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Theory of Magnetic Phases in Hyperhoneycomb and Harmonic-honeycomb Iridates[1] ERIC KIN HO LEE, YONG BAEK KIM, Univ of Toronto
— Motivated by recent experiments, we consider a generic spin model in the $j_{\text{eff}} = 1/2$ basis for the hyperhoneycomb and harmonic-honeycomb iridates. Based on microscopic considerations, the effect of an additional bond-dependent anisotropic spin exchange interaction (Γ) beyond the Heisenberg-Kitaev model is investigated. We obtain the magnetic phase diagrams of the hyperhoneycomb and harmonic-honeycomb (H-1) lattices via a combination of the Luttinger-Tisza approximation, single-Q variational ansatz, and classical Monte Carlo simulated annealing. The resulting phase diagrams on both systems show the existence of incommensurate, non-coplanar spiral magnetic orders as well as other commensurate magnetic orders. The spiral orders show counter-propagating spiral patterns, which may be favorably compared to recent experimental results on both iridates. The parameter regime of various magnetic orders and ordering wavevectors are quite similar in both systems. We discuss the implications of our work to recent experiments and also compare our results to those of the two dimensional honeycomb iridate systems.

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