Quantum oscillations in the nodal-line Dirac semimetal ZrSiS

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By means of angle-resolved photoemission spectroscopy (ARPES), ZrSiS has been established to harbor a 3D topological nodal-line semimetallic phase as well as multiple surface Dirac states protected by nonsymmorphic crystal symmetry [1,2]. Here, we report on our observation of de Haas – van Alphen (dHvA) and Shubnikov – de Haas (SdH) oscillations in high-quality single crystals investigated in Ref. 2. The combined dHvA and SdH study revealed five independent quantum oscillations for magnetic field applied along the tetragonal axis and four oscillations for the perpendicular direction. Analysis of the associated phase shifts indicated that the quantum oscillations in ZrSiS arise from the linearly dispersed 3D and 2D bands observed by ARPES. Moreover, the angular dependencies of the frequencies could be well reproduced by the results of our ab-initio electronic band structure and Fermi surface calculations. Notably, our dHvA and SdH data appeared fully consistent with those derived recently from the quantum oscillations in the thermoelectric power of ZrSiS [3].

References:

[1] L. M. Schoop, et al., Nature Commun. **7**, 11696 (2016).
[2] M. Neupane, et al., Phys. Rev. B **93**, 201104(R) (2016).
[3] M. Matusiak, J. R. Cooper, and D. Kaczorowski, Nature Commun., in print.