PHYSICS

CONDENSED MATTER PHYSICS SEMINAR SERIES

4:00 pm - Rm 184 NSH

Thursday, September 12

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Theoretical Condensed Matter Physics

Indiana University

RKKY Interactions on Dirac Surfaces

Conduction electrons mediate indirect spin-exchange interactions between dilute magnetic degrees of freedom hosted by impurities or lattice defects. This mechanism, first identified by Ruderman, Kittel, Kasuya, and Yosida (RKKY), can endow otherwise non-magnetic metals with ferromagnetism or other magnetic ground states. More recently, the possibility of controlling magnetic interactions using two-dimensional materials in which electrons are governed by a Dirac equation ("Dirac surfaces") has been explored. We review how this plays out in a basic such system, graphene, and discuss how they can be further controlled by the introduction of an effective magnetic field when the lattice is subject to strain. We then consider related Dirac surfaces hosted by topological insulators. A particularly interesting example, topological crystalline insulators, hosts a variety of ferromagnetic ground states, which in principle can be controlled by a gate potential. Finally, we show that the form of RKKY interactions on Dirac surfaces leads to an "emergent" long-range interaction among spin-gradients, and discuss the implications of this for domain wall excitations of the system.