













PHYSICS	
CYCLE	XXXVIII
COORDINATOR	Prof. Stefano CARRETTA email: stefano.carretta@unipr.it Department of Mathematical, Physical and Computer Sciences
DURATION	3 years
STARTING DATE OF THE PHD PROGRAM	01/11/2022
RESEARCH TOPICS (The candidate MUST mandatorily indicate one research topic in the form ANNEX A and submit a RESEARCH PROJECT in the relevant field)	
<ul style="list-style-type: none">• Spectroscopic characterization of minerals interesting for the environmental sciences• Computational and theoretical models of single neuron dynamics and collective dynamical regimes of neuronal activity in non-human primates (<i>Bound research topic</i>)• Molecular spins for Quantum Technologies beyond the qubit encoding (<i>Bound research topic</i>)• Methods to find the super-spreaders in complex networks• Emulsion Dynamics on Earth and in Microgravity• Gauge Theories and Holography at the Crossroads• Precision tests of fundamental physics from the Large Scale Structure of the Universe (<i>Bound research topic</i>)• Artificial intelligence models: development and application on in vivo X-ray imaging in drug discovery (<i>Bound research topic</i>)• Nonlinear evolution in open many-body quantum systems	
TRAINING OBJECTIVES	
<p>The PhD in Physics, with a duration of 3 years, is established as a unifying element of the third-level University education in the Physics area. Besides their main commitment to the research activity, students are supposed to spend a substantial part of their training period in attending advanced courses as well as national and international schools. Students are encouraged to spend part of their time abroad, in order to participate in scientific collaborations in their fields of interest, and follow advanced courses in support of their research program. During the three years, teaching commitments are progressively reduced towards a full time engagement in the research activity. The evaluation of the training program is carried out - at the end of each year - through open seminars held by the students. The independent scientific research is expected to lead to publication of results in international, peer reviewed journals. The ultimate goal of the PhD in Physics is a highly specialized scientific training that opens professional carriers in academic institutions and research laboratories, either public or private. The PhD in Physics is divided into three areas corresponding to major groups of disciplines of Physical Sciences covered by the research activity of the Department of Mathematical, Physical and Computer Sciences: Condensed Matter and Materials Physics, Theoretical Physics, Biophysics and Applied Physics.</p>	
ADMISSION REQUIREMENTS	<p>Regardless of age and citizenship, applicants holding at least one of the following academic qualifications can apply for admission:</p> <ul style="list-style-type: none">– Laurea specialistica or Laurea magistrale (second cycle master's degree)– Laurea Vecchio Ordinamento (degree obtained under the previous Italian regulations);– Second cycle Master's degree obtained abroad, equivalent to the above mentioned Italian degrees and recognized as suitable for the admission to doctoral program <p>Undergraduates can also apply for admission to the selection, with the obligation to obtain the degree within the deadline set for enrollment, that is by 24.10.2022</p>

POSITIONS PUT OUT TO COMPETITION	9	With Scholarship	9
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Position with Scholarship		
N°	Funding entity	Research Topic, if any
3	Scholarship funded by University of Parma (Ministerial funds)	---
1	Scholarship co-funded by Fondazione Cariparma	---
Position with Scholarship LINKED TO SPECIFIC TOPICS (art. 11 of the Competition notice)		
During the Oral Exam, applicants may express and/or confirm their interest of being assigned a scholarship linked to a specific research topic. The Examination Board will evaluate their eligibility based on specific competences, experience and specific aptitudes of the applicants.		
N°	Funding entity	BOUND RESEARCH TOPIC
1	Scholarship partly financed with UNIVERSITY funds and co-financed by the Department of Medicine and Surgery (Project ERC CoG "EMACTIVE")  <small>European Research Council Established by the European Commission</small>	<ul style="list-style-type: none"> Computational and theoretical models of single neuron dynamics and collective dynamical regimes of neuronal activity in non-human primates
1	Scholarship funded by INFN – The Italian National Institute for Nuclear Physics	<ul style="list-style-type: none"> Precision tests of fundamental physics from the Large Scale Structure of the Universe
1	Scholarship financed with funds under the PNRR– Mission 4 component 1 (Ministerial Decree 351/2022 art. 7 “PNRR Research”)  Finanziato dall’Unione europea NextGenerationEU  	<ul style="list-style-type: none"> Molecular spins for Quantum Technologies beyond the qubit encoding
1	Scholarship co-financed with funds under the PNRR - Mission 4 component 2 (Ministerial Decree 352/2022) and co-financed by the Company Chiesi Farmaceutici S.p.A.  Finanziato dall’Unione europea NextGenerationEU  	<ul style="list-style-type: none"> Artificial intelligence models: development and application on in vivo X-ray imaging in drug discovery
1	Scholarship financed under the PNRR – Mission 4 component 2 – Investment 1.4 NATIONAL CENTER for sustainable mobility  Finanziato dall’Unione europea NextGenerationEU  	<ul style="list-style-type: none"> Inference and reconstruction of mobility temporal networks and mobility flows in urban areas Temporal complex networks represent an ideal field of research for the study of interacting social systems within cities and collaborative environments and are used to effectively monitor the evolution of communities, movement and interaction with the environment and services. The proposed research project is embedded in this research area and is developed within the National Center for Sustainable Mobility activities funded by PNRR projects. In this project, theoretical and numerical models will be developed for mobility flows and patterns of aggregation and higher order interaction within urban areas and the University Campus of Parma, exploiting data from multiple sources. The aim is to develop effective modelling for the generation of sustainable and inclusive mobility scenarios



