Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Interacting Weyl semimetals: characterization via the topological Hamiltonian and its breakdown WILLIAM WITCZAK-KREMPA, Perimeter Institute for Theoretical Physics, MICHAEL KNAP, Harvard University, DMITRY ABANIN, Perimeter Institute for Theoretical Physics — Weyl semimetals (WSMs) have robust linearly-dispersing excitations. Unusual properties arise from the latter, such as anomalous electrodynamic responses and open Fermi arcs on boundaries. We derive a simple criterion to identify and characterize WSMs in an interacting setting using the exact electronic Green's function at zero frequency, which defines a topological Bloch Hamiltonian. We apply this criterion by numerically analyzing, via cluster and other methods, interacting models with and without time-reversal symmetry. We thus identify mechanisms for how interactions move and renormalize Weyl fermions. Our methods remain valid in the presence of long-ranged Coulomb repulsion. Finally, we introduce a WSM-like phase for which our criterion breaks down, due to fractionalization of the electron.

W. Witczak-Krempa, M. Knap, D. Abanin, Phys. Rev. Lett. 113, 136402 (2014)

William Witczak-Krempa
Perimeter Institute for Theoretical Physics

Date submitted: 12 Nov 2014 Electronic form version 1.4