mechanics* & *Electricity and magnetism*

Oct 2017-June 2018 — Part time maths teacher, University of Bejaia, Algeria
Faculty of Exact Sciences - Department of Physics
Modules: *Analysis and Algebra 1* & *Analysis and Algebra 2*

EDUCATION

April 2018 — Doctoral Degree in Theoretical Physics, **University of Bejaia**, Algeria
PhD Thesis: "Non-commutative formalism in the theory of relativity"
Advisor: Prof. Ahmed Bouda
PhD Thesis Mention: First distinction (Very honourable)

July 2013 — Master's Degree in Theoretical Physics, **University of Bejaia**, Algeria
Master's Thesis: "Linear Gravity" | Advisor: Dr. Abdelmoumene Belabbas
Master's Thesis Mention: First distinction (Excellent; A; 18/20)
Other distinction: Major of class "16,23/20"

July 2011 — Bachelor's Degree in General Physics, **University of Bejaia**
Algeria. Distinction: Major of class "14,22/20".

June 2008 — High School diploma in Experimental Sciences, **Akbou**, Algeria

PUBLICATIONS AND CURRENT RESULTS

[4] N. Takka, A. Bouda, Maxwell's equations and Lorentz force in doubly special relativity (submitted for publication, 2019).

[3] N. Takka, Exact form of the generalized Lorentz force in Fock's nonlinear relativity, Int. J. Mod. Phys. A34, 1950016 (2019).

[2] N. Takka and A. Bouda, Exact form of Maxwell's equations and Dirac's magnetic monopole in Fock's nonlinear relativity, Mod. Phys. Lett. A33, 1850173 (2018).

[1] N. Takka, A. Bouda and T. Foughali, Maxwell's equations in the context of the Fock transformation and the magnetic monopole, Can. J. Phys. 95, 987 (2017).

PROJECTS

Current – 2015	Member of the project team : CNEPRU Research Project, *no. D00620140121*, *Laboratory of Theoretical Physics (LPT), Faculty of Exact Sciences & 06000 Bejaia, Algeria*

LANGUAGES

Tamazight:	Native speaker
Arabic:	Very good command
French:	Excellent command
English:	Good command (reading and written), Intermediate knowledge (speaking)

SKILLS AND COMPETENCIES

Computer knowledge:	Linux, LaTeX and some basic knowledge of programming
Physical knowledge:	Quantum mechanics and general relativity
Personal assets:	Ambition, motivation, curiosity and imagination

INTERESTS AND ACTIVITIES

Interests:	Achieve challenging goals in fundamental theoretical physics
Intellectual activities:	Reading, writing and teaching
Sporting activities:	Jogging

HONORS AND AWARDS

July 2013 : Major of physics disciplines at the university of Bejaia

REFERENCES

Ahmed Bouda /Professor
Vice Rector for Post-Graduate
Laboratory of Theoretical Physics
University of Bejaia, 06000, Algeria
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Depatement of Physics
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Foughali Taoufik /Lecturer Class A
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Abdelhakim Gharbi /Lecturer Class A
Laboratory of Theoretical Physics
University of Bejaia, 06000, Algeria
✉ hakimgharbi74@gmail.com

February 15, 2019

Research Statement

Naimi Takka

My primary interests in fundamental theoretical physics are quantum mechanics, relativity and their eventual reconciliation. In this perspective, during the preparation of my PhD degree and as a member of the Laboratory of Theoretical Physics (LPT) at the university of Bejaia-Algeria, I have participated in the research project CNEPRU [1] that have provided me with the first experience in these areas.

After finishing my Master's Thesis, publicly supported in Juin 20, 2013, my first initiation to scientific research is related to the study of the similarity between Gravity and Electromagnetism [2]. The academic year after, I successfully passed the competition of access to the doctorate 3^{rd} cycle LMD and I have chosen to work on a large field of research entitled " *Non-commutative formalism in the theory of relativity*". Under the direction of my thesis supervisor giving me a large degree of freedom, I have identified the possibility of studying electrodynamics in the context of Fock's nonlinear relativity almost a year after. To give a brief overview of this avenue of research, we can take as origin [5] where the most general form of Lorentz transformation of coordinates "*Fock-Lorentz transformation*" was established on the basis of the first principle of relativity alone. As one consequence, a new invariant appears naturally and was interpreted as the visible part of the universe R [6]. The objective targeted by such extension of special relativity (SR) is mainly to explore the implications of the non-constancy of the speed of light in vacuum which was subsequently reinforced by the desire to resolve some problems and paradoxes in cosmology [3] and in quantum gravity [4]. By inspiring from [7], they have succeeded in [8] to reproduce the usual Fock-Lorentz transformation of coordinates and to suggest a momentum transformation after having defined the appropriate deformed Poisson brackets. The main novelty of this rewriting is that the contraction $x_\mu p^\mu$ becomes an invariant which made possible the coherent description of free particles. In [9] and [10], the correspondence between the R-Minkowski spacetime and de Sitter spacetime has been established after having derived the Klein-Gordon and Dirac equations, respectively. To establish an extended form of both Maxwell's equations and Lorentz force, we were inspired mainly by the special relativistic version of Feynman's proof[11]-[13] from which we constructed a formal approach more adapted to the noncommutative algebra. This latter is conditioned by the knowledge of phase space algebra and the explicit form of the four-dimensional momentum valid in the absence of electromagnetic field [14]. In doing so, we have derived an extended first approximation of the generalized homogeneous Maxwell's equations. To deduce the second group, we have imposed the electric-magnetic duality. In the same context, we have developped an iterative methode allowing the generalization of Lorentz force. As particularity, the particle mass appears similarily as in the k-Minkowski space-time (the space of another extension of SR; DSR). After having restored the corresponding R-Lorentz algebra symmetry, Dirac's magnetic monopole emerges in the final result with a more symmetric analogy compared with the well-known electrostatic field. In other words, unlike the previous works where the magnetostatic field generated by the hypothetical magnetic charge was found without imposing the non-dependence on time despite its similarity with the usual electrostatic field, in our case, the analogy is more complet. On a quest for new generalizations even more satisfying, we have derived the exact form of both Maxwell's equations and Dirac's magnetic monopole in the same first context [15]. To this end, we have first found a more general symmetrization mechanism allowing the obtention of the corresponding exact momentum and the R-deformed commutation relations. After that, we have also used an iterative method in order to restore the patial part of R-Lorentz algebra symmetry. As new consequence, the universe could contain locally the magnetic charge but in its totality it is neutral. Another particularity of such derivation is that the final results take a very contracted form in spite of the fact that the calculations are very long. Recently, I have succeeded to find the remaining exact Lorentz force [16]. By investigating the aforementioned thematic in doubly (or deformed) special relativity (DSR), we have recently submitted a fourth paper for publication in an international journal [17].

At present, I seek an ambitious occasion to deepen my knowledge and to expand my personal experience by making exchanges with the high-level scientists in the world. Because I am so sure of myself and determined to give the best of my potential in order to achieve promising objectives in my scientific career, I apply to this offer hoping that it can be in harmony with such attempt and then in the interest of both parties. Since the realization of such feats often requires an enabling environment, your proposition constitutes an excellent opportunity for me to study a wide range of interests in several areas of physics by ensuring complementarity between different fields. For this purpose, I am very interested in working with your group in order to investigate new areas of research by contributing to the efforts of the group.

Summarizing all written above, I believe that my personal convictions to progress as far as possible in my life, my diverse background in physics and first experience in PhD degree, have built a solid ground for pursuing my academic career. All this assets gives me the motivation to apply to your institution.

References

[1] CNEPRU research project-Algeria, no. D00620140121 (ongoing).

[2] A.Bouda, A.Belabbas, Int. J. Theor. Phys. **49**, 2630 (2010).

[3] A. Albrecht and J. Magueijo, Phys. Rev. **D59**, 043516 (1999).

[4] J. Magueijo and L. Smolin, Phys. Rev. Lett. **88**, 190403 (2002).

[5] V. Fock, The Theory of Space, Time and Gravitation (Pergamon Press, 1964).

[6] S. N. Manida, gr-qc/9905046 (1999).

[7] S. Ghosh and P. Pal, Phys. Rev. **D75**, 105021 (2007).

