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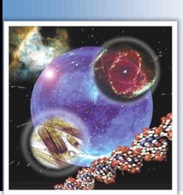
3:00 p.m.-4:00 p.m.

UC 2.02.02

Dirac fermions, two-dimensional topological insulators, and valley Hall effect in transition metal intercalated graphene

First-principles calculation is a bridge between theory/modeling and experiment. This is especially true in the development of better materials, as exemplified by countless examples, and by examples in my own group. I will then discuss in depth how to engineer Dirac fermions in two-dimensional (2D) transition metal layers. In particular, I will discuss our recent prediction of transition metal intercalated graphene systems on semiconductor SiC substrate [Li, et al., Phys. Rev. Lett. 109, 206802 (2012)]. Metal intercalation not only can significantly increase the binding of the graphene to the substrate, which is highly desirable for device applications, but can also introduce Dirac cone of primarily transition-metal nature to replace that of graphene at the Fermi level. More interestingly, the transition-metal Dirac cone can be made a 2D topological insulator for quantum spin Hall effect with a band gap as large as 100 meV, as well as exhibiting an unusual valley Hall effect. This may pave the way for experimental realization of new graphene systems for low energy-consumption spintronics and beyond.



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