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Emergent phases in the spin orbit coupled spin-1 Bose Hubbard model STEFAN NATU, JEDEDIAH PIXLEY, Condensed Matter Theory Center and Joint Quantum Institute, Department of Physics, University of Maryland, College Park — Motivated by recent experiments on spin orbit coupled, ultra-cold Bose gases [1], we theoretically study the spin-1 Bose Hubbard model in the presence and absence of spin orbit coupling (SOC). In the absence of SOC, using a spatially homogenous Gutzwiller mean field theory, we determine the phase diagram and excitation spectrum of the spin-1 Bose Hubbard model on a hyper-cubic lattice in both the polar and ferromagnetic phases. We focus on the evolution of various density, spin, and nematic order parameters across the phase diagram as a function of chemical potential and nearest neighbor hopping. We then generalize the Gutzwiller mean-field theory to incorporate spin-orbit coupling by allowing the mean-fields to be spatially inhomogeneous, which enable us to study spontaneous translational symmetry broken phases. To connect with ongoing experiments, we focus on the lattice generalization of the experimentally realized 1D spin-orbit coupling.

[1] Y.-J. Lin, K Jimenez-Garcia, and I. B. Spielman, Nature 471, 83 (2011).

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