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Generic spin model for the honeycomb iridates beyond the Kitaev limit JEFFREY G. RAU, ERIC KIN-HO LEE, HAE-YOUNG KEE, University of Toronto — Recently, realizations of Kitaev physics have been sought in the A_2IrO_3 family of honeycomb iridates, originating from oxygen-mediated exchange through edge-shared octahedra. However, for the $j_{\text{eff}} = 1/2$ Mott insulator in these materials exchange from direct d-orbital overlap is relevant, and it was proposed that a Heisenberg term should be added to the Kitaev model. Here we provide the generic nearest-neighbour spin Hamiltonian when both oxygen-mediated and direct overlap are present, containing a bond dependent off-diagonal exchange in addition to Heisenberg and Kitaev terms. We analyze this complete model using a combination of classical techniques and exact diagonalization. Near the Kitaev limit we find new magnetic phases: 120° and incommensurate spiral order, as well as extended regions of zigzag and stripy order. Possible applications to Na_2IrO_3 and Li_2IrO_3 are discussed.

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