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Topological Phases of Interacting Fermions in Optical Lattices[1]
VITO SCAROLA, Virginia Tech, CHUANCHANG ZENG, Clemson University, TUDOR STANESCU, West Virginia University, CHUANWEI ZHANG, University of Texas, Dallas, SUMANTA TEWARI, Clemson University — Recent experiments have placed cold atoms into optical lattices in the presence of synthetic fields. This talk will review studies of Hubbard-Hofstadter models in regimes revealing topological phases of ultracold fermions arising from the interplay of inter-particle interactions and synthetic fields in kagome and square optical lattices. Focusing on one regime in particular, attractive interactions in a square optical lattice, we find that attractive s-wave interactions lead to a higher-order topological superfluid [1]. Higher-order topological superconductors hosting Majorana-Kramers pairs as corner modes have recently been proposed in two-dimensional materials. Here, we show that such Majorana-Kramers pairs can be realized using a conventional s-wave superfluid in an optical lattice but with a soliton. The Majorana-Kramers pairs emerge at the corners defined by the intersections of line solitons and the one-dimensional edges of the system. Our scheme sets the stage for observing possible higher-order topological superfluidity with conventional s-wave superfluids of cold atoms. 1. C. Zeng et al., Phys. Rev. Lett. 123, 060402 (2019)

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