[8] A. Bouda and T. Foughali, Mod. Phys. Lett. **A27**, 1250036 (2012).

[9] T. Foughali and A. Bouda, Can. J. Phys. **93**, 734 (2015).

[10] T. Foughali and A. Bouda, Int. J. Theor. Phys. **55**, 2247 (2016).

[11] F. J. Dyson, Am. J. Phys. **58**, 209 (1990).

[12] S. Tanimura, Annals Phys. **220**, 229 (1992).

[13] A. Bérard, Y. Grandati and H. Mohrbach, J. Math. Phys. **40**, 3732 (1999).

[14] N. Takka, A. Bouda and T. Foughali, Can. J. Phys. **95**, 987 (2017).

[15] N. Takka and A. Bouda, Mod. Phys. Lett. **A33**, 1850173 (2018).

[16] N. Takka, Int. J. Mod. Phys. **A34**, 1950016 (2019).

[17] N. Takka and A. Bouda, (submitted for publication, 2019).

Letter of Recommendation

Prof. BOUDA Ahmed
Vice Rector for Post-Graduate Studies and Scientific Research at the University of Bejaia
Affiliation: Laboratory of Theoretical Physics (LPT), Faculty of Exact Sciences, University of Bejaia, 06000 Bejaia, Algeria
Team Leader: Quantum Mechanics and Gravitation
Tel/Fax : + 213 (0) 553 813 851/ 34 81 37 32
E-mail : bouda_a@yahoo.fr

November 5, 2018

Dear Members of the Selection Committee:

I am writing in support of Naimi Takka for Postdoctoral Research Position. He has considerable abilities to do scientific research and I encourage you to give him your most careful consideration.

Under my supervision and for almost five years, Mr. Takka has been conducting a research on the application of non-commutative formalism in the theory of relativity. This effort has been rewarded with the publication of two papers and the submission of a third to a world-renowned international journal. In this works, we have mainly generalized the laws of electrodynamics and studied the emergence of Diracs magnetic monopole in Focks nonlinear relativity. A similar attempt is considered in the third one devoted to doubly (or deformed) special relativity (DSR). During the period of preparation of his PhD thesis in Theoretical Physics, publicly supported in April 12, 2018, he also shed light on some interesting perspectives. This is a student that I will enjoy watching develop into a highly productive research scientist.

In summary, Mr. Takka is a very motivated person, with a great potential for improvement which is always eager to acquire new knowledge and take up new challenges.

If I can be of any further assistance, or provide you with any further information, please do not hesitate to contact me.

Sincerely,

Prof. BOUDA Ahmed
Teacher and thesis supervisor

Mr. Mohamed Meziani Abdelkader
Lecturer Class A at the Department of Physics
Faculty of Exact Sciences
Abderahmane Mira University of Bejaia
E-mail: amohamed_meziane@yahoo.fr

Letter of reference

I, the undersigned, Mohamed Meziani Abdelkader, attests to have had Mr. Naimi Takka as student during the two cycles, graduate and post-graduate levels of his training in physics. During the graduate level of his training, I assured him the unit of analytical mechanics in the second year, the unit of thermodynamics and statistical physics in the third year. During the post-graduate level, I assured him the unit of relativistic quantum mechanics in first year and the unit of path integrals in second year. The student had a lot of ability to assimilate and master the concepts and concepts taught. He was serious, hardworking and very motivated. He had obtained very satisfactory results.

The candidate, in addition to his scientific abilities, is very sociable, respectful and easily integrates into the community in which he lives.

Done at Bejaia, on October 29, 2018.
A. Mohamed Meziani

A meziani

Dr. FOUGHALI Taoufik
Maitre de conférences A
Laboratoire de Physique Théorique
Département de Physique, Université de Bejaia
Email : taoufik.foughali@univ-bejaia.dz

Bejaia, November 01st 2018

Recommendation Letter

I am writing in support of **Naimi TAKKA** for a postdoctoral position

I have known **Mr. Naimi TAKKA** as a Master 2 student in Physics. He was following my lecture "**Gauge Field Theory"** that I delivered for Physics Master 2 (Option: Theoretical Physics) during the academic year (2012-2013) at Bejaia University.

Mr. TAKKA showed a clear interest in my lectures, and was very motivated to learn and understand how things go in details and always sought to have a coherent understanding and see for links with other fields and topics he was interested in. He was always volunteer, had an active participation in courses and answered my questions during the class. **Mr. TAKKA** was among the best 5% in his promotion, taking in account his active presence in class and his results in tests.

After that, and as part of the preparation of his doctoral thesis, I had the opportunity to work with **Mr. TAKKA** on an exciting research project on non-commutative formalism in deformed relativity. This work resulted in an article that was published in Canadian Journal of Physics, on which **Naimi** is a author. In addition to the Can. J. Phys paper, **Naimi** published an other paper after his thesis, which attest to his hard work, and outstanding writing skills.

For all these reasons, I would recommend **Mr. TAKKA** for a postdoctoral position.

Please, accept all salutations.

Dr. Taoufik FOUGHALI

Dr. Abdelhakim GHARBI
Email: hakimgharbi74@gmail.com
Associate Professor, Physics Department
University of Bejaia
Route de Targa ou Zemmour
06000 Bejaia, Algérie

Bejaia, October 24th 2018

Recommendation Letter

Dear Madame, Sir, after the request of **Mr. Naimi Takka** for a recommendation letter to support his application to your Postdoctoral Research Position, here are my appreciations about Mr. TAKKA.

I have known **Mr. Naimi Takka** as a Master student in Physics. He was following my lectures "**Mécanique quantique approfondie"** that I delivered for Physics Master (Option: Theoretical Physics) during the first semester of the academic year (2011-2012) at Bejaia University.

Mr. Naimi Takka showed a clear interest in my lecture and was very motivated to learn and understand how things go in details and always sought to have a coherent understanding and see for links with other fields and topics he was interested in. He was always volunteer, had an active participation in courses and answered my questions during the class.

Mr. Naimi Takka is among the best 5% in his promotion, taking into account his active presence in class and his results in tests.

For all these reasons, I give Mr. TAKKA my highest recommendation. He would be a good catch for any research laboratory and I urge you to consider his candidacy to your Postdoctoral Research Position.

. Please, accept all salutations.

Dr. Abdelhakim GHARBI

AcademicJobsOnline.org

xu, wulong

Address		**Email** 396440567@qq.com (update 2018/12/26)	
Beijing, Beijing China		**Home Phone** **Office Phone** **Skype Name** wulongxu555@outlook.com	
Current Title / Dates	Master, 2016-2019		
Current Institution	Beijing university of Technology	**Department**	Theoretical physics
Location	Beijing, Beijing , China		
Highest Degree	MS	**Institution**	**Date** 2019/06 exp
Research Interests	**Primary** Extended Higgs Sectors, Simplified Models		
Secondary	Dark Matter; Exclusive processes and hadronic matrix elements		
Current Research Interests: **Web Pages:** http://arXiv:1812.07224 http://[hep-th]			
Discipline(s)	Theoretical Physics; Particle and Astroparticle Phenomenology; Cosmology; Physics		
Position(s) applied	PHD		
1. Yong-Chang Huang, , ychuang@bjut.edu.cn (teaching) (2018/12/26)		file (PDF, PDF, 2018/12/26)	
2. Wen-Yu Wang, , wywang@bjut.edu.cn (teaching) (2018/12/26)			
Received Materials	**PHD**	**Cover Letter:** file (PDF, PDF 2018/12/26) **Curriculum Vitae:** file (PDF, PDF 2019/01/30) **Research Statement:** file (PDF, PDF 2018/12/26) **Copies of grades transcripts:** file (PDF, PDF 2018/12/26)	

cover letter

Dear Professor,

I appreciate that you can take time off your busy schedule to read my letter. This is a letter of my motivation to apply for PhD position and scholarship.

My name is Wu-Long Xu. I am a third-year graduate student of College of Applied Sciences,Beijing university of Technology in Beijing, China. My major is theoretical physics. Absolutely I want to continue to work in it all the time.

A successful person live his life through his value. He knows his purpose. Being accountable in all the that are happening in life is an example of having high emotional quotient.

