

Condensed Matter Theory Center Seminar
Tuesday, November 4 at 11:00 AM
2205 Physics Building

Speaker: Titus Neupert (Princeton)

Title: Interacting surface states of three-dimensional topological insulators

Abstract:

The surface states of three-dimensional topological insulators are celebrated for their robustness against perturbations, provided that time-reversal symmetry and particle number conservation are not violated. In my talk, I want to survey their possible phases in the limit where interactions between the surface electrons are strong. To that end, I choose a spherical topological insulator geometry to make the surface amenable to numerical studies of finite size systems. In this case, the single-particle problem maps to that of Landau orbitals on the sphere with a magnetic monopole at the center that has unit strength and opposite sign for electrons with opposite spin.

Restricting the single particle Hilbert space to the small region in the surface Brillouin zone that is covered by the surface Dirac cone enforces a nontrivial quantum geometry on the problem, resulting in distinct real-space localization properties of the electron orbitals. Assuming density-density contact interactions, we find superconducting and anomalous (quantum) Hall phases for attractive and repulsive interactions, respectively. Our setup is ideally adapted to the search for recently proposed topologically ordered surface terminations that could be microscopically stabilized by tailored surface interaction profiles.

Host: Philip Brydon

<http://www.physics.umd.edu/cmtc/seminars.html>
