PhD Program between the Freie Universität Berlin (FUB) and the China Scholarship Council (CSC)

Open PhD Position at Freie Universität Berlin, offered only to Chinese CSC scholarship candidates 2024

Department/Institute: Physics

Subject area: Spintronics / Ultrafast optics / Nanoscience / 2D materials

Name of Supervisor: Prof. Dr. Kirill Bolotin

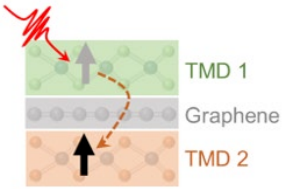
Number of open PhD positions: 1

Type of the PhD Study: 2 sandwich

Project title: Ultrafast opto-spintronics of two-dimensional heterostructures

PhD Project description:

Spintronics attempts to encode information into an electron's spin degree of freedom. Spintronics-based computing schemes could potentially be much faster and more energy efficient compared to traditional charge-based computers. One big goal for the field of spintronics is to manipulate spins with picosecond time resolution using ultrafast optical pulses, to demonstrate prototype processing blocks.



The goal of the project is to develop a spintronics platform based on two-dimensional materials. You will fabricate heterostructures of two-dimensional materials, monolayer transition metal dichalcogenides (TMDs) and two-dimensional ferromagnets. You will then probe the dynamics of spins of these structures with sub-picosecond resolution using photocurrent spectroscopy and Kerr microscopy. You will study spin transfer, spin torques, and magnetization dynamics in this system. The ultimate goal of the project is to use spin and other degrees of freedom as information carriers in next-generation electronics.

During the project, you will work in an active international team that is part of a big research cluster devoted to the study of ultrafast spin dynamics in advanced materials. Your main goal will be to develop new techniques for studying the ultrafast dynamics of spin/pseudospin in 2D materials and to discover new phenomena using these techniques. You will carry out device nanofabrication, two-dimensional materials growth and transfer, and participate in the development of a new ultrafast setup. You will also be engaged in building models and developing a theoretical understanding of spintronic systems. The project combines techniques from nanofabrication, laser physics, ultrafast optics, electrical transport, nanoscience, as well as fundamental theory. We look forward to working with you!

Language requirements:

- IELTS: 6,5 oder TOEFL: 95 ibt

OR

- Test Daf 16 bzw. DSH 2

Academic requirements:

Masters in Physics, Applied Physics, Material Science, or Nanoscience. Coursework in Quantum Mechanics and Electrodynamics is necessary. Programming experience is a plus. Experience with electronics, 2D materials, nanofabrication or optics is a plus. Enthusiasm about both experimental and theoretical science is a big plus!

Information of the professor or research group leader (website, awards etc.):

The Bolotin lab (bolotingroup.com) specializes in quantum electronics and optoelectronics of two-dimensional materials. Prof. Kirill Bolotin holds the chair of electrical transport in 2D materials in Free University Berlin. The key experimental techniques are electrical transport, strain engineering, photocurrent spectroscopy, and state-of-art nanofabrication. His work, among which are the discoveries of the fractional quantum effect in graphene, the demonstration of strain-engineering of 2D MoS_2, first measurements of the exciton binding energy in 2D MoS_2, and the discovery of the renormalization of the elastic constants of the 2D materials was cited more than 12,000 times. Kirill Bolotin recently moved to Free University Berlin (Germany) from Vanderbilt University (USA); the work of the group was recognized by the US NSF Career Award (2010), the Sloan foundation award (2011), and the ERC Starting grant (2016). The group includes postdocs, PhD students (including CSC students from previous years), and Master students from 8 countries and various background. The group operates a newly-opened nanofabrication cleanroom as well as a range of measurement setups. The group believes in combining theoretical and experimental approaches to probe frontier physical phenomena.

Please Note: In a first step, the complete application should be uploaded to the online portal (https://fuberlin.moveon4.de/form/60acfece5d328710e40bdbd5/eng) for evaluation by January 15th, 2024. Please do not contact the professor before. He/she will get in contact with you after having received the complete application via the International Office of Freie Universität Berlin in January.