Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Magnetic Catalysis and Axionic Charge-Density-Wave order in Weyl semimetals BITAN ROY, JAY DEEP SAU, Condensed Matter Theory Center, University of Maryland — Three-dimensional Weyl and Dirac semiemtals are extremely robust against weak electronic correlations. However, when placed in strong magnetic fields, they can support a chiral-symmetry-breaking charge-density-wave order even for sufficiently weak electron-electron repulsion. Such novel phenomena stems from the existence of one-dimensional chiral zeroth Landau levels which can hybridize for arbitrarily weak interactions. In the former systems, due to the momentum space separation of Weyl nodes the ordered phase lacks translational symmetry and represents a dynamic axionic phase of matter. I will demonstrate the scaling behavior of the spectral gap for a wide range of subcritical (weak) interactions as well as that of diamagnetic susceptibility with magnetic field. I will argue that similar mechanism for charge-density-wave ordering remains operative in double-Weyl semimetals, where dispersion is linear (quadratic) for the z (planar) component(s) of momentum. Role of topological defects, e.g., axion strings, existence of 1-dimensional gapless dispersive modes along the core of such defects, anomaly cancellation through Callan-Hervey mechanism will also be discussed. Pertinence of our study in recently observed Dirac semimetals, such as Cd_3As_2, Na_3Bi, will be addressed.

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Date submitted: 14 Nov 2014 Electronic form version 1.4