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Dirac and Weyl Rings in Three Dimensional Cold Atom Optical Lattices. YONG XU, CHUANWEI ZHANG, The University of Texas at Dallas — Recently three dimensional topological quantum materials with gapless energy spectra have attracted considerable interests in many branches of physics. Besides the celebrated example, Dirac and Weyl points which possess gapless point structures in the underlying energy dispersion, the topologically protected gapless spectrum can also occur along a ring, named Dirac and Weyl nodal rings. Ultracold atomic gases provide an ideal platform for exploring new topological materials with designed symmetries. However, whether Dirac and Weyl rings can exist in the single-particle spectrum of cold atoms remains elusive. Here we propose a realistic model for realizing Dirac and Weyl rings in the single-particle band dispersion of a cold atom optical lattice. Our scheme is based on previously experimentally already implemented Raman coupling setup for realizing spin-orbit coupling. Without the Zeeman field, the model preserves both pseudo-time-reversal and inversion symmetries, allowing Dirac rings. The Dirac rings split into Weyl rings with a Zeeman field that breaks the pseudo-time-reversal symmetry. We examine the superfluidity of attractive Fermi gases in this model and also find Dirac and Weyl rings in the quasiparticle spectrum.

Yong Xu
The University of Texas at Dallas

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