



Study programme MSc in Physics Academic Year 2020/2021

1. OVERVIEW

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

- providing a deep and flexible education in the various areas of modern physics, its theoretical and experimental aspects and its applications; with particular attention to the recent developments of research and technology.
- providing the cultural foundations, the technical abilities, the full control of the scientific research method that are needed to get in touch with the recent research frontiers studied in the Department, and give a personal contribution with the Master's Thesis work.
- promoting scientific and technological innovation by a direct research experience in the areas studied in the Department and also by international collaborations.

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 a supervisor.

The variety of the research areas is reflected by a course structure with different study plans suggested by the research areas active in the department:

- *Condensed Matter and Quantum Gases*
- *Theory of Fundamental Interactions and Cosmology*
- *Theoretical and Computational Nuclear Physics and Astrophysics*
- *Statistical and Biological Physics*
- *Astroparticle and Particle Physics*
- *Biological and Medical Physics*
- *Experiment Design and Implementation*
- *Experimental Gravitation and Cosmology*
- *Nanophotonics*
- *Physics and Chemistry for Energy and the Environment*
- *Physics of Complex Systems*
- *Physical Science Communication and Teaching Methods*

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

Suggested study plans will be published on the website; the student can choose a different and personalized study plan, following the rules of the Didactic Regulation.

2. ADMISSION REQUIREMENTS

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

a) curricular requirements:

- I. Bachelor degree lasting at least three years, or equivalent
- II. a total number of 84 ECTS in Mathematics and Physics (MAT/* + FIS/*), of which at least 24 ECTS in the area of Mathematics (MAT/*) and at least 54 ECTS in the area of Physics (FIS/*).

b) an adequate personal qualification, including knowledge of English at level B2, 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 November 2020. 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.

The knowledge of english at level B2 is verified by presenting international certificates, or by passing an exam at the home university.

3. COURSE STRUCTURE

The academic calendar will be published on the website as soon as possible.

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

MANDATORY CORE COURSES (TAF B)							
Year	Code	module	Tuition hours	ECTS	SSD	Term	Lecturer
1	145164	Experimental Methods	56 totali, di cui 42 ore di lezione 14 ore esercitazioni	6	FIS/01	I	Stefano Vitale
1	145644	Quantum Mechanics, Fields and Symmetries	56 totali, di cui 42 ore di lezione 14 ore esercitazioni	6	FIS/02	I	Winfried Leidemann

Besides these two mandatory core lecture courses, graduates choose five options from the list below for a total number of 42 ECTS. The choice must include:

- 1 module belonging to the so called SSD FIS/02,
- 3 modules belonging to FIS/03 and/or FIS/04.
- 1 module not yet selected among the list of core modules

Graduates can take other core modules in the list – which have not been selected among the required 5 by choosing them as elective.

ELECTIVE CORE COURSES (TAF B)							
Year	Code	Module	Tuition hours	ECTS	SSD	Term	Lecturer
1	145648	Experimental Physics	60 totali, di cui 12 ore di lezione 48 ore esercitazioni	6	FIS/01	II	Mario Scotoni
1	145646	Quantum Field Theory I	56	6	FIS/02	I	Albino Perego
1	145177	Statistical Mechanics	60 totali, di cui 32 ore di lezione 24 ore esercitazioni	6	FIS/02	I	Raffaello Potestio
1	145649	Computational Physics	48	6	FIS/02	II	Francesco Pederiva
1	145653	Solid State Physics I	48	6	FIS/03	I	Giacomo Baldi
1	145511	Atomic Physics	48	6	FIS/03	I	Gabriele Ferrari
1	145854	Condensed matter theory	48	6	FIS/03	II	Matteo Calandra Buonauro
1	145645	Nuclear and Subnuclear Physics	48	6	FIS/04	II	Winfried Leidemann
1	145651	Quantum Theories for Multiparticle Systems	48	6	FIS/04	II	Giuseppina Orlandini
1	145775	Astroparticle Physics	48	6	FIS/04	II	Roberto Battiston
2	145660	Fundamental Interactions	48	6	FIS/04	I	Roberto Iuppa

3.b Elective integrative courses

Besides the mandatory and elective core modules, students shall obtain other 24 ECTS, i.e. 4 modules among the integrative elective courses in the following SSD: FIS/*, MAT/06, MAT/07, CHIM/03, CHIM/06, BIO/10.

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 (<https://offertaformativa.unitn.it/en/lm/physics/courses-hours-examinations>).

