UNIVERSITÀ DEGLI STUDI DI FERRARA

Master School in Physics

SCHOOL REGULATIONS and PROGRAM
ACADEMIC YEAR 2012-2013
(Applications Fall 2012)

Web site	**http://www.unife.it/science/master-degree-physics**
Course President	Prof. Raffaele Tripiccione, e-mail **tripiccione@fe.infn.it**
Course Manager	Dr.ssa Elisa Marchetti **elisa.marchetti@unife.it**
Secretariat	Via Savonarola, 9 **segreteria.scienze@unife.it** Tel. +39-0532.293303 **http://www.unife.it/studenti/offerta-formativa/orari-e-recapiti**
Deadlines	**Applications before October 1st, 2012** For more informations: http://www.unife.it/studenti/immatricolazioni-e-iscrizioni/immatricolazione-a-corsi-di-laurea-magistrale-non-a-ciclo-unico **Registration before March 31st, 2013**
Vacations: Christmas	From December 23rd, 2012 to January 6th, 2013 (included)
Vacations: Easter	From Thursday before Easters' day to Wednesday after Easters' day (included)

Note: In the Academic Year 2012-2013 the new two-year course of Laurea Magistrale in PHYSICS is started.

APPLICATION	FREE APPLICATIONS. The CCS (Consiglio del Corso di Studi, i.e. the body of the teachers) will **evaluate the degrees and also the scientific background** of each applicant, to make sure that it matches the level of the course. If assessment is positive, the applicants can register.
TEACHING AND ATTENDANCE	"IN PRESENZA" The "Corso di laurea" teaching is based on standard lectures to the student audience. Students are required to attend laboratory courses: a maximum absence to 1/3 of lectures/activities is tolerated.
SCHOOL LENGTH	TWO YEARS

GOALS AND PROGRAM	The goal of the Master School in Physics is a strengthening in the mastery of classical and modern Physics, as well as of the scientific method, together with a solid scientific and operative preparation in the chosen specialization field. These goals require adequate skills in the handling of mathematical and computing tools and techniques, and also familiarity with modern instrumentation and advanced data analysis. With these objectives, the Master in Physics is structured in a first part in which the basic facts learnt in the first three-year School are thoroughly investigated, especially in the subjects of Mathematics, Electromagnetism, Quantum Mechanics and its applications, and Scattering theory; and in a second part in which the taught courses are in the fields of research and activity of our Department. The school activity then turns into the study of the frontier developments, both theoretical and experimental, of the chosen research domain, also with up to date experimental and data analysis techniques. This 2-year route ends with the final test, a real research autonomously executed, original, which can be carried either in the University labs or in Research Centers or in private enterprises.
Professional Career prospects	Career prospects with a "Laurea Magistrale" LM in Physics, i.e. 2 further years of study beyond LT (three-years school) This 2-year specialization school aims at preparing graduates with deeper and advanced knowledge in theoretical and experimental Physics, together with a specialized expertise in the chosen field. The student of such school, i.e. an LT graduate, will be able after completion to: -- upgrade her/his education with PhD studies -- access to research jobs both in Universities and in research Institutions -- take up R&D careers in private firms -- teach science in high schools and Universities. In the Italian public administration, a LM graduate can be hired as: 2.1.1.1.1 Physicist 2.1.1.1.2 Astronomer and Astrophysicist 2.2.2.5.3 Geophysicist 2.1.1.5.4 Meteorologist 2.3.1.1.3 Biophysicist 2.6.2.0.1 Researcher and Graduate technician in Physical Sciences
DEGREE FOR REGISTRATION	A sufficient requirement for acceptance is possession of Italian Laurea or three-year Diploma Universitario in Physics, **as well as any other degree obtained abroad, which is evaluated to be equivalent by this University CCS.**
DEADLINES FOR APPLICATION AND FOR REGISTRATION	**Application must be submitted no later than OCTOBER 1st, 2012.** **The document list and required payment (100 Euro) is indicated in:** **http://www.unife.it/studenti/immatricolazioni-e-iscrizioni/immatricolazione-a-corsi-di-laurea-magistrale-non-a-ciclo-unico** **Registration deadline is MARCH 31st, 2013.**
SCIENTIFIC BACKGROUND REQUIRED FOR ACCEPTANCE	Scientific background assumed in the course includes: – Good practical knowledge of Calculus, Geometry and Algebra. – Basic notions of Chemistry. – Good understanding of basical Classical Mechanics, Thermodynamics, Electromagnetism and Optics. – Familiarity of experimentation and its techniques; basic electronics. – Knowledge of the main theories in Classical and Modern Physics, Special Relativity, Quantum Mechanics and relative mathematical methods, and elements of Statistical Mechanics. – Sufficient mastership of the English language to understand Physics textbooks in English and lectures in English. – Computing skills : ability to use existing scientific programs. – Ability to understand and solve (or at least know how can be solved) Physics problems.
THE ASSESSMENT OF THE PHYSICS BACKGROUND.	The evaluation of the applicant's qualifications and Physics background will be done by an Evaluation Committee appointed by the CCS, via an **Admission interview** on the basic knowledge requested and the applicant's own motivation and interests, in order to determine: 1. Acceptance of the applicants for registration .

