



PHYSICS

PHD PROGRAMS



POLITECNICO
MILANO 1863

**MILANO
LEONARDO
CAMPUS**

Programme

The PhD Programme in Physics provides a strong interdisciplinary education in applied Physics and Engineering methodologies. It consists of courses and of the development of the PhD thesis. The courses are both on topics specifically characterizing the PhD Programme and on transdisciplinary topics of general interest (20 credits overall, typically offered at Campus Leonardo). The development of the PhD thesis represents the major student's activity (160 credits) and includes experimental research work and training activities on selected research topics in the following areas: Ultrafast optics and spectroscopy; Solid state lasers and photonic devices; Photonics for health, food and cultural heritage; Epitaxial growth and nanostructure fabrication; Electronic, optical and magnetic properties of low-dimensional systems.

Mission and goals

The PhD Course is characterized by a strong experimental character. It aims at providing high scientific education and training to develop general research abilities in all areas of applied physics, as increasingly needed by advanced technological companies. The education contents are strictly related to the research activities carried out in the advanced experimental laboratories at the Department of Physics (Milano-Leonardo Campus and Como Campus). All research activities are performed in collaboration with high level international institutions (e.g., University of Cambridge, Massachusetts Institute of Technology, Stanford University, University College London, Harvard University). Besides experimental basic research, consistent effort is devoted to the design and development of innovative instrumentation.

PhD education can be attained in the following main areas, where the Department of Physics is active:

i) Ultrafast optics and spectroscopy: a) development of new nonlinear optics-based methods to generate broadly tunable pulses, from the infrared the

extreme-ultraviolet, with duration down to single optical cycle limit (from a few femtoseconds to attoseconds); b) application to the study of primary photoinduced processes in atoms, molecules and solid state materials.

ii) Solid state lasers and photonic devices: a) development of ultra-broad band solid-state lasers and amplifiers for optical frequency combs; b) femtosecond laser micromachining of transparent materials for novel optofluidic devices and integrated quantum optical circuits; c) theoretical investigation and design of optical nanostructures for sensing applications.

iii) Photonics for health, food and cultural heritage. Development of innovative photonic systems and techniques and application in interdisciplinary fields relying on non-invasiveness and high diagnostic potential of optical means (e.g., fluorescence or photon migration). Projects involve theoretical investigations and simulations as well as extensive experimental work, including development of advanced laboratory set-ups and dedicated prototypes for use in real settings.

iv) Epitaxial growth and nanostructure fabrication (Milano-Leonardo and Como): a) synthesis of artificial materials for microelectronics, optoelectronics, plasmonics and spintronics; b) optical and electron beam lithography; spectroscopy and microscopy; c) SiGe/Si heterostructures; graphene nanoelectronic devices; d) magnetic thin films, oxide thin films.

v) Electronic, optical and magnetic properties of low-dimensional systems (Milano-Leonardo and international synchrotron radiation facilities): a) x-ray spectroscopies with synchrotron radiation; b) ultrafast magnetic and electronic phenomena; c) positron annihilation spectroscopy, antimatter production (at CERN); d) nano-optics and plasmonics.

Career Opportunities

The PhD Programme aims at the development of an experimental approach in problem solving techniques and at the attainment of a high level of professional qualification, opening job opportunities such as i) researcher in companies, universities, research centres; ii) designer of advanced devices and systems relying on physics technologies in high-tech industries and small innovative companies, iii) system manager to solve methodological and technological problems in large companies.

Eligible students

Students with a Bachelor of Science ("Laurea", 3 years) and a Master of Science ("Laurea Magistrale", 2 years), or alternatively a 5-year university degree providing a general education in the basic areas of physics, engineering and chemistry, and possibly a specific knowledge in condensed matter physics, optics and lasers.

Scholarships

PhD scholarships are awarded by Politecnico di Milano in the research areas mentioned above. Research subjects, specific activities and economic conditions can be found at <http://www.dottorato.polimi.it/en/looking-for-a-phd/call-for-positions-and-scholarships/places-and-scholarships/areas-subjects-and-topics-of-research-published-in-the-call/>. Additional scholarships on specific research topics are also usually available.

Contacts

For general information on the PhD at Politecnico di Milano, please visit the following web site: <http://www.dottorato.polimi.it/en/> and contact the School of Doctoral Programmes - Politecnico di Milano at: phdschool@polimi.it.

For specific information on the PhD in Physics, please visit: https://www.fisi.polimi.it/en/teaching/teaching_offer/phd and: www.dottorato.polimi.it/en/phd-programmes/engineering/physics or contact the PhD Secretariat at: daniela.rossi@polimi.it.

