Magnetism and the spin-orbit coupling in Sr_2IrO_4 and $LaCoO_3$

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Sr_2IrO_4 becomes scientifically intriguing in last 8 years after announced by Kim *et al.* (Phys. Rev. Lett. **101** (2008) 076402) formation in Sr_2IrO_4 of new quantum state bands produced predominantly by the strong spin-orbit coupling. The successful revealing of the Ir^{4+} many-electron crystal-field (CEF) states with the importance of the spin-orbit coupling confirms the Quantum Atomistic Solid State Theory (QUASST) worked out by Radwanski *et al.* (Acta Phys Pol. B **31** (2000) 3079, Acta Phys. **7-8** (2007)). QUASST was the only theory, which has claimed from 1995 the existence of the discrete CEF electronic structure and the foundamental importance of the spin-orbit coupling in $3d/4d/5d/$ oxides for physically-adequate description of the magnetism and the low-energy electronic structure. Thus, it is of scientific importance to present our studies at the conference, where many-electron crystal-field based analyses have been largely ignored or even expelled. We have performed calculations of the low-energy electronic structure and the magnetic properties, like the value and the direction of the magnetic moment, at the atomic scale and in the meV energy scale. Comparison will be made with $LaCoO_3$, where the low-spin Co state is also realized. The role of electron, intra- and inter-site, correlations will be discussed.