New Frontiers for Topological Semimetals

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Following their insulating counterparts, topological semi-metals have attracted much theoretical and experimental interest. Weyl and Dirac semimetals have recently been theoretically predicted and experimentally observed; both display topologically protected Fermi-arc surface states, as well as large negative magnetoresistance due to the "chiral anomaly." In this talk, I will discuss two new avenues for finding topological phenomena in gapless materials. First, I will go beyond Weyl and Dirac fermions to discuss how non-symmorphic crystal symmetries can stabilize topological band degeneracies in spin-orbit coupled materials. Some notable consequences of these degeneracies are the presence of Fermi arcs in non-Weyl systems, the fermionic spin-1 generalization of a Weyl fermion, and the existence of Dirac lines. I will pay particular attention to experimentally realizable material candidates. Time permitting, I will also discuss how an external magnetic field can be used to create a Weyl semimetal from a topologically trivial material, and I will show how this lends insight into recent experiments on the half-Heusler GdPtBi.