	2. Structure of courses avoiding repetition of already known subjects and considering the applicant's own interests. **First evaluation: 12th October 2012 hour 3PM at Physics Department Building C - Scientific-Technological Campus, via Saragat, 1, 44122 – Ferrara – ITALY.**
CALENDAR OF LECTURES	The Course teaching year is structured in two semesters, each followed by two exam sessions. During exam sessions there are no lectures. The calendar of lectures and exams is as follows: **1° Semester** lectures September 24th, 2012 – January 18th, 2013 exams January 21st, 2013 – February 22nd, 2013 **2° Semester** lectures February 25th, 2013 – June 7th, 2013 esami June 10th, 2013 – July 31st, 2013 **"Second Chance" exams** September 1st, 2013 – September 27th, 2013

Course structure and regulation

The Laurea Magistrale LM in Physics is normally obtained in 2 years after having acquired 120 credits. A student who has obtained the 120 credits required by the curriculum can attain the LM even before completing the two years of the school.

Types of courses	**B = Basic** B1 – Experimental and practical applications B2 – Theoretical and on the fundamentals of Physics B3 – Microphysics and the Structure of matter. B4 – Astrophysics, Geophysics and Space Physics. **C = Related or supplementary** **D** = **Optional** (Student's choice) **E1** = **Foreign language** **E2 = Preparation of the final exam.** **F** = any study, work or experimental activity, not included in the previous classification, to improve abilities in languages, computing, networking, or anything aimed at future career prospects and the choice of a profession with a direct knowledge of the chosen field via, e.g., stages..
NOTE: In the following SSD will stand for: Dydactic Sector, ie course category in the Italian classification	

The teaching of the LM is done entirely in English

First course Year

Note: for every course the corresponding exam must be passed

Semester	Course	SSD	Course type	Total credits	Theory type credits	Lab or stage or skill credits	Lectures HOURS	Teacher
I	**Mathematical Methods of Physics** *(Metodi Matematici della Fisica)*	FIS/02	B2	**6**	6	0	48	Titarchuck L.
	Quantum Mechanics *(Meccanica Quantistica)*	FIS/02	B2	**6**	6	0	48	Moretti M.
	Solid state physics *(Fisica dello stato solido)*	FIS/03	B3	**6**	6	0	48	Spizzo F.
II	**Scattering Theory** *(Teoria dello scattering)*	FIS/02	B2	**6**	6	0	48	Drago A.
	Elements of subnuclear physics *(Elementi di Fisica delle particelle elementari)*	FIS/04	B3	**6**	6	0	48	Bettoni (INFN Researcher)
	Advanced Electromagnetism *(Complementi di Elettromagnetismo)*	FIS/01	B1	**6**	6	0	48	Piemontese L. (Contract)

To meet the 60 CFUs (credits) requirement for the 1st year, the 24 missing CFUs can be chosen between:

- **12 CFU** chosen from basic courses belonging to SSD FIS/01 in **Table I**

and

(Option 1)* - **6 CFU** chosen from basic courses belonging to SSD FIS/02-03-04-05-07 in one only of **Tables IIA-IIE and** a free choice course (**type D**), corresponding to **6 CFU**

or

(Option 2)* - **12 CFU** chosen from basic courses belonging to SSD FIS/02-03-04-05-07 in one only of **Tables IIA-IIE**

(*) The same option must be chosen in both years.

