UNIVERSITY
OF TRENTO - Italy
Department of Physics
Doctoral Proramme in Physics

Corso di dottorato in Fisica, ciclo 33: descrizione delle borse a tematica vincolata
PhD Programme in Physics, Cycle 33: description of reserved topic scholarships

1. Scholarships A (Department of Physics/Unitn)

Combined DFT/MD protocol for the simulation of molecular materials for organic solar cells."

The main objective of the thesis is the development of a reliable computational protocol aimed at the investigation of novel materials in the field of organic photovoltaics. The proposed approach will be directly tested on benchmark systems to be characterized by our present, and eventually future, experimental collaborators. Part of the training and research will be carried out at the École Nationale Supérieure de Chimie - ChimieParisTech in Paris. The computational methods are not limited to this specific field of research but could, in principle, be applied also to other systems of interest. For instance, the combined DFT/MD computational protocol might be applied to photosensitive chemical compounds or even fluorophores, including biological macromolecules.

Reference person: prof. Gianluca Lattanzi (gianluca.lattanzi@unitn.it)

2. Scholarships B (Department of Physics/Unitn)

Frequency combs in silicon integrated microresonators

Nonlinear optics in integrated optical microresonators allows generating new frequencies in nonclassical spectral regions. Here we aim to investigate the formation of frequency combs in second order and third order nonlinear materials in order to investigate the complex nonlinear dynamics of comb formation. During the thesis, the PhD student will model, design and experimentally measure the different fabricated structures in order to characterize generated frequency combs in the MIR. This activity is within the PRIN project NEMO.

Reference person: prof. Lorenzo Pavesi (lorenzo.pavesi@unitn.it)

3. Scholarships C1 and C2 (INFN)

Particle, Astroparticle, Nuclear, Theoretical Physics, related technologies and applications, including medical Physics.

The thesis topics will be selected within the many areas of forefront research pursued at Trento Institute for Fundamental Physics and Applications (TIFPA) of INFN. Current main activities include:
1) experimental astroparticle Physics,
2) experimental gravitation both earth and space based ,
3) gravitational wave astronomy,
4) antimatter related experiments,
5) R&D on particle and radiation detectors and other solid state quantum micro devices,
6) computational Physics and AstroPhysics,
7) theory of fundamental interactions,
8) theoretical cosmology ,
9) medical physics applied to therapy with high energy charged particles

For further information on the possible research topics see www.infn.it or contact Prof. Marco Durante (TIFPA Director), Prof. Rita Dolesi for experimental Physics (Rita.Dolesi@unitn.it); Prof. Francesco Pederiva for theoretical Physics (Francesco.Pederiva@unitn.it).

4. Scholarship D (INFN)

Silicon photomultipliers with ultra-high dynamic range

The Silicon Photo-multiplier (SiPM) is replacing the photo-multiplier tube, for the detection of extremely faint light, in several applications because of its solid-state nature, its better performance and customization level.
The technology has reached a very mature level in its "conventional" approach: peak detection in the UV part of the spectrum and small/medium dynamic range.
More recently, new challenging technology developments are under evaluation for applications requiring very high dynamic range (e.g. for detection of high-energy particles) or high immunity to background noise (e.g. due to radiation damage or constant light illumination). To this purpose, at FBK, new developments have been started to create SiPMs with ultra-small cell size and ultra-short signal response.
The PhD activity will focus on the research and development optimization of this technology, aiming at improving its performance and at extending its potential applications, within the current research programs of TIFPA and FBK.

For more information contact Dr. Marco Durante, TIFPA Director (marco.durante@tifpa.it), or Dr. Alberto Gola (gola@fbk.eu).

5. Scholarship E (FBK)

Solid-state Sensors for Quantum Photonic Applications

The research activity will be focused to the realization of experiments of quantum optics by exploiting the Quanta Image Sensors developed within the IRIS research units of FBK. Joining a deep understanding of the underlying physics and of the operating principle of these unique sensors, experimental setups for Quantum Photonics applications like quantum-based microscopy for superresolution using entangled photons, secure quantum communications, and other emerging quantum photonics applications will be explored.

Reference person: Dr. Matteo Perenzoni *(perenzoni@fbk.eu)*