PAUL SCHERRER INSTITUT

PSI Colloquium

Friday, March 24, 2017, 11:15 h, WHGA/001

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Spin-orbit coupling meets with electron correlations - A guided tour to complex iridium oxides -

Transition metal oxides with 3d elements have been long a major playground for the science of strongly correlated electron systems (SCES). Recently, 5d transition metal oxides (TMO), in particular iridium oxides, emerged as a new paradigm in SCES research, where very strong spin-orbit coupling meets with electron correlations. Spin-orbit coupling is a relativistic effect and relates the spin moment of an electron to its orbital momentum via a momentum-dependent effective magnetic field. While it is of the order of tenths meV for 3d TMO, spin orbit coupling is as large as a half eV in 5d TMO represented by iridium oxides, due to the strong relativistic effect inherent in heavy elements. The large spin-orbit coupling in 5d TMO can be even comparable to the on-site Coulomb repulsion U [1,2]. In this talk, we would like to demonstrate the exotic ground states of 5d Ir^{4+} complex oxides produced by the novel interlay of strong spin-orbit coupling with the electron correlations and the symmetry of lattice. Topics include the spin-orbital Mott state and J_{eff}=1/2 Heisenberg antiferromagnetism in the layered perovskite Sr_2IrO_4 [1-4], Kitaev-type quantum spin liquid state in the honeycomb based α- and β-Li_2IrO_3 [4,5], correlated Dirac node semi-metal state in the perovskite $SrIrO_3$ [6,7], and spintronic functions in IrO_2[8].

[1] B. J. Kim *et al.*, *Phys. Rev. Lett.* **101**, 076402 (2008).
[2] B. J. Kim *et al.*, *Science* **323**, 1329 (2009).
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[4] G. Jackeli and G. Khaliullin, *Phys. Rev. Lett.* **102**, 017205 (2009).
[5] T.Takayama, *et al.*, s *Phys. Rev. Lett.*114, 077202 (2015).
[6] Y. Chen *et al.* ,Nat. Commun. 6:6593 doi: 10.1038/ncomms7593 (2015).
[7] J. Matsuno *et al.*, *Phys. Rev. Lett.* **114** 247209(2015).
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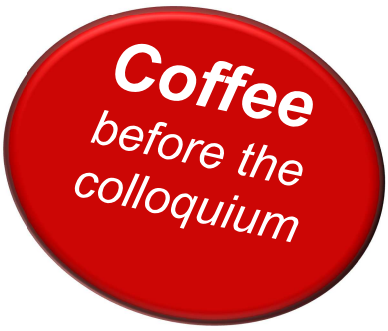

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