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Competing exotic quantum phases of spin-1/2 ultra-cold lattice bosons with extended spin interactions[1] CHIA-CHEN CHANG, Univ of California - Davis, VALERY ROUSSEAU, Louisiana State University , RICHARD T. SCALETTAR, Univ of California - Davis, GEORGE BATROUNI, INLN, Université de Nice-Sophia Antipolis, CNRS and Institut Universitaire de France — Rapid progress in pure optical trapping techniques makes it possible now to create degenerate Bose gases with spin degrees of freedom. Systems such as ^{87}Rb or ^{23}Na in the $F = 1$ hyperfine state offer a unique platform for studying the interplay of superfluidity and magnetism, phases resulting from macroscopic quantum coherence and symmetry breaking respectively. Motivated by these experimental developments, we study ground state phases of a two-component spinor Bose gas loaded on an optical lattice. The system is described effectively by the Bose-Hubbard Hamiltonian with onsite and extended spin-spin interactions. Using mean-field theory and quantum Monte Carlo simulations, we map out the phase diagram of the system. A rich variety of phases is identified, including antiferromagnetic (AF) Mott insulators, ferromagnetic or AF superfluids, and supersolids.

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