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**The Consequences of Spin-Orbit Coupling on the $5d^3$ Electronic Configuration**

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The impact of spin-orbit coupling on collective properties of matter is of considerable interest. The most intensively investigated materials in this regard are Iridium-based transition metal oxides which exhibit a host of interesting ground states that originate from a $5d^5$ $J_{\text{eff}}=1/2$ electronic configuration. Moving beyond the $J_{\text{eff}}=1/2$ paradigm to other electronic configurations where spin-orbit coupling plays a prominent role is a key objective of ongoing research. Here we focus on several Osmium-based transition metal oxides such as $NaOsO_3$, $Cd_2Os_2O_7$, $Ca_3LiOsO_6$, $Sr_2ScOsO_6$, $Ba_2YOsO_6$, and $Sr_2FeOsO_6$, which are nominally in the $5d^3$ electronic configuration. Within the LS coupling picture and a strong octahedral crystal field, the $5d^3$ configuration is expected to be an orbital singlet and spin-orbit effects should be minimal. Nevertheless, our neutron and x-ray scattering investigations of these materials as well as investigations by other groups show dramatic effects of spin-orbit coupling including reduced moment magnetic order, enhanced spin-phonon coupling, and large spin gaps. In particular, the anisotropy induced by spin-orbit coupling tips the balance of the frustrated interactions and drives the selection of particular magnetic ground states. To understand the mechanism driving the spin-orbit effects, we have explored the ground state $t_{2g}$ manifold with resonant inelastic x-ray scattering and observe a spectrum inexplicable by an LS coupling picture. On the other hand, an intermediate coupling approach reveals that the ground state wave function is a J=3/2 configuration which answers the question of how strong spin-orbit coupling effects arise in $5d^3$ systems.