Max-Planck-Institut für
Struktur und Dynamik der Materie

Max Planck Institute for the Structure and Dynamics of Matter

IMPRS UFAST Call for PhD applications 2022/2023

PM1- Quantum phase change memories in Bismuth

Title of PhD Project	**Quantum phase change memories in Bismuth**
Type	Experimental
Supervisor(s)	Prof. Philip Moll Dr. Chunyu Guo
Affiliation(s):	Max Planck Institute for the Structure and Dynamics of Matter
Number of positions:	1
Abstract:	Bismuth remains one of the most enigmatic elemental conductors. The semi-metal is characterized by an ultra-low carrier density with almost perfect electron hole compensation. Even weak magnetic fields drive it into exotic regimes of electron transport, and the quantum limit can be reached conveniently at a few Tesla. Recent developments have tied its unusual behavior to a hidden topological anomaly in its band structure, depicting it as a “higher order topological insulator” (HOTI). These ideas provide a first attempt to separate high mobility bulk carriers from electrons at topologically protected surface states. Currently, this field is dominated by studies of macroscopic single crystals, while the bulk/boundary relations of such coupled topological systems clearly call for micron-sized samples with much larger surface participation in transport. In this project, you will develop a novel method to direct-write topological quantum wires into microscopic Bismuth samples using Focused Ion Beams. The nonlocal surface transport, following these wires, will be probed by magnetotransport at millikelvin temperatures. Disorder-driven transitions into superconducting states will further provide phase coherence to these structures, with the goal to explore Bismuth as a materials platform for quantum technologies.
Contact person for scientific questions about the project:	Chunyu Guo – Chunyu.guo@mpsd.mpg.de