My undergraduate eduction was trained in physics in the Qiqihaer University in China. Here i have some problem that my grade is not good. In that age i was playful. The time of classes always conflict with the schedules of playing football and games. But truth be told, in the undergraduate period i was not an outstanding student subjected to the judgment based on academic records. At that time i thought textbooks were more or less boring and it cost a lot of time in thinking the meaning of physics. However a turning point occurred when i participated in a research project making a water rocket. It's a interested project on innovative mechanical design, which was truly challenging to me with theory and experience. But i found soon that it's amazing project for a experimental experience, with valuable physics issues involved. I felt the power of theory. Then i put my heart in the work absorbed the knowledge. This experience excited me a great curiosity in research as i tasted the feelings of discovering physical laws of things in nature.

Most of my research activities during postgraduate are presented in my CV for your information. In a word, i am enjoying the three years at theoretical physics, especially cosmology and gravity. This working experience is very valuable for me, not only technically. In fact it teaches me something that i hadn't learnt from school, e.g. failure is the final test of perseverance.

Why i apply for this thesis.

Firstly, i am really interested in this research proposal, which, expected to be carried out on the microscopic scale, is very appealing to me.

secondly, the thesis's supervisors are well-Known specialists in this research field, whose guidance and advice will be absolutely helpful for my academic career.

Lastly, gravity and cosmology are considered as a pretty meaningful research direction. And i think this group is the best place to devote my energy to this promising research area.

Why i am a worthy candidate

Having three years' research experience on theoretical theory, particularly based on GR and standard cosmology, which is crucial to this thesis research.

Skilled in numerical analysis and data processing by means of the software, which is eagerly expected in this thesis research.

With sufficient wide range knowledge in theoretical physics, which is a favorable condition for this thesis research.

i am sure that, with the benefit of your advice, i can acquire broader perspectives and more profound insights.

I am very thankful you have read all my letter. I hope i can become a doctor and i can do something for physics. Thank you very much again.

Wulong xu

Gender: Male

Date of Birth: **25**/5/1993

Add: **Beijing university of Technology.**

Beijing China

E-mail: 396440567@qq.com

Tel: 010-18810816972

Education

Bachelor of Science: in physics in QiQihaer University September 2012-June 2016Heilongjiang,China

Master degree:College of Applied Sciences,Beijing University of Technology September 2016-Present Beijing, China

Anticipated Graduation : June 2019 in Theoretical Physics

Research Experience

Professor H's Group **September 2016- Present**

Research contents:

Su(5) grand unification theory ;

Single field inflation i.e.Higgs inflation.and hybird inflation. In different gravity background.

Dynamic of domain wall (brane world) : in different background bulk evolution of domain wall (brane world) and its fluctuating. And this is my present work specially in a charged dilaton black hole .

Paper

My paper: "Dynamics of domain wall in a black hole bulk" (prepare to PRD,arXiv: 1901.02155 [gr-qc]).

The other paper: AiChen Li,Wulong Xu and Dingfang Zeng "Linear Stability Analysis of Evolving Thin Shell Wormholes"(prepare to JHEP,arXiv:1812.07224 [hep-th])

Research Interests

Cosmology , gravity , particle physics, dark matter, dark energy, field theory, superstring theory, inflation. Black hole.

Computer

Specialized software: mathematical, latex

Literature searching online.

Award

Second prize for excellent graduate students 2017.12.

Hobbies

Fitness, Badminton, Reading, Music.

Statement

Wu-Long Xu

I. RESEARCH EXPERIENCE

This year i mainly study the particle physics and cosmology. In particle physics, i follow the su(5) grand unification theory. In cosmology, i studied the inflation such as singer filed inflation(mainly include higgs inflation) and hybrid inflation. My paper published soon is "the dynamics of domain wall in a black hole ". Meanwhile i calculated the perturbation of metric used by the paper "Linear Stability Analysis of Evolving Thin Shell Wormholes"[1].

A. su(5) grand unification theory

the gauge group is $su_c(3)\times su(2)\times u(1)$ in SM. The group's rank is 4 as well as su(5) group. So su(5) group can include the subgroup $su_c(3)\times su(2)\times u(1)$. Among the represent of generator of su(5), it need to find these represents for $su(3), su(2), U_Y(1), U_e(1)$. The gauge field of su(5) can be represented a metric A. A all has 24 gauge fields $A^a_b(a,b=1,2,\cdot,5)$. and the gauge fields $G^\alpha_\beta(\alpha,\beta=1,2,3), W^+, W^-, W^3, B$ of the subgroup$su(3)\times su(2)\times u(1)$ is $A^\alpha_\beta(\alpha,\beta=1,2,3), A^s_r(r,s=4,5)$.and the 12 new elements A^r_α, A^α_r correspond to the gauge fields $X_i, Y_i, \bar{X}_i, \bar{Y}_i(i=1,2,3)$ disappearing in the group of SM.

In the every generation of fermi, it total have fifteen kinds particles if neutrino don't have mass. So these fermi can fill a decuplet and quintuplet. The lagrange for fermi field is

$$\begin{aligned}\mathscr{L}_f &= i(\bar{\psi}^c_R)_a(\not{D}\psi^c_R)^a + i(\bar{\psi}_L)_{ab}(\not{D}\psi_L)^{ab}\\ (D_\mu\psi^c_R)^a &= [\partial_\mu\delta^a_b - ig_5(T^iA^i_\mu)^a_b](\psi^c_R)^b\end{aligned} \tag{1}$$

Then we will get the Feynman rule of interaction between fermi filed and gauged filed.

For the higgs mechanism, it take two higgs multiplet. One is $\phi^a_b(a,b=1,2,\cdots,5)$, another is $H^a(a=1,\cdots,5)$. Fermi and gauge boson will acquire the mass form this mechanism. The lagrange density of higgs fields is

$$\mathscr{L} = (D^\mu\phi)^{\dagger a}_b(D_\mu\phi)^b_a + (D^\mu H)^\dagger_a(D_\mu H)^a - V(\phi) - V(H) \tag{2}$$

In this theory, it exist a problem about proton decay. So it also need some improvement to do.

B. singer inflation

our university has the character of homogenity and isotropy.so the metric have the following form.

$$ds^2 = -dt^2 + a^2(t)[\frac{dr^2}{1-kr^2} + r^2(d\theta^2 + \sin^2\theta d\phi^2)] \tag{3}$$

then we can get the left side of Einstein equation .and we assume the early university is perfect fluid($T_{\mu\nu} = Pg_{\mu\nu} + (P+\rho)U_\mu U_\nu$). so taking them into the Einstein equation(note G is the Newton gravitational constant)

$$G_{\mu\nu} = 8\pi GT_{\mu\nu} \tag{4}$$

then we get two FRW equations

$$\begin{aligned}H^2 + \frac{k^2}{a^2} &= \frac{8\pi}{3}G\rho\\ \frac{\ddot{a}}{a} &= -\frac{4\pi G}{3}(\rho+3P)\end{aligned} \tag{5}$$

also we can by transformation get the state equation

$$\dot{\rho} + 3H(P+\rho) = 0 \tag{6}$$

and for solving the flat and horizon problem .we need to ask $\ddot{a} > 0$. and for the FRW equation right side in different age it has a different relation. so we note that : (1)in the dust matter situation ,we have the relation $\rho a^3 = constant$ and P=0. (2)in the relativistic gas(early university)we have$P = \frac{1}{3}\rho$ .and $\rho a^4 = constant$. then we consider universe have a inflation stage.and we know the inflaton in general is a scalar field .and for the most model ,we find the singer inflation is a better choose.so we just discuss the singer inflation .

so the lagrange is$L = -\frac{1}{2}\nabla_\mu\phi\nabla^\mu\phi - V(\phi)$ and we have the energy -momentum tensor.$T_{\mu\nu} = 2\frac{\delta L}{\delta g_{\mu\nu}} - g_{\mu\nu}L$. so

$$\begin{aligned}H^2 + \frac{k^2}{a^2} &= \frac{8\pi}{3}G\rho = \frac{8\pi}{3}G(\frac{1}{2}\dot{\phi}^2 + V(\phi))\\ \frac{\ddot{a}}{a} &= -\frac{4\pi G}{3}(\rho+3P) = -\frac{8\pi G}{3}(\dot{\phi}^2 - V(\phi))\\ \ddot{\phi} + 3H\dot{\phi} &= -V'(\phi)\end{aligned} \tag{7}$$

when we ask $\ddot{a} > 0$ and the (9)is order to slow the evolution of ϕwe naturally think a special condition.

