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dHvA oscillations in nodal-line semimetals ZrSiM (M=S,Se,Te) JIN HU, ZHIJIE TANG, JINYU LIU, YANGLIN ZHU, ZHIQIANG MAO, Tulane University — The breakthrough in the discovery of topological semimetals provides opportunities to explore the exotic properties of relativistic fermions in condensed matter. Among those materials, the Dirac nodal-line semimetal represents a new type of topological quantum state which displays Dirac cones along a one dimensional line, in contrast with the Dirac or Weyl semimetals with discrete Dirac or Weyl cones. Here we report the quantum oscillation studies on the nodal-line semiemtals ZrSiS, ZrSiSe, and ZrSiTe. We have observed very strong dHvA oscillations in these materials, which provides an ideal opportunity to study their properties of Dirac states. In ZrSiS, we found distinct properties associated with the novel Dirac state protected by non-symmorphic symmetry which was previously probed by ARPES experiments: the 2D Dirac cone state exhibits particularly strong Zeeman splitting at low fields. In ZrSiSe and ZrSiTe, we have provided evidence for nodal-line fermions in these materials, and revealed the evolution of band structure toward 2D from ZrSiS to ZrSiSe and to ZrSiTe. In addition, we have demonstrated that their atomically thin crystals are accessible via mechanical exfoliation, which raises the possibility of realizing the theoretically predicted 2D topological insulators.

Jin Hu
Tulane University

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