

Abstract Submitted
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Chiral magnetism and spontaneous spin Hall effect of interacting Bose superfluids¹ XIAOPENG LI, STEFAN NATU, Univ of Maryland-College Park, ARUN PARAMEKANTI, University of Toronto — Recent experiments on ultracold atoms in optical lattices have synthesized a variety of tunable bands with degenerate double-well structures in momentum space. Such degeneracies in the single particle spectrum strongly enhance quantum fluctuations, and may lead to exotic many-body ground states. We consider weakly interacting spinor Bose gases in such bands, and discover a universal quantum “order by disorder” phenomenon which selects a novel chiral spin superfluid with remarkable properties such as spontaneous anomalous spin Hall effect and momentum space antiferromagnetism. For bosons in the excited Dirac band of a hexagonal lattice, such a state supports staggered spin loop currents in real space. We show that Bloch oscillations provide a powerful dynamical route to quantum state preparation of such a chiral spin superfluid. Our predictions can be readily tested in spin resolved time-of-flight experiments.

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