$$\begin{aligned} \dot{\phi}^2 &\ll V(\phi) \\ \ddot{\phi} &\ll 3H\dot{\phi} \end{aligned} \tag{8}$$

these are the slow-roll conditions. so applying for the conditions we can get the equations.

$$\begin{aligned} H^2 &= \frac{V(\phi)}{3M_{pl}^2} \\ 3H\dot{\phi} &= -V'(\phi) \end{aligned} \tag{9}$$

and the shape of the potential $V(\phi)$determines the slow-roll parameters

$$\begin{aligned} \epsilon(\phi) &= \frac{1}{2}M_{pl}^2(\frac{V'}{V})^2 \\ \eta(\phi) &= M_{pl}^2\frac{V''}{V} \end{aligned} \tag{10}$$

we know that$\epsilon \ll 1 and |\eta| \ll 1$ according to the slow-roll conditions .

$$\begin{aligned} &\epsilon(\phi) = \frac{1}{2}M_{pl}^2(\frac{V'}{V})^2 \ll 1 \rightarrow V' \ll \sqrt{2}\frac{V}{M_{pl}} \rightarrow V \ll e^{\frac{\sqrt{2}}{M_{pl}}\phi} \\ &\eta(\phi) = M_{pl}^2\frac{V''}{V} \ll 1 \rightarrow V'' \ll \frac{1}{M_{pl}^2}V \rightarrow V \ll e^{\frac{1}{M_{pl}}\phi} \\ &N(\phi) = \ln\frac{a_{enda}}{a} = \int_t^{t_{end}} H dt = \int_\phi^{\phi_{end}} \frac{H}{\dot{\phi}}d\phi \propto \int_{\phi_{end}}^{\phi} \frac{V}{V,\phi}d\phi \\ &\quad = \int_{\phi_{end}}^{\phi} \frac{1}{\sqrt{2\epsilon}}d\phi \end{aligned} \tag{11}$$

II. RESEARCH INTERESTS

Everyone expect the unification of four kinds interactions. But for the quantum gravity, we can't get successfully it all the time. My interests include Ads/CFT, holographic principle, black hole thermodynamics, particle physics and so on.

[1] A. c. Li, W. l. Xu and D. f. Zeng, "Linear Stability Analysis of Evolving Thin Shell Wormholes," arXiv:1812.07224 [hep-th].

北京工業大學
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GRADUATE SCHOOL OF BEIJING UNIVERSITY OF TECHNOLOGY
ACADEMIC RECORD(ENGLISH TRANSLATION)

Student Number	S201606076	Name	XU Wulong
Date of Enrollment	2016-09-06	Program	Master's Degree
Department	College of Applied Sciences		
Subject	Physics		

No.	Course	Credit	Record	Note
1	Natural Dialectics	1	85.00	★
2	Advanced Quantum Mechanics	3	90.00	★
3	Research on Theory and Practice of Socialism with Chinese Characteristics	2	84.00	★
4	Group Theory and Applications in Physics	3	98.00	
5	Quantum Field Theory I	2	88.00	★
6	Quantum Theory of Field II	3	95.00	
7	First Foreign Language (English)	2	64.00	★
8	Defferential geometry and Application in Physics	3	88.00	
9	Gauge Field Theory I	2	90.00	★
10	Advanced Quantum Statistic Physics	3	80.00	★
11	Superstring Theory I	3	84.00	
12	Particle Physics	3	94.00	
13	Fundamentals for Supersymmetric Theory	3	85.00	
14	Superstring Theory II	3	91.00	
	Credits Degree Courses: 15	Total Credits	36	
	Graduation Thesis			

Note:
★ Course for Degrees
☆ Scores in the Make-up Examination
● Exempt from Advanced Studies

Date:2018-11-06

北京工业大学研究生院

Official Seal

Director, Principal Prof. Yong-Chang Huang

Institute of theoretical Physics

Beijing University of Technology

Beijing, 100022

P. R. China

E-mail: ychuang@bjut.edu.cn

Dear Madam or Sir,

I would like to recommend Mr. Wu-long Xu to your graduate program, as his supervisor in his graduate research. I made this recommendation based on my impressions on his being an outstanding student and a highly persevering and diligent person.

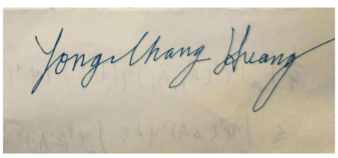
Mr. Xu is very earnest in his study. His studied graduate courses that include *Advanced Quantum Mechanics, Quantum Field Theory, General Relativity and Cosmology* and so on. These courses are really tough, but Mr. Xu passed them with very good performance.

Mr. Xu and I began our research in March 2018. During the collaboration, his enthusiasm, cognition and creativity always impressed me. After several discussions with me on the direction of the project, he independently pointed out the possible problems and corresponding solutions. With his own idea, the topic was successfully discussed in a novel and interesting perspective.

Upon finishing a exercise about SU(5) grand unification theory, we turned our attention to cosmology and researched on mainly dynamics of domain wall in a special black hole. Being occupied with my tight schedule, I encouraged Mr. Xu to finish the calculation by himself. It was during this period that he fully presented his mathematical ability and logical thinking. With several weeks of rigorous work, he successfully and independently derived evolution equations for domain wall and skillfully analyzed the entire moving situation. Finally he gets a way that by analyzing parameters can stop moving of domain wall in a location. At same time we analyzed the stability in the position. His achievement on the project is very satisfying and being written in a novel paper to submit to Physical Review D, which is the consequences of his persistent hard-work and great personality that I consider very important for future Ph. D. studies.

In general, based on my experience mentoring Mr. Wu-Long Xu, I highly recommend him and believe his probability of success in your program is very high. He is going to work with me until the next summer to complete his MS research. To be honest, I would rather like to have such an excellent young man stay in my group for Ph. D.; however, he really deserves a better academic environment to study abroad. As an outstanding student with great personalities and problem-solving skills, he deserves a chance to make his own success as a young scientist, and to personally impress you as he did here. Should you have any questions, please do not hesitate to contact me.

Yours sincerely



Yunesi, Arash

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501 Blairstone Rd Apt 1728 Tallahassee, FL 32301-3093		**Home Phone** **Cell Phone** (850) 980-5693 **Office Phone**	
Current Title / Dates	Graduate Research/Teaching Assistant, 2013-2019		
Current Institution	Florida State University	**Department**	Physics Department
Location	77 Cheiftan way, Tallahassee, FL 32301-3093		
Highest Degree	PhD	**Institution** Florida State University	**Date** 2019/08 exp
Thesis Advisor	Takemichi Okui		
Research Interests	**Primary** SCET, Effective Field Theories		
Secondary	Dark Matter, Baryogenesis; Scattering Amplitudes		
Current Research Interests: **Web Pages:** http://inspirehep.net/search?ln=en&p=find+a+yunesi&of=hb&action_search=Search&sf=earliestdate&so=d			
Discipline(s)	Physics		
Position(s) applied	PHD		
1. Takemichi Okui, Florida State University, okui@hep.fsu.edu (2018/11/29)			file (PDF, PDF, 2018/11/30)
2. Yanou Cui, University of Riverside, yanou.cui@ucr.edu (2018/11/29)			file (PDF, PDF, 2018/12/08)
3. Laura Reina, Florida State University, Reina@hep.fsu.edu (2018/11/29)			file (PDF, PDF, 2018/12/21)
Received Materials	**PHD**	**Cover Letter:** file (PDF, PDF 2018/12/31) **Curriculum Vitae:** file (PDF, PDF 2018/12/13) **Research Statement:** file (PDF, PDF 2018/12/26) **Copies of grades transcripts:** file (PDF, PDF 2018/12/31)	

Arash Yunesi
Department of Physics
Florida State University
77 Chieftan Way
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December 27, 2018

Dear Members of Search Committee:

I am writing to apply for the position of postdoctoral research scholar in theoretical high energy physics at Karlsruhe Institute of Technology. I am working mainly on Effective Field Theories, under supervision of Professor Takemichi Okui. I will finish my dissertation by summer 2019 and expect to receive my PhD in August 2019.

