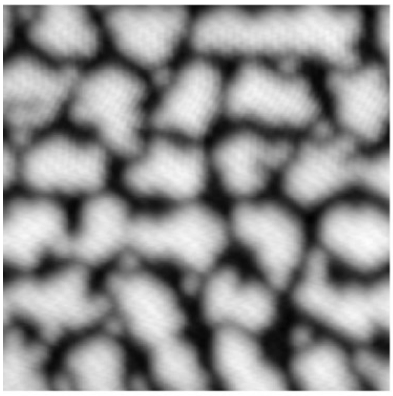
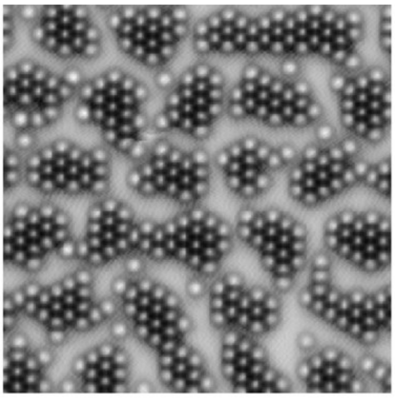
Ph.D. Position in Experimental Physics

University of Regensburg





We study topological insulators (TIs), which are a promising candidate for future spintronic applications (as e.g. quantum computing), on the atomic scale. TIs are mainly layered materials which are conducting at the surface but insulating in their bulk. The electric conduction at the surface manifests in the presence of spin-polarized metallic states. These topologically protected surface states cannot be destroyed by perturbations that do not break time reversal symmetry [1].

In a first experiment [2], we studied using combined low temperature (LT) atomic force (AFM) and scanning tunneling microscopy (STM) the surface of the TI $TlBiSe_2$. The AFM and STM channels show vastly different results: in the STM images the conducting states appear as nanoscale patches with a size of approximately 1.5 nm (left image), whereas AFM is able to resolve the individual thallium atoms composing the patches of the topmost layer (right image).
The possible candidate would study the influence of structural and magnetic perturbations on topological surface states using combined LT STM/AFM and scanning tunneling spectroscopy (STS). Structural perturbations could be step edges, single atoms and artificial structures created from adsorbed atoms by atomic manipulation. Magnetic perturbations could be induced by using magnetic probe tips or by adsorbing adatoms and clusters from magnetic materials like Fe. The combination of STM/AFM and STS allows us to study the electronic properties of the samples at the atomic scale. Therefore, an important step within this project is to atomically engineer STM/AFM tips that reliably enable atomic resolution imaging, as well as possess a defined electronic density of states suitable for STS experiments, like e.g. superconductive tips.

Ideally, the candidate already worked in the field of surface science, has experience with UHV and low temperature systems, and optionally possesses knowledge about STM or/and AFM.
Applications should be sent along with a CV, a brief cover letter including why this position would appeal to you, and a transcript of recent grades per email to:

Prof. Dr. Franz J. Giessibl
franz.giessibl@ur.de

Related articles:

[1] M. Z. Hasan *et al.*, Rev. Mod. Phys **82**, 3045 (2010)
[2] F. Pielmeier *et al*., New J. Phys. **17**, 023067 (2015).
[3] M. Emmrich *et al*., Science **348**, 308 (2015).
[4] J. Berwanger *et al*., Phys. Rev. B **98**, 195409 (2018).
[5] T. Eelbo *et al*., Phys. Rev. B **89**, 104424 (2014).