Magnetic Ordering on Topological Crystalline Insulator Surfaces

Herb Fertig

Topological crystalline insulators (TCI's) are a class of materials which can support non-trivial band topology protected by crystalline symmetry. Using analytic and numerical methods, we study the effect of bulk magnetic impurities on a TCI model believed to be realized by (Sn,Pb)Te alloys. When the system bulk is insulating, gapless surface states are present whose energetics are affected by the magnetic ordering on the surface, particularly when it breaks the mirror symmetry. This leads to a rich variety of ferromagnetic orderings, with the number of degenerate magnetization directions dependent on which surfaces are exposed and on the doping of those surfaces. In particular we find metallic states with two-fold easy axes as well as ones with six orientations on the (111) surface. The (001) surface by contrast hosts an 8-fold insulating state.

The nature of domain walls between different orderings has interesting consequences for transport on the surfaces as well as the universality classes of thermal disordering transitions.