My Research mainly focuses on building Soft Collinear Effective Theory (SCET) for gravity at the leading and next-to-leading powers of a small parameter. In our work, ”Soft collinear effective theory for gravity”, we identified fundamental building blocks of SCET for gravity and also spelled out a detailed procedure for writing down all terms in the effective Lagrangian. Our procedure works not only for gravitons and interactions between them, but also for any full theory that includes interactions with gravitons at leading and next-to-leading powers of the small parameter. Just as in the case of SCET, decoupling of soft and collinear graviton fields is achieved via a soft Wilson line. Other basic building blocks of Soft Collinear Gravity include collinear Wilson lines for copies of local Lorentz and Diffeomorphism gauge groups in each collinear sector. Based on our detailed procedure, writing down any desired process that includes soft and/or collinear gravitons at LP and NLP is a simple task. Matching the process to the corresponding full theory process through an easy calculation is the only step remaining.

In another published paper, ”LHC Signatures of WIMP-triggered Baryogenesis”, we worked on generating similar cosmic abundances of Dark Matter and Baryons from CP violating decays of thermal Weakly Interacting Massive Particles (WIMPs). Our model is a robust representative of WIMP Baryogenesis mechanism and collider signatures provided are strong probes of this scenario. I am also familiar with other subjects such as fluctuations in the Cosmic Microwave Background, scattering amplitudes of gauge theory and gravity, and inflation theories. Recently I have been working on Reparameterization Invariance of SCET for gravity. This is a nontrivial extension of our work. I am hoping to submit the results to arXiv by January 2019 and present at SCET 2019 workshop.

I have found research in theoretical physics very interesting and rewarding. I believe that with my research interests and previous experience on effective field theories as well as CMB, Dark Matter, and Baryogenesis, I will be able to contribute to your theory group. For further consideration, my CV with a list of publications is enclosed. Thank you for your time and I am looking forward to hear from you.

Sincerely yours,

Arash Yunesi

Arash Yunesi

Arash Yunesi

CONTACT INFORMATION

77 Chieftan Way
Department of Physics
Florida State University
Tallahassee, FL 32306

Cell: (850) 980-5693
E-mail: ayunesi@hep.fsu.edu

RESEARCH INTERESTS

Soft-Collinear Effective Theory (SCET), Effective Field Theories, Physics Beyond Standard Model, Dark Matter, Baryogenesis

EDUCATION

Florida State University, Tallahassee, Florida

PhD Candidate in Physics, 2019

- Advisor: Prof. Takemichi Okui
- Cumulative GPA: 4.00/4

MSc in Physics, 2015

- GPA: 4.00/4

Sharif University of Technology, Tehran, Iran

BSc in Theoretical Physics, 2013
- GPA: 3.5/4

Minor in Mathematics, 2013
- GPA: 3.8/4

HONORS & AWARDS

Evelyn and John Baugh Research Presentation Scholarship, FSU Physics Department, Summer 2018

The Hagopian Family Endowment Fund (for outstanding research in High Energy Physics), FSU Physics Department, Spring 2018

The Dirac Fellowship, FSU Physics Department, Spring 2017

Evelyn and John Baugh Research Presentation Scholarship, FSU Physics Department, Summer 2017

Ranked 52th among more than 100,000 participants in nation-wide universities entrance exam, Iran, Summer 2008

Semifinalist in National Mathematics Olympiad, Iran, Spring 2007

PUBLICATIONS

- T. Okui and A. Yunesi, ”Soft Collinear Effective Theory for Gravity,” Phys. Rev. D 97, no. 6, 066011 (2018), [arXiv:1710.07685 [hep-th]]
- Y. Cui, T. Okui and A. Yunesi, ”LHC Signatures of WIMP-triggered Baryogenesis,” Phys. Rev. D 94, no. 11, 115022 (2016) [arXiv:1605.08736 [hep-ph]]

PAPERS IN PREPARATION

- T. Okui and A. Yunesi, ”Reparametrization Invariance for Soft Collinear Effective Gravity” Expected publication January 2019

PRESENTATIONS

”Soft-Collinear Effective Gravity”, Theoretical Advanced Study Institute (TASI), University of Colorado Boulder, Summer 2018, Student Talk

”Soft-Collinear Effective Gravity”, Phenomenology Symposium 2018, University of Pittsburgh, Spring 2018, Parallel Talk

"SCET for Gravity", HEP Seminar, FSU Physics Department, 2018

"WIMP-triggered Baryogenesis: SUSY Embedding and LHC Phenomenology", HEP Seminar, FSU Physics Department, 2017

"Baryogenesis and a 750-GeV Diphoton Resonance at LHC", Dirac Lectures, FSU Physics Department, 2016

Schools Attended

- Theoretical Advanced Study Institute (TASI), University of Colorado Boulder, 2018
- Prospects in Theoretical Physics (PiTP), Institute for Advanced Study, 2017
- Dirac Lectures, Florida State University, 2016
- SLAC Summer Institute (SSI), Stanford Linear Accelerator, 2014

Teaching Experience

Electrodynamics I (grader), FSU, Fall 2018
College Physics Recitation, FSU, Spring 2017
Quantum Field Theory II (grader), FSU, Spring 2016
Statistical Physics (grader), FSU, Spring 2015
Theoretical Dynamics (grader), FSU, Fall 2014
College Physics I&II (lab instructor), FSU, Fall 2013, Spring & Summer 2014
Teaching Assistant of Physics of Stars, Sharif University of Technology, Fall 2011
Teaching Assistant of Special Relativity, Sharif University of Technology, Spring 2012
Teaching Assistant of Mathematical Physics, Sharif University of Technology, Fall 2012
General Physics I&II (tutor), Summer 2010 & Fall 2012

Computer Skills

- Physics Packages: FeynRules, MadGraph, FORM
- Languages: C/C++, some experience with Python
- Applications: LaTeX, common Windows/Linux softwares
- Mathematics Softwares: Mathematica
- Operating Systems: Linux, Windows.

Language Skills

English, Professional proficiency
Kurdish, mother tongue
Farsi/Persian, native
Arabic, intermediate reading and writing

Arash Yunesi

Research Statement

Standard Model (SM) of particle physics has been tremendously successful in explaining many experimental results over the past few decades. Despite this success, there are many fundamental questions and experimental results remaining to be answered. For example, Quantum Gravity and Naturalness problem have great theoretical motivation. Experimental results that need explanation include Dark Matter, Baryogenesis, neutrino masses, and etc. These are all interesting challenges for theoretical high energy physics. Besides these, developing top-down Effective Field Theories (EFTs) makes calculations, that would be difficult in the corresponding full theory, much easier. This is because EFTs' target phase space is limited by definition. Moreover, a process with one large and one small energy or mass scale will receive logarithmic enhancements in perturbation theory. This makes calculations in full theory difficult and increases importance of an EFT that can sum these large logarithms.

Effective Field Theories

Effective field theories (EFTs) are useful in any quantum field theory with two or more widely different scales. This is because in EFT, physical quantities can be expanded in powers of the ratio of a small scale over a large scale. Soft Collinear Effective Theory (SCET) is the latest EFT originally developed in the context of QCD. It is used to systematically and efficiently calculate amplitudes of scattering processes that include highly collimated energetic particles as well as low energy radiation, better known as soft. In [1] we have developed ideas similar to SCET for any full theory that includes interactions with gravitons. Since EFT is closer to amplitude level, as highly off-shell modes are integrated out and placed into Wilson coefficients of the effective operators of Lagrangian, interesting properties can be observed in EFT Lagrangian. Our work shows decoupling of collinear gravitons and soft graviton theorem at leading power manifestly. Moreover soft graviton theorem at Next-to-Leading power is also evident from the EFT Lagrangian. It should be emphasized that these theorems are obscure in the original EFT of gravity and one needs to limit to examples or utilize diagrammatic tricks to prove them at scattering amplitude level, as it has been done recently. Our step by step procedure for writing down effective operators at leading power and next-to-leading power works for any full theory that includes interactions of gravitons with themselves and other particles. Although our paper uses symmetry arguments to spell out the structures appearing in SCET for gravity, these should have been confirmed independently starting from full theory. Therefore, during this project I had a very hands on approach and used FORM, C++ and Mathematica, as well pen and paper to directly carry out lengthy calculations starting from full theory and validate what symmetry arguments were dictating. I have learned and applied most of techniques common to new EFTs of SM and this are useful tools for my professional career.

