Search for topological behavior in Kondo lattice systems

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Topological insulators are simple bulk insulators with symmetry protected metallic surface states which exhibit Dirac cone like dispersions. Most of the topological systems studied are weakly correlated. The properties of these massless Dirac fermions in the presence of electron correlation is an interesting emerging area of research where electron correlation is expected to enhance the effective mass of the particles. We studied the behavior of Dirac fermions in novel Kondo lattice system employing ARPES. SmB_6, known to be a Kondo insulator, exhibit unusual properties [1]. Another Sm-based binary system, SmBi exhibits signature of multiple gapped and un-gapped Dirac cones in the band structure [2,3]. Employing ultra-high-resolution ARPES, we discover destruction of a surface Fermi surface across the Neel temperature while the behavior of Dirac cones survives across the magnetic transition. HAXPES data of a non-symmorphic Kondo lattice system, $CeAgSb_2$ and $CeCuSb_2$ exhibit unusual spectral features; while the bulk properties show Kondo behavior, the typical Kondo feature is not observed. Instead, we find a new feature in the core level spectra [4,5]. The ARPES data of $CeAgSb_2$ show distinct Dirac cones as well as diamond-shaped nodal lines; the slope of these linear bands is unusually high, larger than that in graphene and maintains its high value in a wide energy range indicating robust high velocity of these relativistic particles [6]. The slope becomes smaller in the vicinity of strongly correlated Ce 4*f* bands forming a kink; a unique case due to correlation induced effects.

References:

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