Abstract Submitted
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Realization of three-dimensional nodal-line semimetal with ultracold fermions[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 — Despite recent breakthroughs in topological bands for ultracold atoms in 1D and 2D, it has been an open challenge to realize and observe 3D topological matter in an atomic system. While numerous schemes have been proposed, the experimental complexity and the characterization of the 3D band structure acted as a barrier against experimental groups achieving this outstanding goal. In this talk, we report the realization and observation of 3D nodal-line semimetal band with spin-orbit-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. To detect 3D topological phases, we developed k_z resolved spin texture measurement technique based on emergent magnetic group symmetry in our system. By directly imaging spin texture in specific k_z plane with different Zeeman splitting, 3D nodal lines can be reconstructed. The realization of topological band structure is also verified in quench dynamics by detecting band inversion lines, which are bulk counterparts of Fermi arc states. This technique can be broadly applied to characterizing 3D topological states with similar symmetries.

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