Fun Phys Master2 internship project 2022

Name of the laboratory: Centre de Physique Théorique CNRS UMR 7332
http://www.cpt.univ-mrs.fr/
Nanophysics team E6

Thesis advisor: T. Jonckheere
Co-advisors: T. Martin, J. Rech and B. Grémaud
Emails: martin@cpt.univ-mrs.fr, thibaut.jonckheere@cpt.univ-mrs.fr, jerome.rech@cpt.univ-mrs.fr, benoit.gremaud@cpt.univ-mrs.fr
Centre de Physique Théorique, Bat TPR2, 163 Av. de Luminy, Case 907, 13288 Marseille Cedex 09
Tel: 04 91 26 95 41

Web page of the team: http://www.cpt.univ-mrs.fr/~jonckheere/equipe.htm

Subject's title: **Shot-noise in a normal-topological junction**

Subject description:

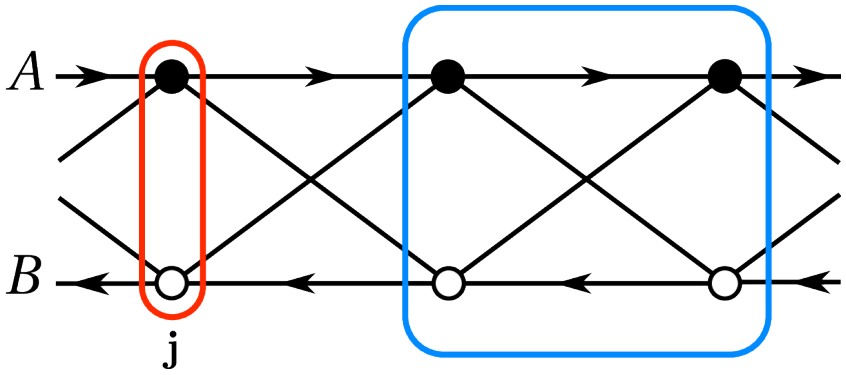
Noise is a fundamentally inescapable ingredient of any electronic device and manifests itself, for instance, in a non-equilibrium situation, when current flows through a conductor, as a consequence of electrons being transmitted or reflected. While at first it may be regarded as a nuisance, it has now been broadly accepted as a key tool to improve our understanding of nanoscale conductors. For instance, in the framework of the fractional Hall effect, studying shot noise allowed experiments to reveal the fractional (anyonic) nature of the excitations at the origin of the transport at the edges, a hallmark of the topological nature of the quantum Hall effect.

Topology in quantum systems corresponds to a hidden (nonlocal) symmetry of the (groundstate) wavefunctions, allowing us to classify them. Unlike standard symmetries (translation, rotation) which are easily broken by defects, the topological ones are usually immune to small perturbations due to a quantized topological invariant, protecting thereby the properties of the system . For instance, within the context of the quantum Hall effect, it explains the position of the transverse conductance at precisely integer (the well-known Chern number) or fractional values of e^2/h and the vanishing longitudinal resistance, i.e. a perfect electronic conduction along the edges. It turns out that, topology is not just found in quantum Hall systems, but, during the past ten years, it has been found to govern many more systems such as Chern insulators, unconventional superconductors, and interacting bosonic and fermionic systems.

In the context of transport in nanowire, it has been recently shown that Majorana bound states at the each of the ends of a topological superconductor lead to unique transport properties, having well defined signatures in the finite frequency noise of a biased junction between a normal metal and such a topological superconductor nanowire. However, in this system, it is still unclear how to quantify the respective impact of the two specific properties, i.e. the Majorana aspect and the edge localization (topology) on the shot noise.

