Abstract Submitted
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Exotic topological density waves in cold atomic Rydberg fermions[1] XIAOPENG LI, Univ of Maryland-College Park — Versatile controllability of interactions in ultracold atomic and molecular gases has now reached an era where quantum correlations and unconventional many-body phases can be studied with no corresponding analogues in solid-state systems. Recent experiments in Rydberg atomic gases have achieved exquisite control over non-local interactions, allowing novel quantum phases unreachable with the usual local interactions in atomic systems. Here I will discuss Rydberg-dressed atomic fermions in a three-dimensional optical lattice where we predict the existence of hitherto unheard-of exotic mixed topological density wave phases. By varying the spatial range of the non-local interaction, we find various chiral density waves with spontaneous time-reversal symmetry breaking, whose quasiparticles form three-dimensional quantum Hall and Weyl semimetal states. Remarkably, certain density waves even exhibit mixed topologies beyond the existing topological classification. Our results suggest gapless sermonic states with long-range interactions could exhibit far richer topology than previously expected. Reference: Xiaopeng Li, S. Das Sarma, Nat. Comms. 6:7137 (2015)

[1]JQI-NSF-PFC, AROAtomtronics- MURI, and LPS-MPO-CMTC, UMD supercomputing resources

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