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)	

Applicant upload Uid#683927/2019-01-26/academicjobsonline.org

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 (2019/01/27)			
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
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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
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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			

PA Code: 22-0000245283-0001432931

Matriculation Number 418483

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

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:

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.

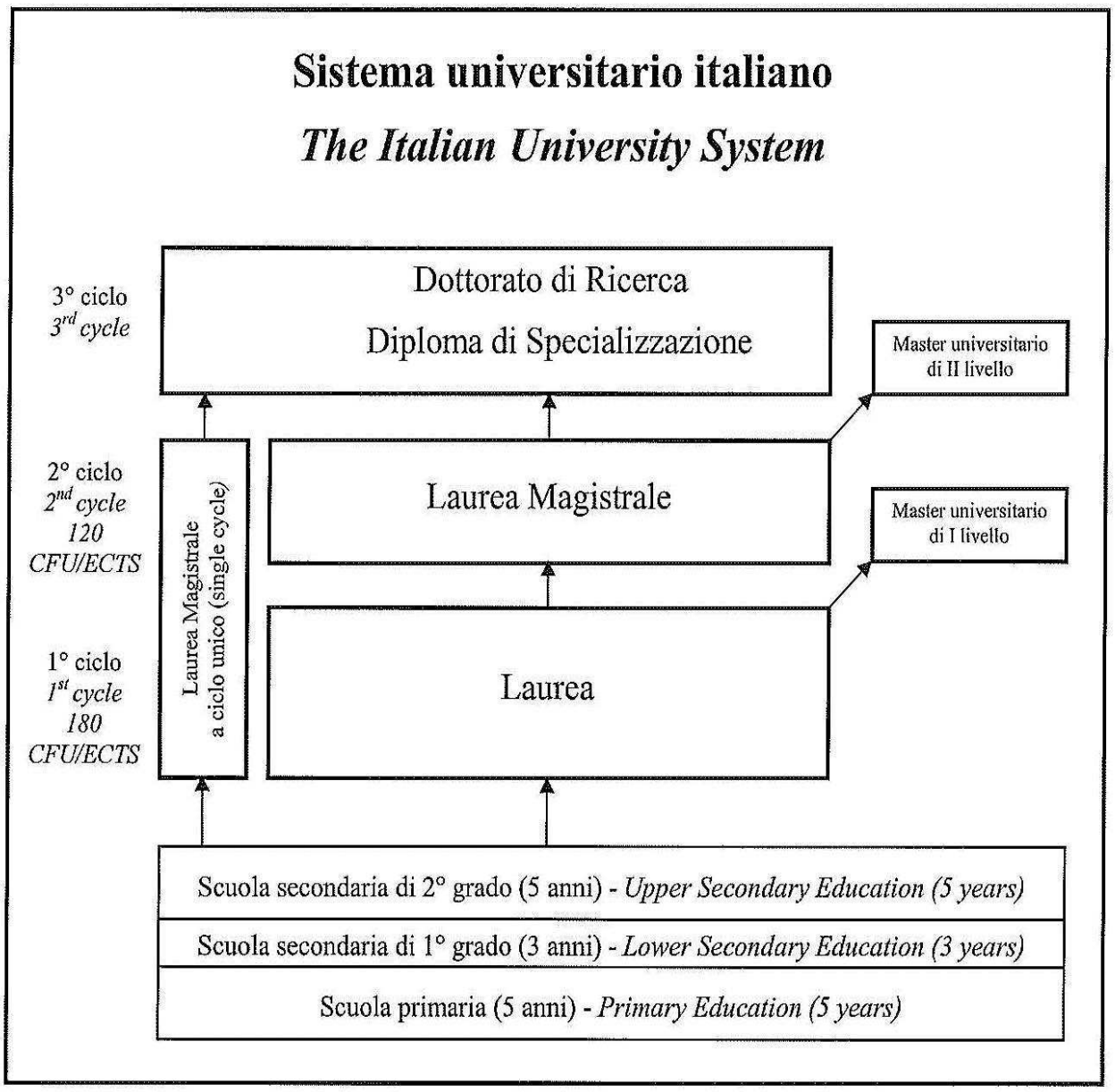
Credits: degree courses are structured in credits (Crediti Formativi Universitari CFU). University credits are based on the workload students need in order to achieve the expected learning outcomes. Each credit corresponds to 25 hours of student workload, including independent study. The average workload 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
Master universitario di I livello
1° ciclo
1st cycle
180
CFU/ECTS
Laurea Magistrale a ciclo unico (single cycle)
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 2019/01/22)	
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** New sources of flavour- and CP-violation at high transverse momenta		
Secondary	Quark-mass effects in Higgs-boson production in gluon fusion; 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)	
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)
5. Ettore Majorana, Infn, ettore.majorana@roma1.infn.it	

