Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Strained and inhomogeneous Weyl and Dirac semimetals: Transport in axial magnetic fields and Fermi arc surface states from pseudo Landau levels ADOLFO GRUSHIN, Univ of California - Berkeley, JORN W. F. VENDERBOS, MIT, ASHVIN VISHWANATH, Harvard, RONI ILAN, Tel Aviv University — Dirac and Weyl semimetals host topologically stable Weyl nodes appearing in pairs of opposite chirality. In this work we allow a space-time dependent Weyl node separation, which acts as a background axial vector potential on the electromagnetic response and the energy spectrum of these materials. This situation arises either from inhomogeneous strain, non-uniform magnetization and also in cold-atomic systems. The resulting axial magnetic field $\mathbf{B_5}$ is observable through an enhancement of the conductivity as $\sigma \sim \mathbf{B_5^2}$ due to an underlying chiral pseudo magnetic effect. Using two lattice models, we analyze the effect of $\mathbf{B_5}$ on the spectral properties of topological semimetals, revealing that (i) the surface Fermi arcs, can be reinterpreted as $n = 0$ pseudo-Landau levels resulting from a $\mathbf{B_5}$ confined to the surface (ii) position-momentum locking a bulk $\mathbf{B_5}$ creates pseudo-Landau levels interpolating in real space between Fermi arcs at opposite surfaces and (iii) there are equilibrium bound currents proportional to $\mathbf{B_5}$ that average to zero over the sample, analogs of bound currents in magnetic materials. We conclude by discussing how our findings cour findings can be probed experimentally.

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Date submitted: 08 Nov 2016 Electronic form version 1.4