Second Course Year

Semester	Course	SSD	Activity type	Total credits	Theory type credits	Lab or stage or skill credits	Lectures HOURS	Teacher
I/II	**Activity type: F**		F	**3**				
	Preparation of thesis and Final test			**45**				

To meet the 60 CFUs (credits) requirement for the 2nd year, the 12 missing CFUs can be chosen between:

(Option 1)* - **6 CFU** chosen from basic courses belonging to SSD FIS/02-03-04-05-07 in the same **Table IIA-IIE as the one chosen in the first year and** a free choice course (**type D**), corresponding to **6 CFU**

or

(Option 2)* - free choice course (**type D**), for a total of **12 CFU**

(*) The same option must be chosen in both years.

Table I

Nota: for every course the corresponding exam must be passed

Semester	Course	SSD	Course type	Total credits	Theory type credits	Lab or stage or skill credits	Lectures HOURS	Teacher
I/II sem 1 anno	**High Energy Physics Laboratory** *(Laboratorio di fisica delle alte energie)*	FIS/01	B1	**12**	6	6	120	To define
I/1	**Physics of complex systems and laboratory** *(Laboratorio di fisica dei sistemi complessi)*	FIS/01	B1	**6**	3	3	60	R. Tripiccione
II/1	**Relativity** *(Relatività)*	FIS/01	B1	**6**	6	0	48	P. Natoli
II/1	**Electron microscopy: theory and applications** *(Microscopie elettroniche: teoria e applicazioni)*	FIS/01	B1	**6**	3	3	60	D. Vincenzi
II/1	**Semiconductor physics laboratory** *(Laboratorio di fisica dei semiconduttori)*	FIS/01	B1	**6**	3	3	60	V. Guidi
II/1	**Measures and Observation of Celestial X and Gamma Rays** *(Misure e osservazioni di raggi X e gamma celesti)*	FIS/01	B1	**6**	3	3	60	Contract
I/1	**Microwave celestial measures and observations** *(Misure e osservazioni celesti a microonde)*	FIS/01	B1	**6**	6	0	48	Contract
II/1	**Sensors: Physics and Technology** *(Sensori: fisica e tecnologia)*	FIS/01	B1	**6**	6	0	48	C. Malagù

Table II A

Nota: for every course the corresponding exam must be passed

Semester	Course	SSD	Course type	Total credits	Theory type credits	Lab or stage or skill credits	Lectures HOURS	Teacher
I/2	**Applications of Quantum Field Theory** *(Applicazioni della teoria dei campi)*	FIS/02	C	**6**	6	0	48	R. Tripiccione
II/1	**Elements of Quantum Field Theory** *(Introduzione alla teoria dei campi)*	FIS/02	C	**6**	6	0	48	M. Moretti

Table II B

Nota: for every course the corresponding exam must be passed

Semester	Course	SSD	Course type	Total credits	Theory type credits	Lab or stage or skill credits	Lectures HOURS	Teacher
I/1	**Physics of critical phenomena** *(Fisica dei fenomeni critici)*	FIS/03	C	**6**	6	0	48	Contract
II/1	**Magnetic Properties of Matter and Laboratory** *(Proprietà magnetiche della materia e laboratorio)*	FIS/03	C	**6**	3	3	60	P. Vavassori
II/1	**Surface physics and nanostructures** *(Fisica delle superfici e nanostrutture)*	FIS/03	C	**6**	6	0	48	Contract

