TOCHA project

European Commission through H2020-FETPROACT-01-2018 under Grant Agreement 824140

Institute of Optical Materials and Technologies IOMT-BAS is looking for a Postdoctoral Researcher to work on the project under Horizon 2020 program FETProactive TOCHA 824140 "Dissipationless topological channels for information transfer and quantum metrology"

https://tocha-project.eu/

Deadline for application: 22 Sept. 2019

Starting date: 1 Oct. 2019

Duration: Full-time position, available for a period of 12 months extendable up to 36 months (3 years)

Hours per week: 40

Short description of the project: The goal of the Project is to develop the next generation of topological devices and architectures across which information can flow without losses. This conceptually simple yet technologically and fundamentally challenging requirement is crucial for the development of technologies in fields ranging from information processing to quantum communication and metrology. In each of these areas, the dissipation of information is a key hurdle that leads, for example, to unacceptable thermal loads or error rates. The Project will harness topological protection in novel materials and nanoscopic structures to empower electrons, phonons and photons to flow with little or no dissipation and, ultimately, crosslink them within a hybrid platform. This will entail the design of novel topological photonic/phononic waveguides and the engineering of disruptive heterostructures elaborated from the combination of topological insulators and ferromagnetic materials. In the optical domain, this will enable the creation of reflection and scattering free waveguides and, in thermal management, efficient transport and localized dissipation of heat. In electronics, the Project will develop ballistic transistors that could operate at THz cut-off frequencies and for metrology; it will establish a new paradigm for electrical resistance quantization standardization. The hybridization of three distinct quantum particles is expected to lead to novel functionalities, such as the shielding of quantum emitters from phonon-based decoherence processes, or the conversion of information from electronic to optical form and vice versa.

Main Tasks and responsibilities The candidate will conduct experiments on synthesis and characterization of 2D transition metal dichalcogenide topological insulators and single crystal topological insulators. In particular, the candidate will explore and optimize the CVT, Bridgman and HTS single crystals growing methods. Different approaches (magnetic doping, controlled

defects) to obtain large size homogeneous single crystals with stable magnetic properties will be explored. Particularly (Bi,Sb)2(Se,Te)3 single crystals doped with V and other transition metals will grow by the Bridgman method. Furthermore, the candidate will study the routes for scalable preparation of atomically thin and uniform TMDC. Methods and technologies for the synthesis of transition metal dichalcogenides (TMDCs) with ultra-high purity and the targeted crystalline structure will be investigated. The synthesis of 2D layered materials with desirable crystal structure on different substrates and with variable reaction/deposition schemes will be performed by CVD and ALD methods. Proper encapsulation will be explored to tackle the issue of these materials ambient stability. The crystal quality will be assessed by XRD, XPS, Raman spectroscopy, EDAX, TEM, etc. The synthesis of single-crystal and monolayer magnetic TMDCs is another research task of the Project to be performed by postdoctoral candidate. Using magnetic and transport characterization techniques, the magnetic properties of TMDCs will be investigated. Furthermore, heterostructures and hybrid structures (topological insulators + photonic/phononic structures will be prepared and studied.

Education, Experience, Knowledge and Competences required:
PhD in Solid state physics with background in nanomaterials preparation structural, optical and magnetic properties investigation. Fluent in English.

Skills/Qualifications
The ideal candidate should have a **PhD** degree in Solid State Physics or a closely related field and be able to work effectively, independently and sociably within a team. Previous experience in thin films and nanomaterials preparation techniques and magnetic characterization techniques is essential. An interest/knowledge in single crystals growth is highly desirable.

Required documents:

1. CV (in English) with list of publications
2. Motivation letter
3. At least one recommendation letter

All required documents should be sent to:
Prof. DSc. Vera Marinova e-mail: vmarinova@iomt.bas.bg