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Observing Topological Chiral Orders in 2D Optical Lattices without Spin-orbit Coupling XIONG-JUN LIU, Institute for Advanced Study and Department of Physics, Hong Kong University of Science and Technology, Clear Water Bay, Hong Kong, ZHENG-XIN LIU, Institute for Advanced Study, Tsinghua University, Beijing, 100084, P. R. China, K.T. LAW, Department of Physics, Hong Kong University of Science and Technology, Clear Water Bay, Hong Kong, W. VINCENT LIU, Department of Physics, University of Pittsburgh, Pittsburgh, Pennsylvania 15260, USA, T.K. NG, Department of Physics, Hong Kong University of Science and Technology, Clear Water Bay, Hong Kong — We propose to observe topological chiral orders with cold atoms without spin-orbit coupling in a two-dimensional optical lattice directly based on the recent experiments which use Raman beams to induce the hopping between nearest-neighbor sites. In the simplest case with s-orbital model, the chiral Chern insulating phases are predicted in the single-particle regime. Moreover, by considering a spin-1/2 system, we predict that the chiral spin liquid phase may exist in the interacting regime. This work proposes realistic cold atom platforms to observe topological chiral orders in the experiment.

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