Table II C

Nota: for every course the corresponding exam must be passed

Semester	Course	SSD	Course type	Total credits	Theory type credits	Lab or stage or skill credits	Lectures HOURS	Teacher
I/2	**Phenomenology of strong interactions** *(Fenomenologia delle interazioni forti)*	FIS/04	C	**6**	6	0	48	Bettoni (INFN Researcher)
II/1	**Nuclear and subnuclear astrophysics** *(Astrofisica Nucleare e Subnucleare)*	FIS/04	C	**6**	6	0	48	G. Fiorentini
I/2	**Nuclear physics** *(Fisica Nucleare)*	FIS/04	C	**6**	6	0	48	A. Drago
II/2	**Phenomenology of electroweak interactions** *(Fenomenologia delle interazioni elettrodeboli)*	FIS/04	C	**6**	6	0	48	Bozzi (INFN Researcher)

Table II D

Nota: for every course the corresponding exam must be passed

Semester	Course	SSD	Course type	Total credits	Theory type credits	Lab or stage or skill credits	Lectures HOURS	Teacher
I/2	**Physical cosmology** *(Cosmologia)*	FIS/05	C	**6**	6	0	48	A. Dolgov (Contract)
II/1	**High energy astrophysics** *(Astrofisica delle alte energie)*	FIS/05	C	**6**	6	0	48	L. Titarchuk

Table II E

Nota: for every course the corresponding exam must be passed

Semester	Course	SSD	Course type	Total credits	Theory type credits	Lab or stage or skill credits	Lectures HOURS	Teacher
I/2	**Medical physics laboratory** *(Laboratorio di fisica medica)*	FIS/07	C	**6**	3	3	60	G. Di Domenico
II/1	**Radioactivity and dosimetry** *(Radioattività e dosimetria)*	FIS/07	C	**6**	6	0	48	M. Marziani
II/1	**Medical physics** *(Fisica medica)*	FIS/07	C	**6**	6	0	48	M. Gambaccini

The student can get **12 type D CFUs (Free choice activities)** by making his/her choice from related courses given in the Faculty OR from courses in other disciplines considered in the LM school in Physics or from other courses in the Triennale (basic) or Magistrale Laurea in this University , as long as they are coherent with the educational goals of the Laurea Magistrale School.

Free choice activities (Type D)

The choice of the "free" activities must be submitted to the CCS not later than **November 30th, 2012**. The choice shall be made **on-line** from the student's web page, which can be accessed from the site: **http://studiare.unife.it.**
NOTE that it is not possible to choose only parts ("modules") of integrated multimodule courses (and exams). Students are also invited to choose courses taught in the Physics curriculum.
In the A.Y 2012-13 the CCS Magistrale in Fisica will provide also the following course:

Semester	Course	SSD	Act.	Credits	Type	Teacher
I	**Introduction to biophysics** *(Introduzione alla biofisica)*	BIO/09	D	6	T	G. Rispoli

Related courses and activities: stage, skill, lab or other

The **3 credits of type F** for learning activities aimed at improving/acquiring further language skills, computing/networking capabilities and at preparation for a job via internships in Universities or stages in non-University organizations can be earned as explained in the following Table:

	Course / Activity	**Foreign language, computing, job**	***SSD***	***Credits Max***
F1	Advanced English	Foreign language	L/LIN 06	**3** per certified course
F2	Stages of professional training in firms or non-University Research Centers.	Job		**3**
F3	Internships in Italian or foreign labs or Research Centers connected to Universities.	Job		**3**
F4	Credits from courses on computing and networking skills (P. Ex. Advanced ECDL certification; or, advanced courses on computing).	Computing	INF/01	3 per certified course

The practical organization of stages and internships will be made by the CCS, who will also evaluate the credits earned, keeping in mind that a month of full time work is worth six credits.

The acknowledgement of activities F1 and F4 must be requested by the student at the Student Secretariat, and they all must be approved by the CCS as part of the student's curriculum.
For activities of type F2 (always) and F3 (only for internships in Universities other than Ferrara) the student must prepare beforehand, together with the Didactic Manager, the plan of her/his activities.
For each of these activities, when not made in the University of Ferrara, beside the official tutor of the student another tutor will be appointed, chosen between the members of the host Institution.
The tutor will record in the students' on-line exam history, all the "F" earned credits in a single operation, which will happen during the 2nd course year.

