



Study programme MSc in Physics Academic Year 2019/2020

1. OVERVIEW

The Master of Science in Physics (LM-17) aims at:

- promoting the development of graduate's ability to solve complex problems and her/his attitude towards innovation by a direct research experience in Physics. Problem solving and innovation attitude are indeed important assets in the job market, which is not limited to academic research.
- providing the cultural foundations, the technical abilities, the full control of the scientific research method that are needed to successfully meet the challenges posed by modern research in Physics and its related interdisciplinary areas.

In order to achieve these goals, the Master of Science in Physics devotes approximately one third of its ECTS (to the core lectures modules in modern Physics, one third to more specialized lecture modules in one of the research areas that are actively pursued in the Department of Physics, one third to the master thesis, which is coordinated within a research group under the guidance of one or more supervisor(s).

The variety of the research areas is reflected by a course structure organized in two study plans:

- "Theoretical and Computational Physics"
- "Experimental Physics"

Each study plan can be further characterized and personalized with a large number of lecture modules, all aimed at further improving and deepening of the knowledge and competences in the following research areas:

Study plan "Theoretical and Computational Physics":

- *Condensed Matter and Quantum Gases*
- *Theory of Fundamental Interactions and Cosmology*
- *Theoretical and Computational Nuclear Physics and Astrophysics*
- *Statistical and Biological Physics*

Study plan "Experimental Physics":

- *Astroparticle and Particle Physics*
- *Biological and Medical Physics*
- *Experiment Design and Implementation*
- *Experiments on Fundamental Interactions and Cosmology*

- *Nanophotonics*
- *Physical Science Communication and Teaching Methods*
- *Physics and Chemistry for Energy and the Environment*
- *Structure and Dynamics of Complex Systems*

Several research areas are interdisciplinary and largely benefit from the interaction with research groups in Engineering, Biology and Mathematics.

2. ADMISSION REQUIREMENTS

In order to be admitted to the Master of Science in Physics, graduates shall fulfill the following requirements:

- a Bachelor degree lasting at least three years or longer; a graduates must have obtained at least 24 ECTS in the area of Mathematics (MAT/*) and at least 54 ECTS in the area of Physics (FIS/*) and a total number of 84 ECTS in Mathematics and Physics (MAT/* + FIS/*);
- b) an adequate personal qualification, including knowledge of English at level B1, or more.

The personal qualification will be judged with an interview by a Committee, composed by Prof. A. Miotello and Prof. L. Vanzo. The interview will be arranged at the Department of Physics within September 2019. Results will be made available before the starting date of the lectures. Students with at least 30 ECTS in Mathematics (MAT/*) and 90 ECTS in Physics (FIS/*) with a Bachelor degree and a final mark of at least 95/110 might be accepted without an interview.

3. COURSE STRUCTURE

Lectures for the first year, first term start on Monday, September 23rd, 2019.

Lectures for the second year, first term start on Monday, September 16th, 2019.

All students are requested to attend the modules on "Health and safety in the workplace" and "Health and safety in the laboratories".

3.a Core modules for the Study Plan *Theoretical and Computational Physics*

MANDATORY CORE COURSES								
Year	Code	module		Tuition hours	ECTS/ty pe	SSD	Term	Lecturer
1	145164	Experimental Methods		56 in total: 42 lecture hours 14 lab hours	6/b	FIS/01	I	Stefano Vitale
1	145644	Quantum Mechanics, Fields and Symmetries		56 in total: 42 lecture hours 14 lab hours	6/b	FIS/02	I	Winfried Leidemann
1	145646	Quantum Field Theory I		56	6/b	FIS/02	II	Albino Perego

Besides these three mandatory core lecture courses, graduates choose four options from the list below for a total number of 42 ECTS. The choice must include 1 module belonging to the so called FIS/02 and 3 modules belonging to FIS/03 and/or FIS/04. Graduates can take other core modules in the list – which have not been selected

among the required 4-) by choosing them as elective.

ELECTIVE CORE COURSES								
Year	Code	Module		Tuition hours	ECTS /type	SSD	Term	Lecturer
1	145653	Solid State Physics I		48	6/b	FIS/03	I	Giacomo Baldi
1	145177	Statistical Mechanics		48	6/b	FIS/02	I	Raffaello Potestio
1	145649	Computational Physics		48	6/b	FIS/02	II	Francesco Pederiva
1	145645	Nuclear and Subnuclear Physics		48	6/b	FIS/04	II	Winfried Leidemann
1	145654	Solid State Physics II		48	6/b	FIS/03	II	Roberto S. Brusa
1	145651	Quantum Theories for Multiparticle Systems		48	6/b	FIS/04	II	Giuseppina Orlandini
2	145660	Fundamental Interactions		48	6/b	FIS/04	I	Roberto Iuppa

