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Spin-Orbital Locking, Emergent Pseudo-Spin, and Magnetic order in Na_2IrO_3 SUBHRO BHATTACHARJEE[1], University of Toronto, SUNG-SIK LEE[2], McMaster University, YONG BAEK KIM[3], University of Toronto — The nature of magnetic order in the honeycomb lattice Iridate Na_2IrO_3 is explored by considering trigonal crystal field effect and spin-orbit coupling. An effective Hamiltonian is derived in terms of an emergent pseudo-spin-1/2, resulting from a spin-orbital locking, which is different from $j_{\rm eff} = 1/2$ that is obtained when the spin-orbit coupling dominates. The resulting Hamiltonian is anisotropic and frustrated. Mean field theory suggests a ground state with 4-sublattice *zig-zag* magnetic order in the relevant parameter regime, in conformity with experiments. Various properties of the phase, the spin-wave spectrum and experimental consequences are discussed. Our approach contrasts with the recent proposal of a Heisenberg-Kitaev system for this material, and we point out the intrinsic difficulties with the latter approach for describing the magnetic properties of Na_2IrO_3.

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