Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

First-order quantum phase transition in three-dimensional topological band insulators VLADIMIR JURICIC, DAVID ABERGEL, Nordita, Center for Quantum Materials, Stockholm University and KTH, Stockholm, ALEXANDER BALATSKY, Nordita, Center for Quantum Materials, Stockholm University and KTH, Stockholm and Institute for Materials Science, LANL, Los Alamos, USA — It is commonly assumed that the transition between topologically distinct noninteracting gapped phases of fermions is necessarily accompanied by the closing of the gap as long as the symmetries of the Hamiltonian are maintained. We show that such a quantum phase transition is possible without closing the gap in the case of a three-dimensional topological band insulator [1]. We demonstrate this by calculating the free energy of the Bernevig-Hughes-Zhang model, and show that as the band curvature continuously varies, a jump between the band gap minima corresponding to the topologically trivial and nontrivial insulators occurs. Therefore, this first order phase transition is a generic feature of three-dimensional topological band-insulators. For a certain parameter range we predict a re-entrant topological phase transition. We discuss our findings in connection with the recent experimental observation of a discontinuous phase transition in a family of topological crystalline insulators. [1] V. Juricic, D. S. L. Abergel, and A. V. Balatsky, arXiv: 1608.07819.

Vladimir Juricic
Nordita, Center for Quantum Materials, Stockholm Univ., and KTH

Date submitted: 20 Nov 2016 Electronic form version 1.4