Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Symmetry Protected Topological Hopf Insulator and its Generalizations FARZAN VAFA, CHUNXIAO LIU, CENKE XU, University of California, Santa Barbara — The 10-fold way classification has provided us the prototypes of topological insulators. The usual wisdom is that even the topological insulators with symmetries beyond the 10-fold way classification can also be understood as these prototypes enriched with other symmetries. The boundary states of all these prototypes should be either gapless Dirac fermion, Weyl fermion, or Majorana fermion. One important open question is, can these prototypes represent all possible topological insulators? We study a class of $3d$ topological insulators whose topological nature is characterized by the Hopf map and its multi-band as well as $4d$ generalizations. We identify the symmetry C', a generalized particle-hole symmetry that gives the Hopf insulator a Z_2 classification. We demonstrate that the minimal model of the $3d$ Hopf insulator must have a "Fermi ring" on its boundary, instead of a massless Dirac fermion; though the more generic multi-band version of the Hopf insulator protected by the C' symmetry still has a Dirac fermion on its boundary. Similar phenomena are found for the $4d$ analogue of the Hopf insulator. We also discuss the relation between the Hopf insulator and the Weyl and Dirac semimetals, which points the direction for its experimental realization.

Farzan Vafa
University of California, Santa Barbara

Date submitted: 10 Nov 2016 Electronic form version 1.4