In order to address this question, we propose to study the shot-noise properties in a different system, namely a tight-binding model in the Creutz lattice (see figure). This system has a peculiar band structure: both bands are flat, which means that the eigenstates are localized (the blue plaquette in the figure), contrary to the Bloch states for usual bands which are fully delocalized. Furthermore, the two bands are topological, i.e. exhibiting a non-vanishing winding number (a quantity similar to the Chern number, but for one-dimensional system) In particular, this implies that, for open boundary conditions, the lattice has two edge states localized at each end of the

lattice. Furthermore, playing with the values of the different hopping amplitudes, one can tune the system properties at will: changing the symmetry class of the topological insulator, controlling the localization size of the edge states, the flatness of the bands. This would allow us, in principle, to understand much more clearly how the shot noise properties depend on the different aspect of the system (topology, localization, bandwidth).



In this project, we will want to study the shot noise in the transport properties for a biased junction between a normal metal (a regular ladder geometry) and the Creutz lattice. We will use the non-equilibrium Keldysh formalism to compute the finite frequency emission and absorption noise as functions of the bias voltage and the parameters of the tight-binding model. The project will have both analytical and numerical aspects.

References:

‡1 Noise in mesoscopic physics, Thierry Martin, les Houches Session LXXXI, H. Bouchiat et. al. eds. (Elsevier 2005). arXiv:cond-mat/0501208

‡2 Quantum Transport, Y. Nazarov and Y. Blanter, Cambridge University Press.

‡3 Finite frequency noise in a normal metal - topological superconductor junction,

‡4 D. Bathellier, L. Raymond, T. Jonckheere, J. Rech, A. Zazunov, T. Martin, , Phys. Rev. B 99, 104502 (2019)

‡5 M. Creutz, Phys. Rev. Lett. 83, 2636 (1999).

‡6 Pairing and superconductivity in the flat band: Creutz lattice, Rubem Mondaini, George Batrouni and Benoît Grémaud, Phys. Rev. B 98, 155142 (2018).

Duration: the normal duration of a CPT internship

Any self-financial support? NO this internship would be financed by the CPT.

Specify whether the internship project may naturally lead to a PhD thesis. Not directly.

Motivational letter for internship in CPT

Marseille, February 2022

To whom it may concern,

My name is Panagiotis Tselifis and I am conducting this letter first in order to express my interest in the M2 internship (stage) *Shot-noise in a normal-topological junction*, supervised by T. Jonckheere and the Nanophysics team of CPT, and second to apply for the CPT internship grant. I am currently registered in the 2nd year of the Fundamental Physics Master program in Aix-Marseille Université.

First, a few words about my background. I obtained my B.Sc. in Physics on October 2020 from the University of Athens, Greece. During my undergraduate studies, I showed great interest in theoretical and more mathematically challenging courses, which deepened during the process of writing my bachelor thesis. On September 2021, I began my graduate studies in Marseille, where I had the chance to be acquainted with (quantum) statistical field theory methods and many-body physics, mainly through the lectures of T. Martin. Furthermore, I had to write a brief bibliographic report on random matrix theory and the replica technique, while now I am working on a numerical project on the Kitaev chain (topological-normal-topological junction).

Second, my motivation. My ambition is to follow an academic career in the interplay of Mathematics and Theoretical Physics. For that, I believe that many-body problems (quantum transport, superconductivity, quantum Hall effect, etc.) provide an excellent arena for both development and application of rigorous mathematical methods on physically interesting phenomena, while the numerical techniques one needs to employ are of invaluable importance. Besides, in recent years, one cannot but notice a significant interest of the scientific community in topological condensed matter systems, especially in view of Majorana-modes associated aspects. The pioneering work of the Nanophysics team of CPT in that matter, namely the study of the properties of quantum noise in mesoscopic systems that potentially carry Majorana modes, is highly motivating.

Finally, the possibility of working under the supervision of researchers whose work is already familiar to me accounts for a supplementary reason for asking for this internship. Surely, a collaboration with the Nanophysics team will offer me an invaluable insight to the applications of both analytical and numerical methods in topological condensed matter and quantum transport topics and eventually form my career as a theoretician. At the same time, applying my previous knowledge, while acquiring new skills will hopefully benefit the entire team. For all of the above reasons, I believe that I am an excellent candidate for the aforementioned internship.

