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Mean field phase digram of the layered perovskite $(Li, Na)_2IrO_3$ in the strong interaction limit: possible realization of spin liquid phases[1] MEHDI KARGARIAN, JUN WEN, GREGORY A. FIETE, The University of Texas at Austin — We study the phase diagram of layered perovskite $(Li, Na)_2IrO_3$ with an underlying honeycomb lattice structure in the strongly interacting limit. Because of the strong spin-orbit coupling of iridium, the effective spin exchange model is highly anisotropic and frustrated. We use the Schwinger fermion approach to map out the phase diagram of the model. At the mean field level several spin liquid phases are found: a gapless spin liquid , a chiral spin liquid, and a helical spin liquid phase. Moreover, in the strong exchange coupling limit we obtain a dimerized phase. The gapless spin liquid phase is characterized by Dirac nodes. In the chiral phase the Dirac nodes are gapped in the bulk, and the system possess a nonzero Chern number signifying existence of chiral modes along the boundary of the system. The helical phase preserves time reversal symmetry, has a bulk gap, and features helical gapless edge modes along boundary analogous to those in topological insulators with a nontrivial invariant. We further investigate the nature of the spin liquid phase by considering the gauge fluctuations above the mean field solution. The chiral spin liquid phase is stable as it breaks time reversal symmetry and acquires a nonzero Chern-Simon term in the effective low energy theory.

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Mehdi Kargarian
The University of Texas at Austin

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