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Diamagnetism of Weyl semimetals SI WU, ALEXANDER ZYUZIN, ANTON BURKOV, University of Waterloo — We present a study of the diamagnetic orbital response in a Weyl semimetal, the recently discovered gapless topological phase of matter. Weyl semimetal is a three-dimensional (3D) material, characterized by the presence of isolated Dirac (Weyl) point nodes in its band structure. It can be thought of as the closest 3D analog of graphene. It is known from graphene studies that two-dimensional (2D) Dirac fermions have a highly nontrivial singular diamagnetic response to an applied perpendicular magnetic field, reflecting the quantum critical nature of the ground state of undoped graphene. Here we investigate the analogous orbital response of 3D Dirac fermions in a Weyl semimetal to an applied magnetic field. As in 2D graphene, we find strong signatures of quantum criticality in the diamagnetic response of 3D Weyl semimetal. In particular, we find that the orbital susceptibility has a characteristic logarithmic dependence on the applied field, deviation of the chemical potential from the charge-neutral position and temperature. This unusual diamagnetic response can be used for experimental characterization of Weyl semimetals.

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