I look forward to your positive response. Thank you for your time and consideration.

Sincerely,

Panagiotis TSELIFIS

M2 FunPhys student

21226974

panagiotis.tselifis@etu.univ-amu.fr

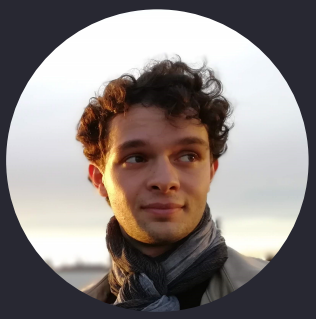
PANAGIOTIS TSELIFIS

graduate student in Physics

@ panagiotis.tselifis@etu.univ-amu.fr

+30 6984455306 | Marseille, France

Date of birth: 15/02/1997 | Nationality: Greek



EDUCATION

M.Sc. in Physics

Aix-Marseille Université

Sept 2021 - Jul 2022 | Marseille, France

program: *Fundamental Physics*

B.Sc. in Physics

National and Kapodistrian University of Athens

Sept 2015 - Oct 2020 | Athens, Greece

section of *Nuclear and Particle Physics*
overall grade: "Very Good" **[8.11/10]**
thesis title: ***Poisson Geometry, groupoids and Poisson σ-models***

Erasmus+ for Studies

Université Grenoble-Alpes

Sept 2018 - Feb 2019 | Grenoble, France

with courses from Master 1 and Master 2

High School Diploma

June 2015 | Athens, Greece

overall grade: "Excellent" **[19.5/20]**

ACHIEVEMENTS

M.Sc. Scholarship

State Scholarships Foundation, Embassy of France in Greece

2021-2022

B.Sc. Scholarship

Hellenic Ministry of Economics

2018-2020

Panhellenic Student Tournaments

Hellenic Mathematical Society

2007, 2010, 2011

DIGITAL COMPETENCE

MS Office ●●●●

Python ●●○○

C++, Mathematica, R ●○○○

LANGUAGES

Greek ●●●●●●

Mother tongue

English ●●●●●●

TOEFL iBT (C1) — 2021

University of Michigan (C2) — 2012

French ●●●●●○

Erasmus+ OLS (C1) — 2019

Paris-Sorbonne (B2) — 2017

German ●●○○○○

primary & secondary education classes

ACADEMIC INTERESTS

Field theoretical topics in Condensed Matter:

- superconductivity, superfluidity
- quantum transport, quantum noise
- bosonization of fermionic systems

Mathematical methods in Th. Physics:

- groupoids, reduction and integrability
- topological aspects in cond. matter
- random matrix theory

NOTES ET RÉSULTATS

UNIVERSITE D'AIX-MARSEILLE
PANAGIOTIS TSELIFIS
Dossier : 21226974
Année : 2021/2022

ÉLÉMENTS & ÉPREUVES

Code	Libellé	Rang	ECTS	Session 1	Résultat	Session 2	Résultat
SPHCSABC	Semestre 3 M2 Physique : Physique (Relevé 1partiel)						
SPHCX01C	PTP Choix S3 (18 crédits)			16.233/20			
SPHCUD1C	Advanced Quantum Statistical Physics		6	16.4/20	ADM		
SPHCU07C	Quantum Field Theory		6	18.3/20	ADM		
SPHCU09C	General Relativity		6	14/20	ADM		

INFORMATIONS

Signification des codes résultats :
ADM : Admis

Fait à Aix-Marseille, le 28-01-2022, La Directrice de l'UFR Sciences Laurence MOURET

HELLENIC REPUBLIC

National and Kapodistrian University of Athens

EST. 1837

SCHOOL OF SCIENCE

DEPARTMENT OF PHYSICS

DIPLOMA SUPPLEMENT

This Diploma Supplement model was developed by the European Commission, Council of Europe and 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 should be free from any value judgements, equivalence statements or suggestions about recognotion. Information in all eight sections should be provided. Where information is not provided, an explanation should give the reason why.

