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Heisenberg-Kitaev model on the hyperhoneycomb lattice[1] ERIC KIN-HO LEE, ROBERT SCHAFFER, SUBHRO BHATTACHARJEE, University of Toronto, YONG BAEK KIM, University of Toronto, Korea Institute for Advanced Study — Motivated by recent experiments on β-Li_2IrO_3, we study the phase diagram of the Heisenberg-Kitaev model on a three dimensional lattice of tri-coordinated Ir^{4+}, dubbed the hyperhoneycomb lattice. The lattice geometry of this material, along with Ir^{4+} ions carrying $J_{eff} = 1/2$ moments, suggests that the Heisenberg-Kitaev model may effectively capture the low energy spin physics of the system in the strong-coupling limit. Using a combination of semiclassical analysis, exact solution, and slave-fermion mean field theory, we find a spin-liquid and four different magnetically ordered phases—the Neel, the polarized ferromagnet, the skew-stripy, and the skew-zig-zag. The three dimensional Z_2 spin liquid, which extends over an extended parameter regime around the exactly solvable Kitaev point, has a gapless Majorana mode with a deformed Fermi-circle (co-dimensions, $d_c = 2$). We discuss the effect of magnetic field and finite temperature on various phases that may be relevant for future experiments.

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