Politecnico di Milano

PhD in PHYSICS

Research Title: Development of a 2D spin detector for spin resolved ARPES

Scholarships and Financial support	
Monthly net income of PhD scholarship (max 36 months)	€. *1200* (In case of a change of the welfare rates during the three-year period, the amount could be slightly modified)
Number of scholarships	1
Beginning of PhD	1/5/2018
Deadline for application	*10/05/2018*
Context of the research activity	
Motivations and objectives of the research in this field	The research project aims at developing a two dimensional spin detector for spin resolved experiments of angular resolved photoemission. Nowadays there is an increasing interest on quantum materials with peculiar band structure and spin texture, e.g. topological insulators, Rashba systems, Weyl semimetals, etc. Spin and angular resolved photoemission spectroscopy (SARPES) is the technique of choice for the investigation of the spin resolved band structure of these materials, but experiments are extremely time demanding. As a matter of fact, most of experimental stations allow to measure only one energy distribution curve (EDC) with spin polarization at the time, for a selected value of the parallel component of the photoelectron wave vector k. This means that the two-dimensional dispersion mode of electron analyzers at the exit plane (vs. energy and k in the two orthogonal directions) cannot be exploited in

	experiments with spin resolution, to obtain a snapshot of band dispersion. To overcome this limitation, the objective of the present project is to develop a spin detector capable of 2D operation, i.e. with an array of channels for the parallel acquisition of EDCs in correspondence of a matrix of parallel wave-vectors. This would represent a real breakthrough in the field of spin resolved ARPES. See http://www.elettra.trieste.it/it/lightsources/elettra/elettra-beamlines/ape/ape.html
Methods and techniques that will be developed and used to carry out the research	The research program will be jointly carried out by the group of Nanomagnetism of Politecnico di Milano and IOM-CNR researchers working around Elettra synchrotron radiation facility in Basovizza – Trieste. Within this collaboration the PhD student will use the following techniques: 1) Micro- and nano-fabrication of 2D spin filters in cleanroom (http://polifab.polimi.it); (2) Characterization of spin filters using sources of spin-polarized electrons beams (http://nabis.fisi.polimi.it) (3) Test of the 2D spin filter coupled to a hemispherical electron analyzer at IOM-CNR, in the framework of spin polarized ARPES experiments on emerging quantum materials form spintronics.
Educational objectives	The candidate will gain specific skills in the design, realization and test of advanced instrumentation for solid state physics experiments. Furthermore, he will be trained on state of the art micro and nanofabrication techniques, available in the cleanroom Polifab (http://polifab.polimi.it).
Job opportunities	The skills acquired during this research project will represent a solid basis for a career in companies oriented to the R&D of innovative instrumentation, as well as in all companies dealing with instrumentation and processes for micro and nano-fabrication. At least two previous PhD students from the same group are now responsible for processes development in microelectronic companies.
Composition of the research group	The PhD student will work in close collaboration with the researchers of: (i) the Nanomagnetism group of Politecnco di Milano (http://polifab.polimi.it) headed by R. Bertacco, (ii) the IOM-CNR unit of Trieste (https://www.iom.cnr.it) under the supervision of G. Panaccione. Number of Full Professors: 1 Number of Associated Professors:2 Number of Assistant Professors:2 Number of Post-Docs:3 Number of PhD students: 6

Names of the research directors	*Riccardo Bertacco*
Contacts	*riccardo.bertacco@polimi.it*
Additional support	
Housing: financial aid per PhD student per year (gross amount)	*No financial aid additional to the salary.*
Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other informations	
Educational activities The student is supposed to follow 4 courses for PhD students over the three years and give the corresponding exams. *Teaching assistantship* There are various forms of financial aid for activities of support to the teaching practice. The PhD student is encouraged to take part in these activities, within the limits allowed by the regulations. *Computer availability* The PhD student will be given a new notebook for individual use. *Desk availability* Individual use of a desk in a room for PhD students.	