1. INFORMATION IDENTIFYING THE HOLDER OF THE QUALIFICATION

1.Family name(s): TSELIFIS

1.2 Given name(s): PANAGIOTIS

1.3 Date of birth (day/month/year): 15/02/1997

Place of birth - Country: ATHINA - GREECE

1.4 Student identification code or number: 1110201500185

2. INFORMATION IDENTIFYING THE QUALIFICATION

2.1 Name of qualification and (if applicable) title conferred (in original language):

PTYCHIO PHYSIKIS - BACHELOR DEGREE (B.Sc. IN PHYSICS)

2.2 Main field(s) of study for the qualification:

PHYSICS

2.3 Name and status of awarding institution (in original language):

ETHNIKO KAI KAPODISTRIAKO PANEPISTIMIO ATHINON-NATIONAL AND KAPODISTRIAN UNIVERSITY OF ATHENS, PUBLIC UNIVERSITY

2.4 Name and status of institution (if different from 2.3) administering studies (in original language):

2.5 Language(s) of instruction/examination:

GREEK

3. INFORMATION ON THE LEVEL OF THE QUALIFICATION

3.1 Level of qualification:

FIRST CYCLE - UNDERGRADUATE STUDIES

3.2 Official length of programme:

EIGHT (8) SEMESTERS

3.3 Access requirements:

NATIONAL LEVEL EXAMS AT THE END OF SECONDARY EDUCATION "LYKEIO" OR SUCCESSFUL EXAMS IN THE DEPARTMENT AFTER COMPLETION OF ANOTHER UNDERGRADUATE DEGREE OR CATEGORIES DEFINED BY THE MINSTRY OF EDUCATION

ΠΑΡΑΣΚΕΥΗ ΨΩΜΑ

4. INFORMATION ON THE CONTENTS AND RESULTS GAINED

4.1 Mode of study:

FULL-TIME

4.2 Programme requirements:

ATTENDANCE OF 8 SEMESTERS AND THE SUCCESSFUL EXAMINATION IN 44 COURSES, OUT OF WHICH 38 ARE OBLIGATORY (INCLUDING THE DIPLOMA THESIS WHICH IS CONSIDERED AS TWO COURSES: FINAL THESIS I AND FINAL THESIS II) AND 6 ARE OPTIONAL FROM ELECTIVE COURSES . MINIMUM REQUIREMENT FOR GRADUATION: 240 ECTS CREDITS.

