

Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Interacting surface states of three-dimensional topological insulators TITUS NEUPERT, Princeton University, STEPHAN RACHEL, Technische Universitaet Dresden, RONNY THOMALE, MARTIN GREITER, University of Wurzburg — We numerically investigate the surface states of a strong topological insulator in the presence of strong electron-electron interactions. We choose a spherical topological insulator geometry to make the surface amenable to a finite size analysis. 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. Assuming density-density contact interactions, we find superconducting and anomalous (quantum) Hall phases for attractive and repulsive interactions, respectively, as well as chiral fermion and chiral Majorana fermion boundary modes between different phases. Our setup is preeminently adapted to the search for topologically ordered surface terminations that could be microscopically stabilized by tailored surface interaction profiles.

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Date submitted: 09 Nov 2014

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