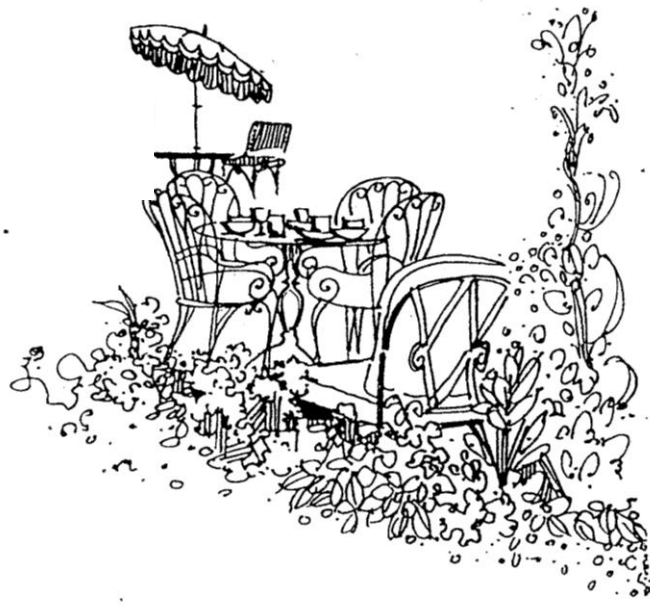
Chez Pierre

Presents ...

Monday, November 25, 2013
12:00pm
MIT Room 4-331



Vidya Madhavan
Boston College

"Massive Dirac Fermions in Topological Crystalline Insulators created by Symmetry Breaking"

Topological crystalline insulators (TCIs) are recently discovered topological materials [1,2] where topology and crystal symmetry intertwine to create linearly dispersing Dirac surface states similar to graphene. Among the theoretical predictions for TCIs is the possibility of imparting mass to the massless Dirac fermions by breaking crystal symmetry, as well as a Lifshitz transition with a change of Fermi surface topology. In this talk I will discuss our recent experimental and theoretical investigations of a TCI, $Pb_{1-x}Sn_xSe$ [3]. We performed scanning tunneling microscopy (STM) studies at low temperatures and as a function of magnetic field. By analyzing two types of STM data: Fourier transforms of interference patterns and Landau level spectroscopy, we reveal two distinct regimes of fermiology separated by a Van-Hove singularity at the Lifshitz transition point. Our studies reveal the coexistence of zero mass Dirac fermions protected by crystal symmetry with massive Dirac fermions resulting from crystal symmetry breaking. These studies create a path to engineering the Dirac band gap and realizing interaction-driven topological quantum phenomena in TCIs.

[1] L. Fu, Topological Crystalline Insulators. *Phys. Rev. Lett.* 106, 106802 (2011).
[2] T. H. Hsieh *et al.*, Topological crystalline insulators in the SnTe material class. *Nat.Commun.* 3, 982 (2012).
[3] Y. Okada, et.al , Observation of Dirac node formation and mass acquisition in a topological crystalline insulator, to be published in *Science (DOI: 10.1126/science.1239451)* (2013).