4.3 Programme details (e.g. modules or units studied), and the individual grades/marks/credits obtained:

No	Course Code	COURSE TITLE	Semester	Teaching Units	Ects credits	Grade	Academic Year
1	10Y0312	ANALYSIS I AND APPLICATIONS	1	6	6	10	2015-16
2	10Y013	PHYSICS I (MECHANICS)	1	6	6	5	2015-16
3	10Y015	COMPUTERS I	1	4	6	10	2015-16
4	10Y0314	PHYSICS I BASIC LABORATORY	1	1	3	9	2015-16
5	10Y0317	PROBABILITIES, STATISTICS AND APPLICATIONS OF NUMERICAL ANALYSIS	1	4	6	7	2016-17
6	10Y0324	PHYSICS II BASIC LABORATORY	2	1	3	9	2015-16
7	10Y025	INTRODUCTION TO ASTROPHYSICS	2	5	6	8	2015-16
8	10Y0323	PHYSICS II (HEAT AND WAVES)	2	6	6	8	2015-16
9	10Y0322	ANALYSIS II AND APPLICATIONS	2	5	6	7	2016-17
10	10Y0321	ORDINARY DIFFERENTIAL EQUATIONS AND LINEAR ALGEBRA	2	6	6	10	2016-17
11	10Y031	THEORETICAL MECHANICS I	3	4	6	7	2016-17
12	10Y034	MATHEMATICAL METHODS FOR PHYSICS I	3	5	6	7	2016-17
13	10Y0333	PHYSICS III BASIC LABORATORY	3	1	3	9	2016-17
14	10Y0338	COMPUTATIONAL PHYSICS	3	4	6	10	2016-17
15	10Y032	PHYSICS III (ELECTROMAGNETISM)	3	6	6	10	2018-19
16	10Y035	INTRODUCTION TO ATMOSPHERIC PHYSICS	3	5	6	8	2019-20
17	10Y0345	PHYSICS IV (MODERN PHYSICS)	4	6	6	6	2016-17
18	10Y041	THEORETICAL MECHANICS II	4	4	6	7	2016-17
19	10Y0343	PHYSICS IV BASIC LABORATORY	4	1	3	9	2016-17
20	10Y044	MATHEMATICAL METHODS FOR PHYSICS II	4	5	6	8	2016-17
21	10Y046	SPECIAL THEORY OF RELATIVITY	4	4	6	7	2016-17
22	10Y0347	STATES AND PROPERTIES OF MATTER	4	4	6	8	2018-19
23	10Y0356	CORE LABORATORY I	5	1	3	9	2017-18
24	10Y053	QUANTUM MECHANICS I	5	5	6	9	2018-19
25	10Y0355	STATISTICAL PHYSICS I	5	4	6	8	2018-19
26	10Y054	ELECTROMAGNETISM I	5	5	6	8	2019-20
27	10Y051	ELECTRONICS I	5	5	6	8	2019-20
28	10Y0367	CORE LABORATORY II	6	1	3	9	2017-18
29	10Y3406	ATOMIC AND MOLECULAR PHYSICS	6	4	6	7	2017-18
30	10Y061	INTRODUCTION TO NUCLEAR PHYSICS AND ELEMENTARY PARTICLES	6	5	6	8	2018-19
31	10Y3404	ELECTROMAGNETISM II	6	5	6	7	2018-19
32	10Y065	QUANTUM MECHANICS II	6	5	6	8	2018-19
33	10Y062	INTRODUCTION TO SOLID STATE PHYSICS	6	5	6	8	2018-19
34	10Y3402	ELEMENTARY PARTICLES I	7	4	6	5	2018-19
35	10E3111	GENERAL THEORY OF RELATIVITY AND COSMOLOGY	7	4	5	8	2019-20
36	10Y071	DIPLOMA THESIS I	7	10	7,5	9	2019-20
37	10E3999	PHYSICS TEACHING METHODS	7	4	5	10	2019-20
38	10E3996	DIFFERENTIAL GEOMETRY AND APPLICATIONS	7	4	5	8	2019-20
39	10Y3403	NUCLEAR PHYSICS I	7	4	6	9	2019-20
40	10Y3400	NUCLEAR PHYSICS LABORATORY	7	1	3	8	2019-20
41	10E3415	ASTROPARTICLE PHYSICS AND COSMIC RAYS	7	4	5	8	2019-20
42	10E3103	NON-LINEAR DYNAMICAL SYSTEMS	8	4	5	6	2018-19
43	10E3414	SPECIAL TOPICS IN NUCLEAR PHYSICS AND ELEMENTARY PARTICLES	8	4	5	7	2018-19
44	10E3416	MODERN QUANTUM PHYSICS AND APPLICATIONS	8	4	5	7	2018-19

ΦΑΝΗ ΜΟΥΡΟΥΤΗ

No	Course Code	COURSE TITLE	Semester	Teaching Units	Ects credits	Grade	Academic Year
45	10Y081	DIPLOMA THESIS II	8	10	7,5	10	2019-20
		Total		**195**	**245**		

The undergraduate program in Physics leads to a Bachelor's Degree. The duration of the program is eight semesters. At the sixth semester the students select one of five directions:
1. Solid State Physics
2. Nuclear and Particle Physics
3. Astrophysics, Astronomy and Mechanics
4. Environmental Physics and Meteorology
5. Electronics, Computers, Telecommunications and Control.