Received Materials	**PHD**	**Curriculum Vitae:** file (PDF, PDF 2019/01/22) **Copies of grades transcripts:** file (PDF, PDF 2019/01/22)

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

SAPIENZA
UNIVERSITÀ DI ROMA

---Matricola: 1672992----------certificato il 28/12/2018 09:05--------Facciata 01----------
----------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 ----------
Il relativo diploma e' stato CONSEGNATO in data 17/12/2018----------

---Matricola: 1672992----------certificato il 28/12/2018 09:05--------Facciata 01----------
---Studente:BRANCACCIO COLOMBA----------
----------(segue)----------

SAPIENZA
UNIVERSITÀ DI ROMA

---Matricola: 1672992----------certificato il 28/12/2018 09:05---------Facciata 02----------
----------CERTIFICATO DI LAUREA----------
Il presente certificato composto da 2 facciate:----------
a. contiene informazioni desunte dall'archivio dell'Università 'La Sapienza' di Roma;----------
b. si rilascia su richiesta dell'interessata e per gli usi consentiti dalla legge----------
c. può essere utilizzato solo in originale;----------
Roma, lì 28/12/2018 09:05----------

---Matricola: 1672992----------certificato il 28/12/2018 09:05---------Facciata 02----------
----------CERTIFICATO DI LAUREA----------
---Studente:BRANCACCIO COLOMBA----------
----------Il responsabile della segreteria o suo delegato----------

SAPIENZA UNIVERSITÀ DI ROMA
Area Servizi agli Studenti
[illegible]
Dott.ssa Graziella Cerioli

Valido per l'estero

Ministero dell'Economia e delle Finanze
MARCA DA BOLLO
€16,00
SEDICI/00
Entrate
01000920 000029F6 W12YD001
00090097 28/12/2018 08:47:47
4578-00088 871C41E9EACD7816
IDENTIFICATIVO : 01180390606249
0 1 18 039060 624 9

SAPIENZA
UNIVERSITÀ DI ROMA

---Matricola: 1672992----------certificato il 28/12/2018 09:06--------Facciata 01----------
----------CERTIFICATO DI ESAMI SOSTENUTI----------
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----------
. 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 ----------
Il presente certificato composto da 1 facciata:----------
a. contiene informazioni desunte dall'archivio dell'Università 'La Sapienza' di Roma;----------
b. si rilascia su richiesta dell'interessata e per gli usi consentiti dalla legge----------
c. può essere utilizzato solo in originale;----------
Roma, lì 28/12/2018 09:06----------

---Matricola: 1672992----------certificato il 28/12/2018 09:06--------Facciata 01----------
----------CERTIFICATO DI ESAMI SOSTENUTI----------
---Studente:BRANCACCIO COLOMBA----------
----------IL RESPONSABILE DELLA SEGRETERIA O SUO DELEGATO----------
---

SAPIENZA UNIVERSITÀ DI ROMA
Area Servizi agli Studenti
Settore Segreteria Ingegneria dell'Informazione, Informatica e Statistica
Il Capo Settore
Sig.ra Graziella Censi

Valido per l'estero

Ministero dell'Economia e delle Finanze
Agenzia Entrate
MARCA DA BOLLO
€16,00
SEDICI/00
01000920 000029FB W1ZYD001
00090096 28/12/2018 08:47:43
4578-00088 887DBABE6D78C4D6
IDENTIFICATIVO : 01180390606250
0 1 18 039060 625 0

[Logo of the Sapienza University of Rome] SAPIENZA
UNIVERSITY OF ROME

Registration no.: 1672992 certified on 28/12/2018 09:05 Page 01

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]*
The relating parchment/diploma has been DELIVERED on 17/12/2018

(continues)

[Logo of the Sapienza University of Rome] SAPIENZA
UNIVERSITY OF ROME

Registration no.: 1672992 certified on 28/12/2018 09:05 Page 02
DEGREE CERTIFICATE

This certificate, consisting of 2 pages:
a. contains information stored in the archives of the Sapienza University of Rome;
b. is issued at the request of the person concerned for all legal intents and purposes
c. may be used only in the original;
Rome, 28/12/2018 09:05

Registration no.: 1672992 certified on 28/12/2018 09:05 Page 02
DEGREE CERTIFICATE

