Topological Heterostructures by Molecular Beam Epitaxy

Topology, both in real space and in reciprocal space, has emerged as a new design principle for materials that can host a wealth of novel properties. Interfaces and heterostructures with topological materials offer opportunities to control and manipulate their electronic states and associated phenomena, for example, via electric field effect, strain, or symmetry breaking. In this presentation, we will discuss recent progress in the growth of thin films of the three-dimensional Dirac semimetal Cd₃As₂ by molecular beam epitaxy. We show that high-mobility, epitaxial Cd₃As₂ films can be grown and discuss some of the phenomena that can be observed, such as an unusually large negative longitudinal magnetoresistance under parallel electric and magnetic fields. These heterostructures allow for experimental tests of theoretically predicted transitions between topological states by manipulating parameters, such as confinement and film strain. For example, as the film thickness is reduced, a band gap opens in the bulk Dirac electronic states and we observe a quantum Hall effect that is associated with surface states. In the second half of the talk will discuss a different type of topological phenomenon, namely the realization and control of non-trivial spin textures in oxide heterostructures and how these affect the electrical transport properties, such as the Hall effect.

Tuesday, February 20 • 4 pm | Tech L211
Reception • 5 pm | Willens Wing Atrium