Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Quantum oscillations without magnetic field in Dirac and Weyl semimetals MARCEL FRANZ, TIANYU LIU, University of British Columbia, DMITRI PIKULIN, Microsoft Station Q — When magnetic field B is applied to a metal, nearly all observable quantities exhibit oscillations periodic in 1/B. Such quantum oscillations reflect the fundamental reorganization of electron states into Landau levels as a canonical response of the metal to the applied magnetic field. We predict here that, remarkably, in the recently discovered Dirac and Weyl semimetals quantum oscillations can occur in the complete absence of magnetic field. These zero-field quantum oscillations are driven by elastic strain which, in the space of the low-energy Dirac fermions, acts as a chiral gauge potential. We propose an experimental setup in which the strain in a thin film (or nanowire) can generate pseudomagnetic field b as large as 15T and numerically demonstrate the resulting de Haas-van Alphen and Shubnikov-de Haas oscillations periodic in 1/b.

Marcel Franz
University of British Columbia

Date submitted: 07 Nov 2016 Electronic form version 1.4