Student: COLOMBA BRANCACCIO

The responsible for the registrar's office or empowered person

SAPIENZA UNIVERSITY OF ROME
Student Services Area
Information Engineering, Computer Science and Statistics Student Office Sector
Sector Manager
Mrs. Graziella Censi
[Illegible signature]

Valid abroad

[Rectangular revenue stamp of € 16.00 obliterated with a seal of the Sapienza University of Rome]

[Logo of the Sapienza University of Rome] SAPIENZA
UNIVERSITY OF ROME

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]*

This certificate, consisting of 1 page:
a. contains information retrieved from the archives of the Sapienza University of Rome;
b. is issued at the request of the person concerned for all legal intents and purposes
c. may be used only in the original;
Rome, 28/12/2018 09:06

Registration no.: 1672992 certified on 28/12/2018 09:06 Page 01
TRANSCRIPT OF RECORDS/CERTIFICATE OF TAKEN EXAMS
Student: COLOMBA BRANCACCIO

THE RESPONSIBLE FOR THE REGISTRAR'S OFFICE OR EMPOWERED PERSON

SAPIENZA UNIVERSITY OF ROME
Student Services Area
Information Engineering, Computer Science and Statistics Student Office Sector
The Sector Manager
Mrs. Graziella Censi
[Illegible signature]

Valid abroad

[Rectangular revenue stamp of € 16.00 obliterated with a seal of the Sapienza University of Rome]

TRIBUNALE ORDINARIO DI ROMA

Ufficio Asseveramento Perizie e Traduzioni

CRONOLOGICO

N. 340-1

VERBALE DI GIURAMENTO

14 GEN. 2019

Addi avanti al sottoscritto Cancelliere è presente il Signor Paolo D'Acunto, identificato con documento P. AUTO U1M587001K rilasciato da MIT-UCO ROMA il 06/11/2015 il quale chiede di ~~asseverare~~ con giuramento la traduzione dalla lingua albanese alla lingua inglese dell'unito documento in ~~copia conforme~~ - fotocopia - ~~originale~~:

Lettera in F.S.C.

Eleonora 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."*

Letto, confermato e sottoscritto.

IL CANCELLIERE

N.B. L'Ufficio non si assume alcuna responsabilità per quanto riguarda il contenuto e la regolarità formale del documento tradotto.

Rome, 14 January 2019

I the undersigned Giovanni Borghi, Technical Manager of the translation company C.S.E. '92 SRL, with registered office in Rome, Via VEIO, 7 – 00183, listed at the Chamber of Commerce of Rome under n. 4544/92, VAT number and Tax Code n. 0428 4881 002.

hereby certify

that the translation from Italian into English of the following documents of Ms. Colomba Brancaccio:

- *Bachelor's Degree*
- *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

Centro Servizi Europa 92 srl
Via Veio, 7 - 00183 Roma
P. IVA 04284881002
Iscrizione CC.I.A.A. di Roma N. 750285
Iscrizione Tribunale di Roma 4544/92
ISO 9001:2008 n. 14Q16862
ISO 17100:2015 n. 78T16862

ORGANISATION EUROPÉENNE POUR LA RECHERCHE NUCLÉAIRE
EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH

Laboratoire Européen pour la Physique des Particules
European Laboratory for Particle Physics
Compact Muon Solenoid Collaboration, CMS

GENÈVE, SUISSE
GENEVA, SWITZERLAND

Adresse postale / Postal address *:

Dr. Maurizio Pierini
CERN-Experimental Physics Department
CH - 1211 GENÈVE 23

Téléphone / Telephone :
Direct +41 22 76 71543
Télécopieur / Telefax :
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

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

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
INFN Research Director and Professor of Physi

Istituto Nazionale di Fisica Nucleare

INFN Sezione di Roma
Dipartimento di Fisica, Università La Sapienza
Piazzale Aldo Moro, 2 - 00185 Roma
http://www.roma1.infn.it

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.