Arash Yunesi, 77 Chieftan Way, Tallahassee, FL 32306
(850)980-5693 • *ayunesi@hep.fsu.edu*

Baryogenesis and Dark Matter

The origins of Dark Matter (DM) and the large asymmetry between matter and antimatter are two of the biggest experimental mysteries in fundamental physics. An attractive scenario for DM has been freeze-out of a thermal Weakly Interacting Massive Particle (WIMP). The idea of producing asymmetry between matter and antimatter using CP violating decays of a metastable WIMP, has been suggested by Cui and Sundrum. This is an interesting explanation and in [2] we studied this scenario and spelled out the possible scenarios along with signatures of them at the LHC. This project was a good practice for me to learn more about Baryogenesis and DM as well as phenomenology at colliders. I also have used FeynRules 2.0 to implement our models and produce UFO files. Using these UFO files and MadGraph I have calculated benchmarks for this model to be tested at the LHC.

Current Work and Future Plans

Currently I am working on SCET for gravity. In [1] we see interesting structures and possible connections between them. We think that these connections are not random and point to some underlying physics within the EFT. We guess that Reparametirization Invariance (RPI) of SCET is responsible for these connections. RPI is not a real symmetry of the physical world, but only a symmetry of our formalism. It comes from the freedom in choosing the direction of light-like basis vectors used in SCET, as well as the ambiguity in decomposing momenta into soft and collinear. So far RPI has proven to be nontrivial in SCET for gravity and it is not the same as RPI for QCD SCET since here we have both local Lorentz group as well as diffeomorphism group. I am hoping to publish my results in early spring 2019.
I am interested in EFTs in general and my experience with SCET has been a good one so far. I would also like to expand more into DM and inflation.

Publications

T. Okui and A. Yunesi, *Soft collinear effective theory for gravity*, *Phys. Rev.* **D97** (2018) 066011, [1710.07685].

Y. Cui, T. Okui and A. Yunesi, *LHC Signatures of WIMP-triggered Baryogenesis*, *Phys. Rev.* **D94** (2016) 115022, [1605.08736].

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Florida State University

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282 Champions Way
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Name:	**Arash Yunesi**
Student ID:	200051730
Birthdate:	12/23/1989
Residency:	Non-Resident Alien (Non-USA)
Print Date:	11/21/2018

Unofficial Transcript

ALL CREDIT HOURS ON THIS RECORD REFLECTED IN SEMESTER HOURS
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External Degrees

Sharif University of Technology
Bachelor of Science 07/30/2013

Beginning of Graduate Record

2013 Fall

Program: Graduate-Unspecified
Plan: Physics Major

Course	Description	Grd	GB	RP	Taken	Passed	Points
PHY5246	THEORETICAL DYNAMICS	A	GRD		3.000	3.000	12.000
PHY5346	ELECTRODYNAMICS A	A	GRD		3.000	3.000	12.000
PHY5645	QUANTUM MECHANICS A	A	GRD		3.000	3.000	12.000
PHY5940	SUPERVISED TEACHING	S	SOU	EXCL	3.000	0.000	0.000

Repeated: Repeat - Exclude Credit

			Taken	Passed	GPA Hrs	Points
Term GPA	4.000	Term Totals	12.000	9.000	9.000	36.000
Transfer Term GPA		Transfer Totals	0.000	0.000	0.000	0.000
Combined Term GPA	4.000	Comb Totals	12.000	9.000	9.000	36.000
Cum GPA	4.000	Cum Totals	12.000	9.000	9.000	36.000
Transfer Cum GPA		Transfer Totals	0.000	0.000	0.000	0.000
Combined Cum GPA	4.000	Comb Totals	12.000	9.000	9.000	36.000

2014 Spring

Program: Doctoral Degree
Plan: Physics Major

Course	Description	Grd	GB	RP	Taken	Passed	Points
PHY5347	ELECTRODYNAMICS B	A	GRD		3.000	3.000	12.000
PHY5524	STATISTICAL MECHANCS	A	GRD		3.000	3.000	12.000
PHY5646	QUANTUM MECHANICS B	A	GRD		3.000	3.000	12.000
PHY5940	SUPERVISED TEACHING	S	SOU	REPT	3.000	3.000	0.000

Repeated: Repeat for Credit

			Taken	Passed	GPA Hrs	Points
Term GPA	4.000	Term Totals	12.000	12.000	9.000	36.000
Transfer Term GPA		Transfer Totals	0.000	0.000	0.000	0.000
Combined Term GPA	4.000	Comb Totals	12.000	12.000	9.000	36.000
Cum GPA	4.000	Cum Totals	24.000	21.000	18.000	72.000
Transfer Cum GPA		Transfer Totals	0.000	0.000	0.000	0.000
Combined Cum GPA	4.000	Comb Totals	24.000	21.000	18.000	72.000

2014 Summer

Program: Doctoral Degree
Plan: Physics Major

Course	Description	Grd	GB	RP	Taken	Passed	Points
PHY5909	DIR INDIV STUDY	S	SOU		12.000	12.000	0.000

			Taken	Passed	GPA Hrs	Points
Term GPA	0.000	Term Totals	12.000	12.000	0.000	0.000
Transfer Term GPA		Transfer Totals	0.000	0.000	0.000	0.000
Combined Term GPA	0.000	Comb Totals	12.000	12.000	0.000	0.000
Cum GPA	4.000	Cum Totals	36.000	33.000	18.000	72.000
Transfer Cum GPA		Transfer Totals	0.000	0.000	0.000	0.000
Combined Cum GPA	4.000	Comb Totals	36.000	33.000	18.000	72.000

2014 Fall

Program: Doctoral Degree
Plan: Physics Major

Course	Description	Grd	GB	RP	Taken	Passed	Points
PHY5667	QUANTUM FIELD THEORY	A	GRD		3.000	3.000	12.000
PHY5670	QUANTM MANY-BODY PHY	A	GRD		3.000	3.000	12.000
PHY5909	DIR INDIV STUDY	S	SOU		3.000	3.000	0.000
PHZ5606	SPEC/GEN RELATIVITY	A	GRD		3.000	3.000	12.000

			Taken	Passed	GPA Hrs	Points
Term GPA	4.000	Term Totals	12.000	12.000	9.000	36.000
Transfer Term GPA		Transfer Totals	0.000	0.000	0.000	0.000
Combined Term GPA	4.000	Comb Totals	12.000	12.000	9.000	36.000
Cum GPA	4.000	Cum Totals	48.000	45.000	27.000	108.000
Transfer Cum GPA		Transfer Totals	0.000	0.000	0.000	0.000
Combined Cum GPA	4.000	Comb Totals	48.000	45.000	27.000	108.000

Florida State University
Office of the Registrar
282 Champions Way
PO Box 3062480
Tallahassee, Florida 32306-2480

Name: Arash Yunesi
Student ID: 200051730
Birthdate: 12/23/1989
Residency: Non-Resident Alien (Non-USA)
Print Date: 11/21/2018

Unofficial Transcript

ALL CREDIT HOURS ON THIS RECORD REFLECTED IN SEMESTER HOURS
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2015 Spring

Program: Doctoral Degree
Plan: Physics Major

Program: Master's Degree
Plan: Physics Major

Course	Description	Grd	GB	RP	Taken	Passed	Points
PHY5669	QUANTM FIELD THRY B	A	GRD		3.000	3.000	12.000
PHY5909	DIR INDIV STUDY	S	SOU		6.000	6.000	0.000
PHZ5354	HIGH ENERGY PHY I	A	GRD		3.000	3.000	12.000

			Taken	Passed	GPA Hrs	Points
Term GPA	4.000	Term Totals	12.000	12.000	6.000	24.000
Transfer Term GPA		Transfer Totals	0.000	0.000	0.000	0.000
Combined Term GPA	4.000	Comb Totals	12.000	12.000	6.000	24.000
Cum GPA	4.000	Cum Totals	60.000	57.000	33.000	132.000
Transfer Cum GPA		Transfer Totals	0.000	0.000	0.000	0.000
Combined Cum GPA	4.000	Comb Totals	60.000	57.000	33.000	132.000

