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Magnetic structure of the frustrated fcc iridate $(\text{NH}_4)_2\text{IrCl}_6$: A candidate $J_{\text{eff}}=1/2$ Mott insulator

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Magnetic materials containing octahedrally coordinated Ir^{4+} ions can give rise **novel $J_{\text{eff}} = \frac{1}{2}$ magnetic moments** due to the interplay of **strong spin-orbit coupling**, onsite Coulomb repulsion and crystalline electric field. The exchange interaction between such moments depends on the geometry of the exchange paths between the magnetic ions and could be **highly anisotropic** such as the **Kitaev exchange** in 2D honeycomb lattice. This could lead to a rich variety of magnetic ground states with **exotic excitation** as has been proposed theoretically and also observed experimentally in several real materials. $(\text{NH}_4)_2\text{IrCl}_6$ retains its cubic symmetry (fcc) down to very low temperatures and offer best possible condition for the cubic crystalline electric field to realize genuine $J_{\text{eff}} = \frac{1}{2}$ state. The crystal and magnetic structures of the $(\text{NH}_4)_2\text{IrCl}_6$ single crystal have been studied using neutron diffraction, synchrotron X-ray diffraction and resonant inelastic X-ray scattering techniques. The study shows that the interplay of geometrical frustration and the bond dependent exchange frustration stabilizes a type-III collinear AFM ordering at $T_N = 2.1$ K with propagation vector $(1 \frac{1}{2} 0)$. Thus **the bond dependent Kitaev interaction in the fcc lattice may oppose the magnetic frustration** which is in sharp contrast to the Kitaev interaction in honeycomb lattices promoting quantum spin-liquid ground states.

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