BOWEN FU S1620861 Date Produced: 04/01/2018

Higher Education Achievement Report

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

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

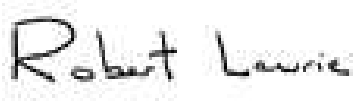
Programme Start Date: 1 September 2016
Qualification Conferred Date: 30 November 2017
Qualification Conferred: Master of Science
Qualification Subject: Theoretical Physics
Overall Classification of the Qualification: With Distinction

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, 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

The University of Edinburgh
James Clerk Maxwell Building
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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,

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

HIGGS CENTRE
for THEORETICAL PHYSICS

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Scotland

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Email: rdb@ph.ed.ac.uk

1 October 2017

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 2019/01/27)	
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 (2019/01/27)

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

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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

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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 Complection Of The

Database Search Tools And Strategies Workshop

Farhood Ziaie
Director Education and Graduate Studies, NSTRI

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

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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شماره ۳۷۴۳۰۶

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 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 OFFICIAL TRANSLATOR TO THE JUDICIARY, IRI Tehran
زهرا عباسعلی
مترجم رسمی انگلیسی
قوه قضائیه ـ تهران
دفتر مترجمی ۴۲۰

Department of Official Translators' Affairs of the Judiciary of the Islamic Republic of Iran
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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
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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 و شناسنامه 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 می‌شود تا از امتیازات آن بهره‌مند 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 Tehran

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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شماره ۳۷۴۲۹۶

ردیف دفتر ثبت

جمهوری اسلامی ایران
قوهٔ قضائیه ـ اداره 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 420 OFFICIAL TRANSLATOR TO THE JUDICIARY IRI Tehran
زهرا عباسعلی
مترجم رسمی انگلیسی
قوه قضائیه ـ تهران
دفتر مترجمی ۴۲۰

محمد رضایی - کارشناس
M.REZAEI
LEGALIZATION OFFICER

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مبلغ ۶۰۱ ریال بابت تعرفه خدمات کنسولی دریافت گردید.

ISLAMIC REPUBLIC OF IRAN
MINISTRY OF FOREIGN AFFAIRS
REGISTRATION AND LEGAL STATUS DEPARTMENT
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31 JUL 2018 - 700095

بسمه تعالی

یرفع الله الذین امنوا منکم والذین 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.

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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.

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
کاوس نوزری
مدیر کل امور دانشجویان داخل

ردیف ۲۳

۱۳۹۷/۴/۱۰

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ZAHRA ABBASALI
OFFICIAL TRANSLATOR TO THE JUDICIARY-IRI Tehran
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
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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.

Title of Course	*Type of Course*	*Theoretical Credits*	*Practical Credits*	*Grade*	*Point*
1st Semester of Academic Year 2013-2014					
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
زهرا عباسعلی
مترجم رسمی انگلیسی
قوه قضائیه ـ 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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شماره ۳۷۴۲۹۵

ردیف دفتر ثبت

جمهوری اسلامی ایران
قوهٔ قضائیه ـ اداره مترجمین رسمی

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

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Department of Official Translation 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
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31 JUL 2018 - 700095

باسمه تعالی
اطلبوا العلم من المهد الی اللحد

تاریخ :
شماره :

دانشگاه آزاد اسلامی واحد تهران مرکزی

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

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

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

۹۴۲۰۱۸۴۲ ۹۴/۱۰/۲۴

دکتر طهمورث شیری
سرپرست معاونت امور آموزشی و تحصیلات تکمیلی

دکترمحمدمهدی طهرانچی
سرپرست دانشگاه آزاداسلامی واحدتهران مرکزی

محمد عابدی
مدیرکل دانش آموختگان دانشگاه

اطلبوا العلم من المهد الی اللحد
دانشگاه آزاد اسلامی
سازمان مرکزی

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 calcu-

lations 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
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
Tsing Hua Chair Professor
Fellow of American Physical Society

Li, Shao-Ping

Address		**Email** ShowpingLee@mails.ccnu.edu.cn (update 2019/01/02)	
152 Luoyu Rd Wuhan, Hubei 430079 China		**Home Phone** **Cell Phone** (86) 15538087619 **Office Phone**	
Current Title / Dates	MS student, September/2016-June/2019		
Current Institution	Central China Normal University	**Department**	College of Physical Science and Technology
Location	152 Luoyu Rd, Wuhan, Hubei 430079, China		
Highest Degree	MS	**Institution** Central China Normal University	**Date** 2019/06 exp
Thesis Advisor	Xin-Qiang Li		
Research Interests	**Primary** Phenomenology of New Physics beyond the Standard Model		
Secondary	Neutrino Physics and Dark Matter; Particle Physics in the Early Universe		
Current Research Interests: *1.Model Building of Theories of New Physics 2.Neutrino Physics & Dark Matter 3.Anomalies in Low-Energy Physics*			
Discipline(s)	Electroweak Particle Physics; Physics; Theoretical Physics		
Position(s) applied	PHD		
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)			file (PDF, PDF, 2019/01/02)
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)			file (PDF, PDF, 2019/01/24)
Received Materials	**PHD**	**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)	

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 Data:
Graduate School (Seal)	成绩属实 Data:

