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Scanning Tunneling Microscopy Study on Dirac Nodal-line Semimetal ZrSiS CHIH-CHUAN SU, Institute of Physics, Academia Sinica, Nankang, Taipei 11529, Taiwan, SYU-YOU GUAN, TZU-CHENG WANG, Department of Physics, National Taiwan University, Taipei 10617, Taiwan, RAMAN SANKAR, Institute of Physics, Academia Sinica, Nankang, Taipei 11529, Taiwan, GUANG-YU GUO, Department of Physics, National Taiwan University, Taipei 10617, Taiwan, FANGCHENG CHOU, Center for Condensed Matter Sciences, National Taiwan University, Taipei 10617, Taiwan, CHIA-SENG CHANG, TIEN-MING CHUANG, Institute of Physics, Academia Sinica, Nankang, Taipei 11529, Taiwan — The discovery of 3D Dirac nodal-line protected by non-symmophic symmetry in ZrSiS family has been reported by angle resolved photoemission spectroscopy (ARPES) and quantum oscillation measurements. ZrSiS also exhibits a butterfly shaped titanic angular magnetoresistance and strong Zeeman splitting in quantum oscillation. These observations with its layered crystal structure make the ZrSiS family an interesting candidate to understand the novel properties of the nodal-line semimetals. Here, we study the electronic structures of the single crystal ZrSiS by using spectroscopic-imaging scanning tunneling microscope at T= 4.2K. Our quasiparticle scattering interference imaging reveals the characteristic wave vectors with linear dispersion from Dirac line nodes in the bulk and its surface states. Our results are in excellent agreement with the first principle calculation, and also in consistent with ARPES and quantum oscillation measurements.

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