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Novel magnetism of Ir⁵⁺ ions in the double perovskite Sr₂YIrO₆¹

GANG CAO, T.F. QI, LA LI, J. TERZIC, S.J. YUAN, L.E. DELONG, G. MURTHY, R.K. KAUL, University of Kentucky — We synthesize and study single crystals of a new double-perovskite Sr₂YIrO₆. Despite two strongly unfavorable conditions for magnetic order, namely, pentavalent Ir⁵⁺(5d⁴) ions which are anticipated to have J=0 singlet ground states in the strong spin-orbit coupling (SOC) limit, and geometric frustration in a face centered cubic structure formed by the Ir⁵⁺ ions, we observe this iridate to undergo a novel magnetic transition at temperatures below 1.3 K. We provide compelling experimental and theoretical evidence that the origin of magnetism is in an unusual interplay between strong non-cubic crystal fields, local exchange interactions and “intermediate-strength” SOC. Sr₂YIrO₆ provides a rare example of the failed dominance of SOC in the iridates.

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