Abstract Submitted
for the DAMOP19 Meeting of
The American Physical Society

Exploring 3D topological matter with spin-orbit-coupled fermions in optical lattices[1] CHENGDONG HE, BO SONG, Hong Kong University of Science and Technology, SEN NIU, LONG ZHANG, Peking University, ZEJIAN REN, ENTONG ZHAO, Hong Kong University of Science and Technology, XIONG-JUN LIU, Peking University, GYU-BOONG JO, Hong Kong University of Science and Technology — Ultracold atoms offer a promising testbed for the experimental study of topological matter. Various topological models have been recently realized in 1D and 2D atomic systems. While 3D topological matter with rich physics remains unexplored due to experimental complexity. Here we report, for the first time, the realization of a 3D nodal line semimetal in optical lattices with SO coupled ultracold fermions. The 3D topological band structure is achieved by stacking 2D Dirac semimetal in the x-y plane along z direction in Raman-dressed optical lattices. k_z resolved spin texture measurement technique based on emergent magnetic group symmetry has been developed to detect 3D topological state. Spin texture in a specific k_z plane can be directly imaged with different Zeeman splitting. 3D nodal lines can be reconstructed with this pseudo-tomography method. Band inversion lines, the bulk counterparts of Fermi arc states, can be extracted from quench dynamics, which reconfirmed the realization of topological phase. Our detection technique can be broadly applied to characterizing 3D topological states with similar symmetries, which provides a new possibility to study exotic quantum physics in higher dimensions.

[1]Funding support: Hong Kong RGC (No. N-HKUST601/17,26300014, 16300215, 16311516, 16305317,16304918) Croucher Foundation.

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Date submitted: 01 Feb 2019 Electronic form version 1.4