3.b Core modules (corsi caratterizzanti) for the Study Plan *Experimental Physics*

Year	Code	Module	Tuition hours	ECTS /type	SSD	Term	Lecturer
1	145164	Experimental Methods	56 in total: 42 lecture hours 14 exercise hours	6/b	FIS/01	I	Stefano Vitale
1	145644	Quantum Mechanics, Fields and Symmetries	56 in total: 42 lecture hours 14 exercise hours	6/b	FIS/02	I	Winfried Leidemann
1	145648	Experimental Physics	60 in total: 12 lecture hours 48 exercise hours	6/b	FIS/01	II	Mario Scotoni

Besides these three mandatory core lecture courses, graduates choose four options from the list below for a total number of 42 ECTS. The choice must include 1 module belonging to the so called FIS/02 and 3 modules belonging to FIS/03 and/or FIS/04. Graduates can take other core modules in the list – which have not been selected among the required 4-) by choosing them as elective.

Year	Code	Module	Tuition hours reserved to assisted learning activity	ETCS/type	SSD	Term	Lecturer
1	145653	Solid State Physics I	48	6/b	FIS/03	I	Giacomo Baldi

1	145177	Statistical Mechanics	48	6/b	FIS/02	I	Raffaello Potestio
1	145649	Computational Physics	48	6/b	FIS/02	II	Francesco Pederiva
1	145654	Solid State Physics II	48	6/b	FIS/03	II	Roberto S. Brusa
1	145645	Nuclear and Subnuclear Physics	48	6/b	FIS/04	II	Winfried Leidemann
1	145651	Quantum Theories for Multiparticle Systems	48	6/b	FIS/04	II	Giuseppina Orlandini
1	145646	Quantum Field Theory I	56	6/b	FIS/02	I	Albino Perego
2	145660	Fundamental Interactions	48	6/b	FIS/04	I	Roberto Iuppa

3.c Elective courses (integrative)

Besides the mandatory and elective core modules, students shall obtain other 24 ECTS, i.e. 4 modules among the integrative elective courses. In this respect, students are encouraged to follow the indications given by the research group they wish to join for their master thesis. Suggestions and further information are available on the website of the Physics Department (<http://web.unitn.it/dphys/25236/percorso-di-laurea>).

Integrative modules for the Master of Science in Physics are listed below. It is possible to choose modules in different subjects, offered by the University of Trento's other master courses and declared as affiliated subjects. The list of affiliated subjects can be found in the Regolamento della Laurea Magistrale in Fisica. The study plan, including the chosen elective courses, will be subject to approval.

Year	Code	Module	Tuition hours	ECTS	SSD	Term	Lecturer
1	145338	Bio-Medical Imaging	48	6	FIS/01	II	Albrecht Haase
1	145650	Physics of Disordered Systems	48	6	FIS/03	II	Giulio Monaco
1	145169	Nuclear Astrophysics	48	6	FIS/04	II	Winfried Leidemann
1	145171	Optoelectronics	48	6	FIS/01	II	Lorenzo Pavesi
1	145175	Quantum Optics	48	6	FIS/01	II	Iacopo Carusotto
1	145775	Astroparticle Physics	48	6	FIS/01	II	Roberto Battiston
1	145513	Quantum Gases and superfluidity	48	6	FIS/03	II	Stefano Giorgini
1	145514	Radiation Biophysics	48	6	FIS/07	II	Chiara La Tessa

