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**Interaction driven quantum phases in spin-orbit-coupled spin-1 bosons** JEDEDIAH PIXLEY, STEFAN NATU, WILLIAM COLE, Condensed Matter Theory Center and Joint Quantum Institute, Department of Physics, University of Maryland, College Park, MATTEO RIZZI, Institut fur Physik, Universitat Mainz, IAN SPIELMAN, Joint Quantum Institute, National Institute of Standards and Technology, and University of Maryland — We study the interplay of spin orbit coupling and strong correlations present for ultra cold spin-1 bosons on a square optical lattice. In addition to the conventional spinful Mott and superfluid phases contained in the spin-1 Bose-Hubbard model, we find new lattice symmetry breaking phases [1]. For weak interactions, the interplay between the lattice momentum and the spin-orbit wave-vector induces a phase transition from a uniform superfluid to a phase where bosons simultaneously condense at the center and edge of the Brillouin zone. This state is characterized by spin density wave order, which arises from the spin-1 nature of the system. Interactions suppress this spin density wave order, and for sufficiently strong interactions the system becomes a Mott insulator. Inside the Mott lobes with an odd-integer filling we derive the effective low energy magnetic Hamiltonian. Focusing on the quasi-one-dimensional limit we solve the strongly coupled magnetic model in three ways: in its classical limit, with a spin-wave analysis, and using the density matrix renormalization group. [1] J. H. Pixley, et. al. arXiv:1509.00005. (Accepted in PRB (R))

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