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

Lu, Bo-Qiang

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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
Email: bqlu@itp.ac.cn

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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(+86) 17611591355

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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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Professor Yue-Liang Wu
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55 ZhongGuanCun East Street
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Email: ylwu@itp.ac.cn
Tel: 86-010-62582368
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
Chinese Academy of Sciences

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,

Zhangyufeng

Yu-Feng Zhou. Professor
Institute of Theoretical Physics,
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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,

Hong-Shi Zong, Professor,
Department of Physics, Nanjing University
Nanjing, China, 210093
Tel: 86-025-83592325
Email: zonghs@nju.edu.cn

Mondal, Buddhadeb

Address		**Email** nadigodeb@gmail.com (update 2019/01/22)	
room-c615, Hostel 13, IIT Bombay, Powai Mumbai, Maharashtra 400076 India		**Home Phone** 9046144043 **Office Phone**	
Current Title / Dates	Student		
Current Institution	Indian Institute of Technology Bombay	**Department**	Physics
Location	IIT Bombay, Powai, Mumbai, Maharashtra 400076, India		
Highest Degree	M.Sc	**Institution** Indian Institute of Technology Bombay	**Date** 2018/08
Thesis Advisor	Prof. Manoranjan Guchait		
Thesis Title	Jet physics at the LHC		
Research Interests	**Primary** Particle physics phenomenology		
Secondary	Collider phenomenology; Data analysis		
Discipline(s)	Physics		
Position(s) applied	PHD		
1. Dr. Manoranjan Guchait, Tata Institute of Fundamental Research, guchait@tifr.res.in (2019/01/22)			
2. Prof. Iris Gebauer, Karlsruhe Institute of Technology, iris.gebauer@kit.edu (2019/01/22)			data (TEXT, PDF, 2019/01/22)
Received Materials	**PHD**	**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)	

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 $Z' = 1500GeV$ 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,
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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

No. - BSC. 000380

GRADE CARD

(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

GRADE CARD

No. - BSC. 083449

(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. 903737

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. 001320/01054 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

Controller of Examinations

[see overleaf]

JADAVPUR UNIVERSITY

KOLKATA-700 032

No. - BSC. 902574

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 HO7	A
PHYSICS HO8	A
PHYSICS PRACTICAL HO3	B
PHYSICS PRACTICAL HO4	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

Controller of Examinations

[see overleaf]

JADAVPUR UNIVERSITY

KOLKATA-700 032

No. - BSC. 903876

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

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

Checked by

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)		

Code	Name	Credits	Tag	Grade	Code	Name	Credits	Tag	Grade
Academic Year: 2016 - 2017, Term: Semester Autumn									
PH 401	Classical Mechanics	8.0	MA	CC	PH 407	Mathematical Physics I	8.0	MA	CC
PH 403	Quantum Mechanics I	8.0	MA	BB	PH 411	Physics Lab I	3.0	MA	AA
PH 405	Electronics	6.0	MA	CC	PH 414	Electronics Laboratory	3.0	MA	BB
SPI=6.94/10					CPI=6.94/10				
Academic Year: 2016 - 2017, Term: Semester Spring									
ES 200	Environmental Studies: Science and Engineering	3.0	MA	CD	PH 413	Programming Lab	5.0	MA	CC
					PH 424	Electromagnetic Theory I	6.0	MA	BC
HS 200	Environmental Studies	3.0	MA	CD	PH 426	Astrophysics	6.0	AU	AU
PH 304	Statistical Physics	6.0	MA	BC					
PH 408	Mathematical Physics II	8.0	MA	CC					
SPI=5.19/10					CPI=6.05/10				
Academic Year: 2017 - 2018, Term: Semester Autumn									
PH 409	Introduction to Condensed Matter Physics I	6.0	MA	CD	PH 505	Introduction to Nuclear & Particle Physics	6.0	MA	CD
PH 412	Physics Lab II	6.0	MA	AA	PH 520	Group Theory Methods	6.0	MA	CC
PH 440	Introduction to Atomic and Molecular Physics	6.0	MA	CD	PH 595	Project I	6.0	MA	AA
SPI=6.83/10					CPI=6.31/10				
Academic Year: 2017 - 2018, Term: Semester Spring									
EP 408	Methods in Experimental Nuclear and Particle Physics	6.0	MA	CC	PH 525	Electromagnetic Theory II	6.0	MA	CC
					PH 540	Elementary Particle Physics	6.0	MA	BC
PH 454	Light Matter Interaction	6.0	MA	CC	PH 596	Project II	6.0	MA	AB
PH 512	Physics Lab IV	6.0	MA	BC					
SPI=6.83/10					CPI=6.44/10				
Academic Year: 2017 - 2018, Term: Semester Summer									
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:

