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Competing chiral magnetic orders in the strongly correlated Haldane-Hubbard model ARUN PARAMEKANTI, CIARAN HICKEY, University of Toronto, PRATIK RATH, Indian Institute of Technology, Kanpur, India — Motivated by recent experiments on ultracold atoms which have realized the Haldane model for a Chern insulator with synthetic gauge fields, we consider its strongly interacting limit with spin-1/2 fermions. A slave rotor mean field theory suggests the appearance of gapped or gapless chiral spin liquid Mott insulators. To study competing magnetic orders in the Mott insulator, we consider the strong coupling effective spin Hamiltonian which includes chiral three-spin exchange. We obtain its classical phase diagram, uncovering various chiral magnetic orders including tetrahedral, cone, and noncoplanar spiral states which can compete with putative chiral quantum spin liquids. We study the effect of thermal fluctuations on these states, identifying crossovers in the spin chirality, and phase transitions associated with lattice symmetry breaking. We also discuss analogous effective spin Hamiltonians for correlated spin-1/2 bosons.

Arun Paramekanti
University of Toronto

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