The degree requirements include thirty-five (35) Theory courses, seven (7) Laboratory courses and one (1) Diploma Thesis. The courses are characterized as Core or Specialization, and as Compulsory or Elective. The thirty-five (35) Theory courses include twenty-five (25) Compulsory Core courses, one (1) Elective Core course (selected from a list of three), six (6) Specialization courses (three Compulsory and three Elective) and three (3) Elective courses that can be selected from the entire list of offered courses of any type and any specialty. The seven (7) Laboratory courses include four (4) Basic Physics Laboratories, two (2) Core Laboratories and one (1) Specialization Laboratory.

4.4 Grading Scheme and, if available, grade distribution quidance:

DESCRIPTION OF THE GREEK GRADING SYSTEM:
THE GRADING SCALE RUNS FROM 1 TO 10
PASSING GRADES RUN FROM 5 TO 10 AS FOLLOWS:
5,00 - 6,49 = GOOD
6,50 - 8,49 = VERY GOOD
8,50 - 10,00 = EXCELLENT

4.5 Overall classification of the qualification (in original language): 8.11 'VERY GOOD' ('LIAN KALOS')

5. INFORMATION ON THE FUNCTION OF THE QUALIFICATION

5.1 Access to further study:

The Physics Degree allows access to graduate studies (Second cycle).

5.2 Professional status (if applicable):

The Degree provides full scientific and teaching certification that allows the holder to apply for teaching positions and to teach in Secondary High Schools. Also, during their studies the students are trained in the use of computers (the E.C.D.L. certificate is granted with the Degree).

The holders of the Physics Degree can work in the Public and Private sector (e.g. in Secondary Education, in Computer or Information Systems etc.), or after graduate studies, in several different sectors of Research and Technology, in Research and Academic Institutions in Greece or abroad, in Energy Organizations, Telecommunications Companies, Meteorological Agencies, High Technology Industries, as well as in the Health Sector (as medical physicists - radiation physicists) etc.

6. ADDITIONAL INFORMATION

6.1 Additional Information:

THE STUDENT HAS CHOSEN THE SPECIALIZATION OF NUCLEAR AND PARTICLE PHYSICS

FINAL THESIS TITLE:

<<Poisson Geometry, Groupoids and Poisson σ-models>>

ERASMUS

6.2 Further information sources:

National and Kapodistrian University of Athens: http://www.uoa.gr
Department of Physics : http://www.phys.uoa.gr
Ministry of Education, Research and Religious Affairs: http://www.minedu.gov.gr

ΦΑΝΗ ΜΟΥΡΟΥΤΗ

7. CERTIFICATION OF THE SUPPLEMENT

7.1 Date (day/month/year): **28-11-2020**

7.2 Signature: **KYPRIADOU ANNA**

7.3 Capacity: **BY THE ORDER OF THE RECTOR, THE DIRECTOR OF EDUCATION AND RESEARCH**

7.4 Official Stamp or Seal

ΕΘΝΙΚΟΝ & ΚΑΠΟΔΙΣΤΡΙΑΚΟΝ ΠΑΝΕΠΙΣΤΗΜΙΟ ΑΘΗΝΩΝ
Με εντολή Πρύτανη
Η Προϊσταμένη της Διεύθυνσης
Εκπαίδευσης και Έρευνας
Άννα Κυπριάδου

8. INFORMATION ON THE NATIONAL HIGHER EDUCATION SYSTEM

Tertiary Education in Greece comprises two parallel sectors: a) the University sector, which includes the Universities, the Technical Universities and the School of Fine Arts and b) the Technological sector, which includes the Higher Technological Education Institutions and the School of Pedagogical and Technological Education (ASPETE). In Greece there are twenty-two (22) Universities and fourteen (14) Technological Education Institutions. According to article 16 of the Greek Constitution, higher education is public and exclusively provided by Higher Education Institutions, which are Legal Entities under Public Law, enjoying full self-administration and academic freedom, while they are subject to state supervision and financed by the government. State supervision is carried out by the Ministry of Education, Research and Religious Affairs.