भारतीय प्रौद्योगिकी संस्थान, मुंबई ★ पवई, मुंबई Powai, Mumbai-76. ★ Indian Institute of Technology, Bombay

Joint/Assistant Registrar (Academic), IIT Bombay

Date: 28-July-2018

Place: Mumbai

सहायक कुलसचिव (शैक्षिक) Assistant Registrar (Academic) भारतीय प्रौद्योगिकी संस्थान, मुंबई Indian Institute of Technology, Bombay पवई, मुंबई / Powai, Mumbai - 400 076.

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

Naghdi, Mohammad

Address		**Email** naghdi.m@gmail.com (update 2019/01/08)	
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).
-

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
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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

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
Cumulative Grade Point Average (C.G.P.A.)	-	4.19

FEDERAL UNIVERSITY OF AGRICULTURE
P.M.B. 2240, ABEOKUTA
28 SEP 2018
FRANCIS - 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.

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

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
Cumulative 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

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

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

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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07010738800, 012802420, 012802421

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E-mail: records@unilag.edu.ng

RECORDS OFFICE

Date:

Ref No.: 8/00017

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

KEY TO DEGREE CLASSIFICATION

4.5 & Above	Distinction
2.4 - 4.49	Pass

KEY TO GRADES

1969 - 1996			1997 to date		
80 & Above	A+	5.0	70 & Above	A	5.0
75 - 79	A	4.5	60 - 69	B	4.0
70 - 74	A-	4.0	50 - 59	C	3.0
65 - 69	B+	3.5	45 - 49	D	2.0
60 - 64	B	3.0	40 - 44	E	1.0
55 - 59	B-	2.5	0 - 39	F	0.0
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			

8/0008 17

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

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
	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
P: Pass
F: Fail
D: Dishonesty
X: Audited
*: Ph.D.
U: Unsatisfied
RR: Repeated Course
J: In Progress
I: Incomplete
N: Not Available
\: Make Up Course
+: M.Sc.
S: Satisfied
WP: Withdraw (Passed State)
P_MR: Minimal Requirment
P_EX: Excellent
P_VG: Very Good
P_GD: Good
P_FA: Fair
NP: Not Passed
①: Courses of First Major
WF: Withdraw (Failed State)
CR: Credit Received
NC: No Credit/Project Complete
EP: Examination Postponed
=: B Sc./M.Sc. Course
&: Optional M.Sc./Ph.D. Course
②: Courses of Second Major
R: Research in Progress

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 2019/01/27)	
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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Email: info@tahaot.com

شماره ۳۷۴۱۲۵

ردیف دفتر ثبت ۱۴۷۰۲۱۷۹

جمهوری اسلامی ایران
قوه 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

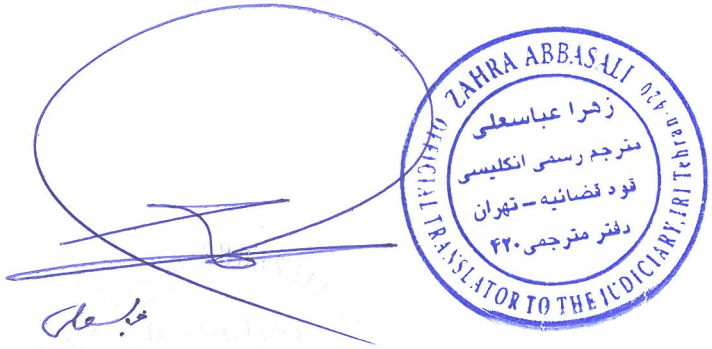
This is to certify that:

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



بسمه تعالی

اولین همایش ملی فیزیک دانشگاه آزاد اسلامی

۳۰ و ۳۱ تیر ماه ۱۳۹۵ - 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 نامتناهی فرکتالی »

به صورت سخنرانی با همکاری معین میرزا امرجی و محمدرضا تنهایی ارائه نمودند.