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	Note	Tuition hours	ECTS	SSD	Term	Lecturer
1	145338	Bio-Medical Imaging	---	48	6	FIS/07	II	Albrecht Haase
1	145169	Nuclear Astrophysics	---	48	6	FIS/04	II	Francesco Pederiva

1	145171	Optoelectronics	---	48	6	FIS/01	II	Lorenzo Pavesi
1	145175	Quantum Optics	---	48	6	FIS/01	II	Iacopo Carusotto
1	145887	Quantum gases, superfluidity and superconductivity	---	48	6	FIS/03	II	Stefano Giorgini
1	145888	Radiation: detection and applications	---	48	6	FIS/07	II	Chiara La Tessa
1	145889	Multi-scale methods in soft matter physics	---	48	6	FIS/03	II	Raffaello Potestio
2	145224	General Relativity and Cosmology	Proped: Relatività	48	6	FIS/02	II	Massimiliano Rinaldi
2	145282	Photonics	---	48	6	FIS/01	I	Stefano Azzini
2	145890	Physics and Chemistry of Materials	---	48	6	FIS/03	I	Michele Orlandi
2	145235	Molecular and Cellular Biophysics	---	48	6	BIO/10	I	Marina Scarpa
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/02	II	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	Leonardo Ricci
2	145231	Laboratory of Condensed Matter	---	56	6	FIS/01	I	Marco Zanatta
2	145891	Medical Biophysics	---	48	6	FIS/07	II	Francesco Tommasino
1 o 2	145948	Quantum Computing	---	56	6	FIS/03	II	Philipp Hauke
1	145892	Gravitational Wave Astronomy and Multimessenger Observations	---	48	6	FIS/05	II	Giovanni Andrea Prodi
1	145893	Ultracold Atoms	---	48	6	FIS/03	II	Giacomo Lamporesi
1	145894	Experimental Techniques in Nuclear and Subnuclear Physics	---	56	6	FIS/04	II	Francesco Nozzoli
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)	Proped.: <i>Exp. Phys. Lab. High School I</i>	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)	in italiano	60	6	FIS/06	I	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)	in italiano	60	6	FIS/06	I	Lorenzo Giovannini
1 o 2	145605	Renewable Energy and Meteorology (mut. dal corso LM Ingegneria Energetica 0337H cod. 140511)	---	60	6	FIS/06	II	Lorenzo Giovannini
1 o 2	140531	Introduction to meteorology and climatology (mut. dal corso LM Environmental Meteorology)	---	60	6	FIS/06	I	Simona Bordoni
1 o 2	145734	Air pollution modelling (mut. dal corso LM Environmental Meteorology 0341H cod. 140585)	---	60	6	FIS/06	II	Andrea Bisignano
2	145546	Computational Biophysics (mutuato dal Corso di Laurea Magistrale in Quantitative and Computational Biology) Mod. Physical Modelling in Biomolecules Mod. Computer simulations of Biomolecules	---	96	12	FIS/02 e FIS/03	I	Gianluca Lattanzi e Luca Tubiana

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.c Language Knowledge

3 ECTS: foreign students have to acquire competencies in italian language: 140189 – Prova di conoscenza lingua italiana (A1)

Italian students have to acquire competencies in scientific English or in another language of the European Union:

145852 – Scientific Writing and Presentations in English (B2a)

145328 – Ulteriori conoscenze linguistiche (inglese C1)

145582 – Ulteriori conoscenze linguistiche (lingua tedesca B2)

145584 – Ulteriori conoscenze linguistiche (lingua spagnola B2)

145583 – Ulteriori conoscenze linguistiche (lingua francese B2)

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 of the study 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 2020. Study plan submission deadlines will be available at <https://offertaformativa.unitn.it/en/lm/physics/courses-hours-examinations>.

Study plans suggested by the research groups of the Physics Department (available on the website) will be automatically approved. Otherwise they need to be motivated and submitted to the approval of the Didactic Committee.

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 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 <https://offertaformativa.unitn.it/en/lm/physics/graduation> 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" (<https://offertaformativa.unitn.it/en/lm/physics/graduation>).

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 2020/2021 and the Regolamento del corso di laurea magistrale in Fisica, available at the following website:

<https://offertaformativa.unitn.it/en/lm/physics/rules-and-regulations>

8. STUDENTS OF SECOND YEAR (ENROLLED IN A.Y. 2019-20)

Students of the second year (enrolled in a.y. 2019-20) follow the previous regulation. Their course consists of:

- 3 mandatory core courses, followed in the first year (18 ECTS)
- 4 elective core courses (24 ECTS), of which: 1 of SSD FIS/02 and 3 of SSD FIS/03 e FIS/04.
- Other 4 elective integrative courses (24 ECTS), students are encouraged to follow the indications given by the research groups.
- 12 ECTS at free choice
- Final exam: consists of the defense of a written thesis corresponding to 39 ECTS. During the final exam will be also acquire 3 ECTS for english language knowledge.