Course priorities	No course in this program is preliminary to any other.
Course/exam priorities	No priorities in the exams.
Final exam	As a preparation to the thesis, the student will start an independent activity involving research and critical overview of an advanced topic, upgrading his/her knowledge and skills acquired during the Master Degree in Physics and choosing the most appropriate methods and techniques. The selection of the thesis topic and the research activity will be performed in collaboration and under the supervision of a **tutor** chosen by the student: the name of the tutor and the **title** of the thesis (that has to briefly summarize the topic the thesis work deals with) have to be approved, at least one month before the thesis discussion, by the Consiglio del Corso di Studi (CCS). Within the same deadline the Consiglio del Corso di Studi (CCS), on request by the supervisor, nominates a **referee**. Students admitted in the academic year 2011-2012 and onwards must write and present their thesis in **English**.

	The final exam is evaluated **45 credits**, and consists in the public discussion of the thesis. The examination committee evaluates the scientific background of the candidate on the basis of the results obtained and presented in the thesis, and of the curriculum of studies. The thesis is graded up to 110, with the possibility in outstanding cases of a "cum laude attribute. The grade is computed by adding to the weighted mean of the votes in all exams an additional grade (**up to 8 points**), for the thesis work, with the result capped at 110. The addition "**cum laude**" can only be assigned by unanimous decision of the Thesis Committee when the weighted average of all exams is higher than **103**.
P.I.L. / **Professional training**	All students who have completed the 1st year have the possibility to join the experimental project "Percorsi di Inserimento Lavorativo" (PIL). The program of PIL consists of a period of courses (from October to December) followed by a selection/matching with the available jobs (January). A stage in a firm will follow (February to April) and then, when foreseen, a 12 months job contract. The educational phase will be properly certified and the whole stage period will be attested with credits assigned to the individual study plan.
Curricula with different lengths	The Master in Physics is normally obtained in two years of study, equivalent to the achievement of 120 credits. A student can achieve the degree agreeing on an educational period of different length, within the limits on courses and activities described before. A student who does not want to follow the normal plan can choose: An **educational route longer than normal**, registering to a semester only or to individual courses. If a student chooses this option, and while he is in the school the plan of courses were modified, the student shall adapt to the new didactic plan, after an evaluation of the CDS. An **educational route shorter than normal** (but of at least one year), obtained by anticipating to the first year the trainings and other educational activities normally done during the second year. A proposal must be submitted to the CDS who will make decision on the proposal either by straight approval or by discussing it with the proponent and agreeing on some modifications. In case the official educational route is modified, students with a route longer than normal will be directed to the new plan for the years still missing it the courses in their plan were no longer available. The CCS will consider already done activity and decide on the next route and on the acknowledgement of already achieved credits.
Recognition and acceptance of foreign degrees	The Recognition of a University degree (bachelor) obtained abroad – for admission to the LM - is decided by the CCS after examination of a request furnished with the list of exams passed and the relative programs. For any information of administrative nature please contact the "**Ufficio Mobilità internazionale e studenti stranieri**" (Office for foreign students and international mobility)– Via Savonarola, 9 – e-mail: mob_int@unife.it
Validation of passed exams	Any request of validation of exams must be submitted to the students Secretariat, in via Savonarola 9, in order to be passed on to the CCS.
Transfer of students from other Universities	In case of students from another laurea from Ferrara University, or of transfer from another University Italian or from the EU, the CCS will examine the previous University career, determine the further development if possible at all, and decide about recognition of already achieved credits after having established the equivalence or affinity of the courses.. The requested level in Physics for being accepted in the School is of course not modified by this procedure of course recognition. For each mandatory subject the obtained credits are recognized within the limit of the credits achieved with the equivalent course at Ferrara. The extra credits are recognized, on request, for optional courses and free choice activities**.**
Useful contacts and Web site for other informations	For other questions please contact: **Official web site:** http://www.unife.it/science/master-degree-physics **Official regulations**: http://www.unife.it/ateneo/organi-universitari/statuto-e-regolamenti/statuto-e-regolamenti

Ferrara, July 2012

Prof. Raffaele Tripiccione
Chair of the Consiglio del Corso di Studi (CCS)