ZAHRA ABBASALI
زهرا عباسعلی
مترجم رسمی انگلیسی
دادگستری کل تهران
دفتر مترجمی ۴۲۰
OFFICIAL TRANSLATOR TO THE JUDICIARY

Certified Copy

دبیر اجرائی همایش
دکتر علی واحدی

دبیر علمی همایش
دکتر صمد سبحانیان

رئیس همایش
دکتر ناصر مدیر شهلا

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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شماره ۳۷۴۳۱۱

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

Department of official Translation 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

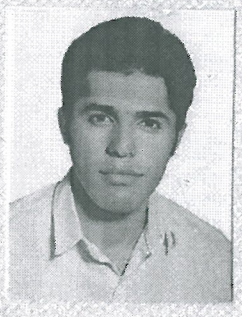
یرفع الله الذین آمنوا منکم والذین اوتوا العلم درجات

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 شکوهی طرقی فرزند حجت دارای شماره ملی ۰۰۱۳۶۸۸۰۰۶ وشناسنامه 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
OFFICIAL TRANSLATOR TO THE JUDICIARY, IRI Tehran
زهرا عباسعلی
مترجم رسمی انگلیسی
قوه قضائیه - تهران
دفتر مترجمی ۴۲۰

دکتر حمید میرزاده
از طرف رئیس دانشگاه آزاد اسلامی
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
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Email: info@tahaot.com

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.

Title of Course	*Type of Course*	*Theoretical Credits*	*Practical Credits*	*Grade*	*Point*
1st Semester of Academic Year 2013-2014					
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
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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شماره ۳۷۴۳۱۹

ردیف دفتر ثبت

جمهوری اسلامی ایران
قوهٔ قضائیه ـ اداره مترجمین رسمی

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

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محمد رضایی - کارشناس
M.REZAEI
LEGALIZATION OFFICER

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.

مبلغ ۱۲۰ ریال بابت تعرفه خدمات کنسولی دریافت گردید.

31 JUL 2018 - 700095

باسمه تعالی
اطلبوا العلم من المهد الی اللحد

تاریخ :
شماره :

دانشگاه آزاد اسلامی واحد تهران مرکزی

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 در تاریخ 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 محاسباتی	الزامی	۱	۱	۱۴/۵۰	چهارده و پنجاه صدم		۲۹
نیمسال اول ۹۳-۹۲	الکترودینامیک (۱).	اختیاری	۴		۱۶	شانزده تمام		۶۴
نیمسال اول ۹۳-۹۲	مکانیک کوانتومی پیشرفته (۱).	الزامی	۳		۱۶	شانزده تمام		۴۸
نیمسال اول ۹۳-۹۲	ریاضی فیزیک ۳	جبرانی	۳		۱۷	هفده تمام		بدون تاثیر
نیمسال اول ۹۳-۹۲	روش تحقیق	جبرانی	۲		۱۷/۵۰	هفده و پنجاه صدم		بدون تاثیر
نیمسال دوم ۹۳-۹۲	مکانیک کوانتومی پیشرفته (۲).	الزامی	۳		۱۷/۵۰	هفده و پنجاه صدم		۵۲/۵۰
نیمسال دوم ۹۳-۹۲	مکانیک آماری پیشرفته (۱).	الزامی	۳		۱۸	هجده تمام		۵۴
نیمسال دوم ۹۳-۹۲	مقدمات ذرات بنیادی	گرایشی	۳		۱۹/۵۰	نوزده و پنجاه صدم		۵۸/۵۰
نیمسال اول ۹۴-۹۳	الکترودینامیک (۲).	الزامی مشترک	۳		۱۷	هفده تمام		۵۱
نیمسال اول ۹۴-۹۳	فیزیک ذرات بنیادی پیشرفته (۱)	گرایشی	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	۲۸	هجده تمام		۱۰۸

جمع کل واحدهای 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

- 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 نصرالله اسکندری
سرپرست معاونت دانشجویی

دکترمهرداد نوابخش
رئیس دانشگاه آزاداسلامی واحد تهران مرکزی

دکتر محمد اکوان
معاون امور آموزشی و تحصیلات تکمیلی
دانشگاه آزاد اسلامی واحد تهران مرکزی

دکتر طهمورث آقاجانی
مدیر کل اداره دانش آموختگان دانشگاه

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

محمد رضایی - کارشناس
M.REZAEI
LEGALIZATION OFFICER

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.

مبلغ ۶۰ ریال بابت تعرفه خدمات کنسولی دریافت گردید.

31 JUL 2018 - 700095

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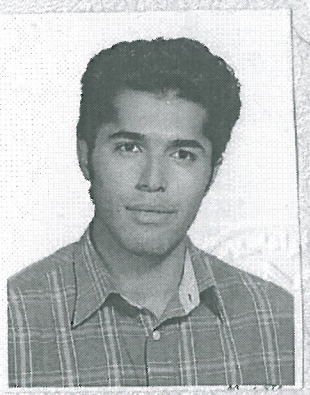
یرفع الله الذین آمنوا منکم والذین اوتوا العلم درجات



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 وشناسنامه 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 در تاریخ ۱۳۹۲/۰۷/۱۶ در واحد دانشگاهی تهران شمال به پایان رسانده است.