ADMISSION PROCEDURES		Assessment of QUALIFICATIONS: up to 50 points (a minimum score of 20 points shall be required to be admitted to the Oral Exam) ORAL EXAM: up to 70 points Minimum score for ELIGIBILITY: 70/120
Foreign Language	Language the fluency of which shall be assessed during the Oral Exam: ENGLISH .	
APPLICANTS ADMITTED TO THE ORAL EXAM CAN TAKE IT EITHER IN PRESENCE OR REMOTELY IN AUDIO AND VIDEO TELECONFERENCE (Applicants who intend to take the Oral Exam remotely must submit a formal request, using the form attached to the competition notice)		
THE INTERVIEW MAY BE HELD ALSO IN ENGLISH		
LIST OF QUALIFICATIONS TO BE SUBMITTED AND THEIR ASSESSMENT		
MANDATORY DOCUMENTS TO BE ATTACHED TO THE ON-LINE APPLICATION		
ANNEX A	(art. 5 of the Competition notice)	
Identification Document	Scanned Copy of a valid identity document with photo (i.e. identity card, passport)	
Curriculum Vitae et studiorum	No specific CV format is required (see art. 4 of the Competition notice)	
Abstract of degree thesis	Abstract of the second cycle master's degree thesis. Undergraduate applicants must submit the draft of the thesis countersigned by their supervisor.	
Qualifications	Certificates and academic transcript of records for both Bachelor' and Master' degrees containing the following details for each degree held: (art. 4 of the Competition notice): University that granted the degree - Type of degree (first cycle/second cycle/single cycle) Name of the degree program - Date of graduation - Final mark - List of exams and corresponding scores (academic transcript of records) - Translation into Italian or English (only for degrees issued in languages other than Italian or English).	
Research Project and Statement of Research interest	A brief text (max 3 pages) in English. The candidates must describe their research interests and indicate the preferred topic among those listed above, possibly suggesting a second choice theme. For the first choice theme, candidates must outlay an original research project including a concise state of the art, the relevance of the problem and the expected results. Candidates are warmly invited to contact the potential supervisors listed at http://smfi.unipr.it/it It <u>does not represent a constraint with respect to the following choice of the doctoral thesis</u> , that shall be defined together with the supervisor and approved by the Academic Board.	
FURTHER QUALIFICATIONS THAT MAY BE ATTACHED TO THE APPLICATION, IF IN POSSESSION OF THE APPLICANT (only qualifications attested by a document drawn up in Italian or in English)		
Other qualifications	Any other document certifying the applicant's training and abilities. Publications, awards, presentations to scientific meeting, stages, fellowships, reference letters, etc	
EVALUATION CRITERIA		
QUALIFICATION	EVALUTATION CRITERIA	POINTS
Curriculum Vitae et studiorum	Including academic career and postgraduate experience, accompanied by a statutory declaration in lieu of the certification of the exams passed with the relevant marks, as well as the final graduation mark.	Up to 25 points



Graduation thesis	Consistency of the Master' Degree thesis with the doctoral program research topics. The assessment will make use of the information contained in the abstract (max 1 page) of the thesis (although not yet discussed, in this case countersigned by the thesis supervisor) and in the curriculum, where a brief description of the thesis work should be reported.	Up to 5 points
Research Project and Statement of Research Interest	The project will be evaluated in relation to its scientific value and originality. The motivation expressed by the candidate in relation to the themes of the research doctorate will be evaluated	Up to 10 points
Other qualifications	Publications, awards, presentations to scientific meeting, stages, fellowships, reference letters, etc	Up to 10 points
ORAL EXAM	EVALUATION CRITERIA	POINTS
The ORAL EXAM includes the presentation of the research project and is intended to assess the suitability of the applicant to pursue scientific research as well as the general knowledge of issues connected to the PhD course	<ul style="list-style-type: none"> ○ preparation on the issues related to the Master's degree thesis ○ research project presentation ○ general knowledge of issues connected to the PhD course ○ knowledge of the foreign language 	Up to 70 points
SCHEDULE OF THE ADMISSION EXAMS		
ORAL EXAM	DATE	15 September 2022 (with possible extension in the following days)
	TIME	10:00 AM (Italian time) The schedule of oral examinations will appear at http://smfi.unipr.it/it
	PLACE	Department of Mathematical, Physical and Computer Sciences PHYSICS BUILDING Parco Area delle Scienze, 7/A – Campus 43124 PARMA - ITALY
OTHER INFORMATION	<p>The Oral Exam will focus on the description of the research work carried out to prepare the Graduation Thesis for the Laurea Magistrale/Specialistica, as well as on the research project that the candidate proposes to carry out within the research topics of the Research Doctorate Program in Physics at the Department of Mathematical, Physical and Computer Sciences of the University of Parma which are described at http://smfi.unipr.it/it</p> <p>In the application to participate in the competitive examination, the candidate must choose and specify one research topic. The candidate may indicate a second priority choice.</p> <p>For foreign candidates, the admission examinations may be held in English at the candidate's choice.</p>	