PHD POSTION WITHIN THE RESEARCH PROJECT OF NATIONAL SCIENCE CENTRE (POLAND)

UNIWERSYTET IM. ADAMA MICKIEWICZA W POZNANIU
Wydział Fizyki

PROJECT **SONATA 14** NATIONAL SCIENCE CENTRE POLAND

Theoretical study of the magnetoresistance phenomena in 2D structures with strong spin-orbit interaction

The motivation for this project is the need of explaining the physical origins of the new kind of magnetoresistance phenomenon, measured experimentally very recently at the surface of topological insulators and oxides interfaces, that reveals linear response to both electric and magnetic field simultaneously. This so-called bilinear magnetoelectric resistance (BMR) emerging in the systems with a strong spin-orbit coupling (SOC) is a manifestation of higher order responses as well as specific properties of the systems that come from symmetry. The non-linear (with respect to the electric field) effects assisted by the spin-orbit interaction need a consistent theoretical formulation, that should take into account all possible origins (both intrinsic and extrinsic) of such system response.
Over the project duration, it is assumed to study the peculiar properties of BMR and other unidirectional magnetoresistive phenomena as well as some related spin and transport effects like spin, anomalous and planar Hall effects as well as current-induced spin polarization.

The main objectives might be divided by the four tasks:

- Theoretical description of BMR in selected models described by the most important effective Hamiltonians for transport modelling in spintronics: surface states of TI, graphene-like 2D crystals and Van der Waals heterostructures, 2D gas at the interfaces of semiconductor heterostructures and oxides perovskites.
- Theoretical description of spin-orbit driven phenomena beyond linear-response limit
- Identification of the possible origins of negative magnetoresistance in systems with spin-orbit interaction beyond the weak localization regime.
- Investigation of electronic and spin transport through two-dimensional layered systems and interfaces.

FORM OF EMPLOYMENT: scholarship
REMUNERATION: 3000 PLN per month
TIMLINE: 3 years, since Sept/Oct 2019

PROJECT INFO: http://zfmezo.home.amu.edu.pl/Sonata14.php
CONTACT: dr Anna Dyrdał (PI), adyrdal@amu.edu.pl
Mesoscopic Physics Division,
Adam Mickiewicz University in Poznan (Poland)

QUALIFICATIONS:

- Master Thesis in the theory of solid-state physics (preferably in the issues related to spintronics, electron transport in nanosystems, magnetism). The candidates with a master thesis prepared in experimental physics in the field of electronic transport and spintronics will be considered if their academic scores of theoretical physics courses and maths will be satisfactory.
- Comfortable communication in English
- self-reliance, availability, good organisation of working time

ADDITIONAL SKILLS:

- Experience in analytical calculations using Green function formalism or semi-classical description based on the Boltzmann equation
- Experience in ab-initio modelling in the field of spintronics

DOCUMENTS:

- Cover Letter
- CV (info about eductaion, publictaions, participation in conferences, awards, etc.)
- Reference Letter from the supervisor of Your master thesis or from the advisor of current research activities (should be sent directly to PI)
- Diploma Supplement (list of courses with marks)
- Please attached to Your application the following statement:

„I agree to the processing of personal data provided in this document for realising the recruitment process pursuant to the Personal Data Protection Act of 10 May 2018 (Journal of Laws 2018, item 1000) and in agreement with Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation)".

Applications should be sent by email to the PI (Anna Dyrdal) until the 2nd of July .