2015 Summer

Program: Doctoral Degree
Plan: Physics Major

Program: Master's Degree
Plan: Physics Major

Course	Description	Grd	GB	RP	Taken	Passed	Points
PHY5909	DIR INDIV STUDY	S	SOU		12.000	12.000	0.000

			Taken	Passed	GPA Hrs	Points
Term GPA	0.000	Term Totals	12.000	12.000	0.000	0.000
Transfer Term GPA		Transfer Totals	0.000	0.000	0.000	0.000
Combined Term GPA	0.000	Comb Totals	12.000	12.000	0.000	0.000
Cum GPA	4.000	Cum Totals	72.000	69.000	33.000	132.000
Transfer Cum GPA		Transfer Totals	0.000	0.000	0.000	0.000
Combined Cum GPA	4.000	Comb Totals	72.000	69.000	33.000	132.000

2015 Fall

Program: Doctoral Degree
Plan: Physics Major

Course	Description	Grd	GB	RP	Taken	Passed	Points
PHY5909	DIR INDIV STUDY	S	SOU		6.000	6.000	0.000
PHZ5355	HIGH ENERGY PHY II	A	GRD		3.000	3.000	12.000

			Taken	Passed	GPA Hrs	Points
Term GPA	4.000	Term Totals	9.000	9.000	3.000	12.000
Transfer Term GPA		Transfer Totals	0.000	0.000	0.000	0.000
Combined Term GPA	4.000	Comb Totals	9.000	9.000	3.000	12.000
Cum GPA	4.000	Cum Totals	81.000	78.000	36.000	144.000
Transfer Cum GPA		Transfer Totals	0.000	0.000	0.000	0.000
Combined Cum GPA	4.000	Comb Totals	81.000	78.000	36.000	144.000

2016 Spring

Program: Doctoral Degree
Plan: Physics Major

Course	Description	Grd	GB	RP	Taken	Passed	Points
PHY5909	DIR INDIV STUDY	S	SOU		9.000	9.000	0.000

			Taken	Passed	GPA Hrs	Points
Term GPA	0.000	Term Totals	9.000	9.000	0.000	0.000
Transfer Term GPA		Transfer Totals	0.000	0.000	0.000	0.000
Combined Term GPA	0.000	Comb Totals	9.000	9.000	0.000	0.000
Cum GPA	4.000	Cum Totals	90.000	87.000	36.000	144.000
Transfer Cum GPA		Transfer Totals	0.000	0.000	0.000	0.000
Combined Cum GPA	4.000	Comb Totals	90.000	87.000	36.000	144.000

2016 Summer

Program: Doctoral Degree
Plan: Physics Major

Course	Description	Grd	GB	RP	Taken	Passed	Points
PHY5909	DIR INDIV STUDY	S	SOU		12.000	12.000	0.000

			Taken	Passed	GPA Hrs	Points
Term GPA	0.000	Term Totals	12.000	12.000	0.000	0.000
Transfer Term GPA		Transfer Totals	0.000	0.000	0.000	0.000
Combined Term GPA	0.000	Comb Totals	12.000	12.000	0.000	0.000

Florida State University

Office of the Registrar
282 Champions Way
PO Box 3062480
Tallahassee, Florida 32306-2480

Name: **Arash Yunesi**
Student ID: 200051730
Birthdate: 12/23/1989
Residency: Non-Resident Alien (Non-USA)
Print Date: 11/21/2018

Unofficial Transcript

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Cum GPA	4.000	Cum Totals	102.000	99.000	36.000	144.000
Transfer Cum GPA		Transfer Totals	0.000	0.000	0.000	0.000
Combined Cum GPA	4.000	Comb Totals	102.000	99.000	36.000	144.000

2016 Fall

Program: Doctoral Degree
Plan: Physics Major

Course	Description	Grd	GB	RP	Taken	Passed	Points
AST5416	COSMOLOGY	A	GRD		3.000	3.000	12.000
PHY5909	DIR INDIV STUDY	S	SOU		9.000	9.000	0.000
PHY8964	PRELIM DOCTORAL EXAM	P	PNP		0.000	0.000	0.000

			Taken	Passed	GPA Hrs	Points
Term GPA	4.000	Term Totals	12.000	12.000	3.000	12.000
Transfer Term GPA		Transfer Totals	0.000	0.000	0.000	0.000
Combined Term GPA	4.000	Comb Totals	12.000	12.000	3.000	12.000
Cum GPA	4.000	Cum Totals	114.000	111.000	39.000	156.000
Transfer Cum GPA		Transfer Totals	0.000	0.000	0.000	0.000
Combined Cum GPA	4.000	Comb Totals	114.000	111.000	39.000	156.000

2017 Spring

Program: Doctoral Degree
Plan: Physics Major

Course	Description	Grd	GB	RP	Taken	Passed	Points
PHY6980	DISSERTATION	S	SOU		9.000	9.000	0.000

			Taken	Passed	GPA Hrs	Points
Term GPA	0.000	Term Totals	9.000	9.000	0.000	0.000
Transfer Term GPA		Transfer Totals	0.000	0.000	0.000	0.000
Combined Term GPA	0.000	Comb Totals	9.000	9.000	0.000	0.000
Cum GPA	4.000	Cum Totals	123.000	120.000	39.000	156.000
Transfer Cum GPA		Transfer Totals	0.000	0.000	0.000	0.000
Combined Cum GPA	4.000	Comb Totals	123.000	120.000	39.000	156.000

2017 Summer

Program: Doctoral Degree
Plan: Physics Major

Course	Description	Grd	GB	RP	Taken	Passed	Points
PHY6980	DISSERTATION	S	SOU		9.000	9.000	0.000

			Taken	Passed	GPA Hrs	Points
Term GPA	0.000	Term Totals	9.000	9.000	0.000	0.000
Transfer Term GPA		Transfer Totals	0.000	0.000	0.000	0.000
Combined Term GPA	0.000	Comb Totals	9.000	9.000	0.000	0.000
Cum GPA	4.000	Cum Totals	132.000	129.000	39.000	156.000
Transfer Cum GPA		Transfer Totals	0.000	0.000	0.000	0.000
Combined Cum GPA	4.000	Comb Totals	132.000	129.000	39.000	156.000

2017 Fall

Program: Doctoral Degree
Plan: Physics Major

Course	Description	Grd	GB	RP	Taken	Passed	Points
PHY6980	DISSERTATION	S	SOU		12.000	12.000	0.000

			Taken	Passed	GPA Hrs	Points
Term GPA	0.000	Term Totals	12.000	12.000	0.000	0.000
Transfer Term GPA		Transfer Totals	0.000	0.000	0.000	0.000
Combined Term GPA	0.000	Comb Totals	12.000	12.000	0.000	0.000
Cum GPA	4.000	Cum Totals	144.000	141.000	39.000	156.000
Transfer Cum GPA		Transfer Totals	0.000	0.000	0.000	0.000
Combined Cum GPA	4.000	Comb Totals	144.000	141.000	39.000	156.000

2018 Spring

Program: Doctoral Degree
Plan: Physics Major

Course	Description	Grd	GB	RP	Taken	Passed	Points
PHY6980	DISSERTATION	S	SOU		12.000	12.000	0.000

			Taken	Passed	GPA Hrs	Points
Term GPA	0.000	Term Totals	12.000	12.000	0.000	0.000
Transfer Term GPA		Transfer Totals	0.000	0.000	0.000	0.000
Combined Term GPA	0.000	Comb Totals	12.000	12.000	0.000	0.000

Florida State University

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Name: **Arash Yunesi**
Student ID: 200051730
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Residency: Non-Resident Alien (Non-USA)
Print Date: 11/21/2018

Unofficial Transcript

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Cum GPA	4.000	Cum Totals	156.000	153.000	39.000	156.000
Transfer Cum GPA		Transfer Totals	0.000	0.000	0.000	0.000
Combined Cum GPA	4.000	Comb Totals	156.000	153.000	39.000	156.000

2018 Summer

Program: Doctoral Degree
Plan: Physics Major

Course	Description	Grd	GB	RP	Taken	Passed	Points
PHY6980	DISSERTATION	S	SOU		9.000	9.000	0.000