1	145729	Multi-scale methods in soft matter	48	6	FIS/03	II	Raffaello Potestio
2	145224	General Relativity and Cosmology	48	6	FIS/02	II	Massimiliano Rinaldi
2	145282	Photonics	48	6	FIS/01	I	Stefano Azzini
2	145652	Physics of Materials	48	6	FIS/03	I	Antonio Miotello
2	145235	Molecular and Cellular Biophysics	48	6	BIO/10	I	Marina Scarpa
2	145511	Atomic Physics	48	6	FIS/03	I	Gabriele Ferrari
2	145512	Nanoscience	48	6	FIS/01	I	Marina Scarpa
2	145647	Quantum Field Theory II	48	6	FIS/02	I	Luciano Vanzo
2	145285	Statistical Field Theory	48	6	FIS/02	II	Pietro Faccioli
2	145659	Computational methods for transport phenomena	48	6	FIS/03	I	Maurizio Dapor
2	145232	Laboratory of Energy Conversion Processes	56	6	FIS/01	I	Paolo Tosi
2	145283	Laboratory of Advanced Photonics	56	6	FIS/01	I	Paolo Bettotti
2	145230	Laboratory of Advanced Electronics	56	6	FIS/01	I	To be appointed
2	145231	Laboratory of Condensed Matter	56	6	FIS/01	I	Marco Zanatta
2	145509	Medical Physics	48	6	FIS/07	II	To be appointed
1 o 2	145948	Quantum Computing	56	6	FIS/02	II	To be appointed
1	145153	Experimental Physics Laboratory at High School Level I (mutuato dal Corso di Laurea Magistrale in Matematica)	56	6	FIS/08	I	Pasquale Onorato
1	145537	Physics education: theoretical and experimental approaches (mutuato dal Corso di Laurea Magistrale in Matematica)	56	6	FIS/08	II	Pasquale Onorato
1 o 2	145341	Fondamenti di meteorologia e climatologia (mut. dal corso di LT Ingegneria per l'ambiente e il territorio 0326G cod. 140257)	60	6	FIS/06	II	Dino Zardi
1 o 2	145342	Fisica dell'atmosfera e del clima (mut. dal corso di LM Ingegneria per l'ambiente e il territorio 0332H cod. 140238)	60	6	FIS/06	I	Lorenzo Giovannini
1 o 2	145605	Renewable Energy and Meteorology (mut. dal corso LM Ingegneria Energetica 0337H)	60	6	FIS/06	II	Lorenzo Giovannini

		cod. 140511)					
1 o 2	140531	Introduction to meteorology and climatology (mut. dal corso LM Environmental Meteorology)	60	6	FIS/06	I	To be appointed
1 o 2	145734	Air pollution modelling (mut. dal corso LM Environmental Meteorology 0341H cod. 140535)	90	9	FIS/06	II	Dino Zardi
2	145546	Computational Biophysics (mutuato dal Corso di Laurea Magistrale in Quantitative and Computational Biology)	96	12	FIS/02	I	Gianluca Lattanzi

The Department Council may decide to cancel some of the above modules when less than 3 students would be interested to attend them. Students will be asked to express their preferences in due time. Students interested in canceled modules will be timely informed and advised on alternative available choices.

3.d Elective modules (free)

Students will obtain other 12 ECTS, without any constraint on their choice of modules. Any module offered by other Departments or even other Universities can be eligible as elective free module, provided that student obtains a final evaluation and the Department of Physics' approval. plan. Students are invited to ask the research group they wish to join for their Master thesis for advice on this choice.

4. STUDY PLANS

Information days on the lectures module, study plans and research activities will be organized in collaboration with the Physics Department before December 2019. Study plan submission deadlines will be available at <https://offertaformativa.unitn.it/en/lm/physics/courses-hours-examinations>.

Study plans agreed with the research groups of the Physics Department (available on the website) will be automatically approved. Otherwise they need to be motivated in an interview with a member of the Teaching Committee, who will decide on its approval. Approved study plans are mandatory, except for elective free courses.

5. TUTORING

Students are strongly recommended to ask lecturers for help. For any other matter regarding the structure of the Master of Science in Physics, students may ask the members of the Teaching Committee, either directly or via their student representatives.

6. FINAL EXAM

The final exam consists of the defense of a written thesis corresponding to 39 ECTS. The final exam will comprise also the 3 ECTS reserved to the English knowledge evaluation, with particular emphasis ESP.

The Master thesis project will bring students into direct contact with at least one cutting edge research topic in Physics allowing them to contribute to its advancement. In general, the final exam aims at verifying the scientific maturity achieved by students at the end of their study career.

The research activity related to the Master thesis is usually carried out in one of the research laboratories in the Department of Physics or any other research structure collaborating with the Department of Physics, under the supervision of one professor and/or researcher in the laboratory. A co-supervisor from any other public or private national or international research institution can be formally included.

Before starting the research activity, students need to be allowed to access the laboratories by sending the form available on the web site <http://offertaformativa.unitn.it/it/lm/fisica/laurearsi> to df.supportstaff@unitn.it

The procedures for the final exam, the criteria for the final mark, further information on the Master thesis and the evaluation committee for the final exam are available on the "Regolamento per lo svolgimento della prova finale" (<http://offertaformativa.unitn.it/it/lm/fisica/laurearsi>).

7. TEACHING COMMITTEE

The members of the teaching committee are: Gianluca Lattanzi, the academic coordinator of the Physics Department, Giacomo Baldi, Paolo Bettotti, Franco Dalfovo, Luciano Vanzo and William Joseph Weber.

Detailed syllabi including evaluation criteria are published at the beginning of the academic year. Any further information, not explicitly written on this document, can be found in Italian on the Manifesto 2019/2020 and the Regolamento del corso di laurea magistrale in Fisica, available at the following website: <http://offertaformativa.unitn.it/it/lm/fisica/regolamenti-e-manifesti>