به حروف پانزده و سی و هشت صدم

این دانشنامه به ایشان اعطا می گردد

Certified Copy

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

دکتر علی محمد صفانیا
رئیس واحد دانشگاهی

از طرف
دکتر حمید میرزاده
رئیس دانشگاه آزاد اسلامی
دکتر سعید کاردار

شماره تایید سازمان مرکزی
۱۵۹۲۱۵۷۰۱۱۱۰

تاریخ تایید سازمان مرکزی
۹۳/۰۱/۲۷

Soguel, Romain

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, 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

Romain Soguel

La Mottaz 22
Apples, Switzerland
+41.(0)77/412.84.69
romain.soguel@gmail.com
02.06.1994

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
l'Education
Service académique

EPFL E-DAF SAC
BP 1233 (Bâtiment BP)
Station 16
1015 Lausanne

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Téléfax: +41 21 693 30 88
@mail: services.etudiants@epfl.ch
http://studying.epfl.ch/guichet_etudiants

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.*

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*

EIDGENÖSSISCHE TECHNISCHE HOCHSCHULE LAUSANNE
POLITECNICO FEDERALE DI LOSANNA
SWISS FEDERAL INSTITUTE OF TECHNOLOGY LAUSANNE

ÉCOLE POLYTECHNIQUE
FÉDÉRALE DE LAUSANNE

Institute of Physics
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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

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 2018/12/26) **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 re-

search 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: “the moving of domain wall in charged dilaton black holes bulk” is modifying.

The other paper: AiChen Li,Wulong Xu and Dingfang Zeng “Linear stability of an evolving thin shell wormhole with fluctuation”(prepare to JHEP,arXiv number will be emerged soon)

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 subgroups$su(3)\times su(2)\times u(1)$ 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)

$$G_{\mu\nu} = 8\pi G T_{\mu\nu} \tag{4}$$

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 .

$$\begin{aligned} \epsilon(\phi) &= \frac{1}{2}M_{pl}^2(\frac{V'}{V})^2 \ll 1 \rightarrow V' \ll \sqrt{2}\frac{V}{M_{pl}} \rightarrow V \ll e^{\frac{\sqrt{2}}{M_{pl}}\phi} \\ \eta(\phi) &= M_{pl}^2\frac{V''}{V} \ll 1 \rightarrow V'' \ll \frac{1}{M_{pl}^2}V \rightarrow V \ll e^{\frac{1}{M_{pl}}\phi} \\ N(\phi) &= \ln\frac{a_{enda}}{a} = \int_t^{t_{end}} H dt = \int_\phi^{\phi_{end}} \frac{H}{\dot{\phi}} d\phi \propto \int_{\phi_{end}}^{\phi} \frac{V}{V,\phi} d\phi \\ &= \int_{\phi_{end}}^{\phi} \frac{1}{\sqrt{2\epsilon}} d\phi \end{aligned} \tag{11}$$

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].

北京工业大学
BEIJING UNIVERSITY OF TECHNOLOGY
100 Ping Le Yuan,Chaoyang District,Beijing 100124,P. R. China http://www.bjut.edu.cn

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

Official Seal

RECOGNITION INSTRUCTION 1. "GRADUATE SCHOOL OF BEIJING UNIVERSITY OF TECHNOLOGY" is microprinted on the lower left corner as a line, they can be seen under the magnifying glass.
2. The fluorescent school badge of Beijing University of Technology on the both side of "北京工业大学" will appear under the ultraviolet lamp.

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.

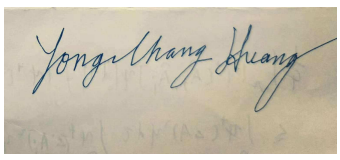
Mr. Xu is very earnest in his study. His studied graduate courses that include *Advanced Quantum Mechanics, Quantum Field Theory, General Relativity and Cosmology* and so on. These courses are really tough, but Mr. Xu passed them with very good performance.

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
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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].

Florida State University

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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
May not be released to a third party without permission

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

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

Course	Description	Grd	GB	RP	Taken	Passed	Points
PHY6980	DISSERTATION	S	SOU		9.000	9.000	0.000

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

			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	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
Office of the Registrar
282 Champions Way
PO Box 3062480
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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

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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