			Taken	Passed	GPA Hrs	Points
Term GPA	0.000	Term Totals	9.000	9.000	0.000	0.000
Transfer Term GPA		Transfer Totals	0.000	0.000	0.000	0.000
Combined Term GPA	0.000	Comb Totals	9.000	9.000	0.000	0.000
Cum GPA	4.000	Cum Totals	165.000	162.000	39.000	156.000
Transfer Cum GPA		Transfer Totals	0.000	0.000	0.000	0.000
Combined Cum GPA	4.000	Comb Totals	165.000	162.000	39.000	156.000

Degrees Awarded

Degree: Master of Science
Program: Physics
Confer Date: 05/02/2015
Plan: Physics

Graduate Career Totals

			Taken	Passed	GPA Hrs	Points
Cum GPA:	4.000	Cum Totals	165.000	162.000	39.000	156.000
Trans Cum GPA		Trans Totals	0.000	0.000	0.000	0.000
Comb Cum GPA	4.000	Comb Totals	165.000	162.000	39.000	156.000

End of Graduate

End of Academic Transcript

FLORIDA STATE UNIVERSITY | *The* COLLEGE *of* ARTS *&* SCIENCES
Department of Physics

Takemichi Okui
Associate Professor
Department of Physics
77 Chieftain Way
Florida State University
Tallahassee, FL 32306

November 30, 2018

Dear colleagues,

This is a letter of recommendation for **Mr. Arash Yunesi** (Aresh) for the postdoc position at your institution. (I call him Aresh as he is called in his native Kurdish tongue, but the Persian-dominated Iranian government has forced him to use the Persian counterpart in official documents.) Aresh is my second graduate student since I started working at Florida State University (FSU) in 2009, and expected to earn a Ph.D. in Spring or Summer 2019.

He has coauthored two papers with me so far. Let me describe those projects and his contributions. His very first paper, "LHC Signatures of WIMP-triggered Baryogenesis" (arXiv:1605.08736, published in PRD) with Y. Cui and myself, concerns the phenomenology of a baryogenesis scenario proposed earlier by Y. Cui and R. Sundrum, where baryon asymmetry is generated from the out-of-equilibrium, B- and CP-violating decays of meta-stable WIMPs. Roughy speaking, owing to the existence of new colored particles (to make connections with the baryon number) and small parameters (for the WIMP's metastability as well as suppressing excessive quark flavor violations), the scenario can lead to exotic LHC phenomenologies such as the productions of multi-bottom and/or multi-top quarks—promptly or displaced—and two separate sets of isolated emerging jets connected by a charged track. Cosmologically, since the baryon asymmetry originates from the abundance of the meta-stable WIMPs, the scenario naturally links the abundance of baryons to that of dark matter, if we additionally assume that there is a stable WIMP species for dark matter. Through this project, Aresh learned a variety of concepts and techniques such as the mechanisms of baryogenesis, relic abundance calculations, some flavor physics, the useful programs like `FeynRules` and `MadGraph` for LHC phenomenology. He checked all the analytical results in the paper and was in charge of all the numerical results.

In his second paper with me, "Soft collinear effective theory for gravity" (arXiv:1710.07685, published in PRD), we showed how to construct a Soft Collinear Effective Theory (SCET) for gravity at the leading and next-to-leading powers. The soft graviton theorem and decoupling of collinear gravitons at the leading power are manifest from the outset in our SCET. At the next-to-leading power, we found amplitudes should have certain simple structures that are completely obscure in Feynman diagrams of the full theory. This can greatly simplifies calculations. During this project, many calculations had to be done in the full theory (i.e., the usual Einstein gravity) to guide us toward the right effective theory as well as to make sure that the predictions of the effective theory match those of the full theory, check the Ward identities of the effective symmetries, etc. Not only those full-theory calculations typically involved a large number of terms in the Feynman rules and many diagrams, but they also had to be expanded in powers of λ (the small expansion parameter in SCET characterizing how well-collimated each "jet" is). For the sake of generality of our construction, we even looked at the gravitational couplings of a spin-3/2 particle, which are almost as nasty as those of the graviton. Aresh did all of those full-theory calculations, sometimes by hand with 20 pages of algebra and some other times using the combinations of `FORM` and `Mathematica`. His lengthy calculations either ended up with a simple few-line result expected from the SCET, thus showing the power and correctness of our SCET, or pointed to things we had missed or misunderstood and helped us identify the right ingredients of the SCET.

After this, we have been investigating how reparametrization invariance (RPI) works in gravity SCET, which is fundamentally different from how RPI works in the usual QCD SCET, because RPI in gravity SCET is tied to the gauge symmetry (diffeomorphism invariance) while in QCD SCET it is separate from the SU(3) color gauge symmetry. I think we have a reasonable guess for RPI transformation laws in gravity SCET, but to be sure many checks must be performed. Since the two projects mentioned above were both conducted under my full guidance, I told him that this RPI project must be driven by him, that I would of course be available for discussions and willing to make suggestions, but he must have his own initiatives.

Aresh is a very sociable person, and he will get along with everybody. He joins lunch nearly everyday and always offer a variety of topics for pleasant conversations. As I described above, he likes analytical calculations and he is strong at it. He thrives when the problems are well defined and the calculations to be done can be clearly formulated. I will be delighted to see him grow into an independent researcher. Please do not hesitate to contact me if you have any questions about Aresh.

Sincerely,

Takemichi Okui

UC RIVERSIDE UNIVERSITY OF CALIFORNIA | Department of Physics & Astronomy

Dear colleague,

It is a pleasure to recommend Arash Yunesi for a postdoctoral research position at your institution. I collaborated with Arash in 2016, together with his Ph.D. advisor, Takemichi Okui. Our work explored general model-building aspects and rich LHC phenomenology in the WIMP baryogenesis framework. Arash made significant contributions to the project by calculating various important quantities such as event cross-sections and baryon asymmetry using QFT, as well as making presentable plots for the publication. Most of his calculations were reliable upon the checks done by Take and myself. It was impressive as I heard from Take that Arash had just completed his QFT class. I was also directly advising Arash on this project during a period when Take was occupied by other tasks. I found him to be very diligent and efficient in getting work done. Based on my interaction with him throughout our collaboration, I think Arash has good technical ability for conducting research work in high energy theory. I have not had much interaction with Arash since then. But according to his CV and publication record, I can see he has a good academic record, and has become skilled at various subjects such as the applications of Soft Collinear Effective Theory.

I recommend him for a postdoctoral position, which will provide him a great opportunity to grow and fulfil his potential as a successful researcher in the HET community.

Sincerely,

Yanou Cui

Assistant Professor of Physics
Tel: 951-827-5822

Department of Physics
315 Keen Building
Florida State University, Tallahassee, FL 32306–4350

URL: http://www.hep.fsu.edu/~reina/ *(850) 644-9282/1492*
Email: reina@hep.fsu.edu *FAX: (850) 644-6735*

December 21, 2018

Postdoc Search
Theoretical Particle Physics

Dear Colleagues,

with this letter I would like to support the application of Arash Yunesi for a postdoc position in theoretical particle physics at your Institution.

Arash Yunesi joined the Graduate Program of the Physics Department of Florida State University in Fall 2014, coming from the University of Teheran. Thanks to his very strong mathematical and physical background, he moved quite rapidly through the graduate core classes and started working with Takemichi Okui in Summer 2015. I expect Takemichi to describe Arash's work in more detail.

Arash has been a student of mine in both the intermediate and advanced quantum field theory classes that I taught in 2015, as well as in a topic course in high energy physics where we discussed particular aspects of the Standard Model and beyond. In all classes he has taken with me Arash has succeeded in mastering both formal and technical aspects of the course very quickly, and always challenged himself with the physics behind them. He has strong formal skills, and can appreciate both the theoretical and experimental subtleties of a problem. His solutions of all projects I proposed in my classes have always been impressively accurate and thoughtful.

As a member of his doctoral committee I have attended a few talks he has given at FSU. I think he has mastered the principles and technicalities of effective field theories, which have become the main subject of his thesis work. The idea of applying soft-collinear effective theory to gravity is certainly interesting and, having a working knowledge of SCET techniques will certainly prepare him to explore a variety of different applications.

I think Arash can be a valuable addition to a group interested in a broad variety of theoretical topics, and will contribute serious and thoughtful work. I strongly encourage you to consider him in your postdoc selection.

Sincerely yours,

Laura Reina
Distinguished Research Professor, Physics