Admission of students to the above institutes depends on their performance at nation-wide exams taking place in the 3rd grade of the upper secondary school (Lyceum). Entrance to the various Schools of the Universities and Technological Education Institutions depends on the general score obtained by Lyceum graduates, on the number of available places (numerus clausus) and on the candidates ranked preferences among Schools and Departments.

The academic year begins on 1st September each year and ends on 31st August of the following year. Each academic year is divided into two semesters. Each semester includes at least thirteen (13) weeks of teaching and two (2) weeks of examinations. The first semester begins in the second fortnight of September and the second semester ends during the second fortnight of June. Throughout the year, there is a total of four weeks of Christmas and Easter holidays.

The majority of the first cycle programmes in Universities comprise 8 semesters (4 years - at least 240 ECTS credits). There are certain first cycle programmes offered by Universities whose duration exceeds the 8 semesters. All first cycle University and TEI graduates can apply for admission to second cycle graduate programmes. The postgraduate programmes last one to two years (2/3 or 4 semesters, 60/90 or 120 ECTS credits) and lead to MA or MSc degrees.

Each semester course carries a number of credits, as set by each department. The study programme of every University Department contains also the course subjects and contents and the number of hours of classes per week. University undergraduate study leading to a first degree ("PTYCHIO"-ΠΤΥΧΙΟ) in Greece lasts at least four years for most subjects. It lasts five years at Technical Universities, at Departments of applied sciences (Agronomy, Forestry, Dentistry, Veterinary Medicine and Pharmacy) and at certain Art Departments (e.g. Music Studies) and six years at Medical Schools.

Students complete their studies and are awarded their degree when they have passed the necessary number of courses stipulated in the study programme and have accumulated the required number of credits.

Students who successfully complete their first cycle studies at Universities are awarded a PTYCHIO (first cycle degree). The Ptychio leads to employment or further study at the post-graduate level leading to the second cycle degree -METAPTYCHIAKO DIPLOMA EIDIKEFSIS, equivalent to the Masters degree- and the third cycle leading to the doctorate degree -DIDAKTORIKO DIPLOMA.

Source: EURYDICE NETWORK: https://webgate.ec.europa.eu/fpfis/mwikis/eurydice/index.php/Greece:Higher_Education

Detailed information on the Greek education system can also be sought at the Ministry of Education, Research and Religious Affairs website: http://www.minedu.gov.gr/

ΦΑΝΗ ΜΟΥΡΟΥΤΗ

HELLENIC REBUBLIC

University Campus
Zografou 15771, Greece

National and Kapodistrian University of Athens

Department of Nuclear and Elementary Particle Physics
Faculty of Physics

Tel.: +30 210-7276938
e-mail: ksfetsos@phys.uoa.gr
http://users.uoa.gr/~ksfetsos/

Athens 4-2-2022

Dear members of the selection committee,

It is a pleasure to recommend Mr. Panagiotis Tselifis to do his thesis to your University.

Panagiotis was my student in the course "Qunantum Mechanics II", a compulsory course in which about 200 students enroll yearly. He did quite well in the exams, being in the top 8% of the class. He did his diploma thesis in the math department under the supervision of I. Androulidakis. I accepted to serve as a co-supervisor due to administrative regulations. His thesis was on Poisson geometry and Poisson σ-models. Due to my own research interests I guided his in certain aspects relevant to Theoretical and Mathematical Physics, in particular on index theorems. He loves pure Mathematics. I am glad that he is now interested in doing a thesis on a Theoretical Physics topic.

My impression of Panagiotis is that he is hard working and capable of being an excellent graduate student. The fact that he has a Physics background but at the same time he has acquired a deeper knowledge of pure mathematics than most physics students will be an asset for him.

I recommend his admittance to the programme strongly.
If you need additional information/clarification please do not hesitate to contact me.

Sincerely yours

Professor Konstantinos Sfetsos