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Spin-Orbit Interaction Rediscovered in Transition Metal Oxides[1]

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The $5d$-transition metal oxides are a class of novel materials that exhibit nearly every collective state known for solids. It is commonly expected that iridium oxides should be more metallic and less magnetic than their $3d$and $4f$ counterparts due to the extended nature of the $5d$orbitals. In marked contrast, many iridates are magnetic insulators that exhibit a large array of phenomena seldom or never seen in other materials. We review the anomalous physical properties of several iridates and address potential underlying mechanisms, which include strong orbital magnetism, the $J_{eff} = 1/2$ insulating state, and spin-orbit coupling; the latter strongly competes with other interactions to create an unusual balance between relevant degrees of freedom in this class of materials.

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