

# ZERNIKE INSTITUTE COLLOQUIUM

Thursday, October 6<sup>th</sup>, 2016

16:00h, Lecture Hall: 5111.0080

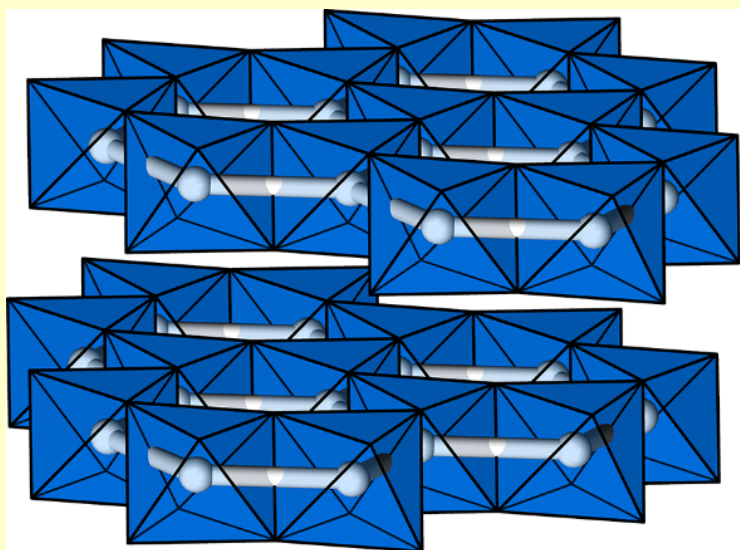
Coffee and cakes from 15:30h

## Spin-orbit coupling meets with electron correlations – a guided tour to exotic electronic states of 5d transition metal oxides

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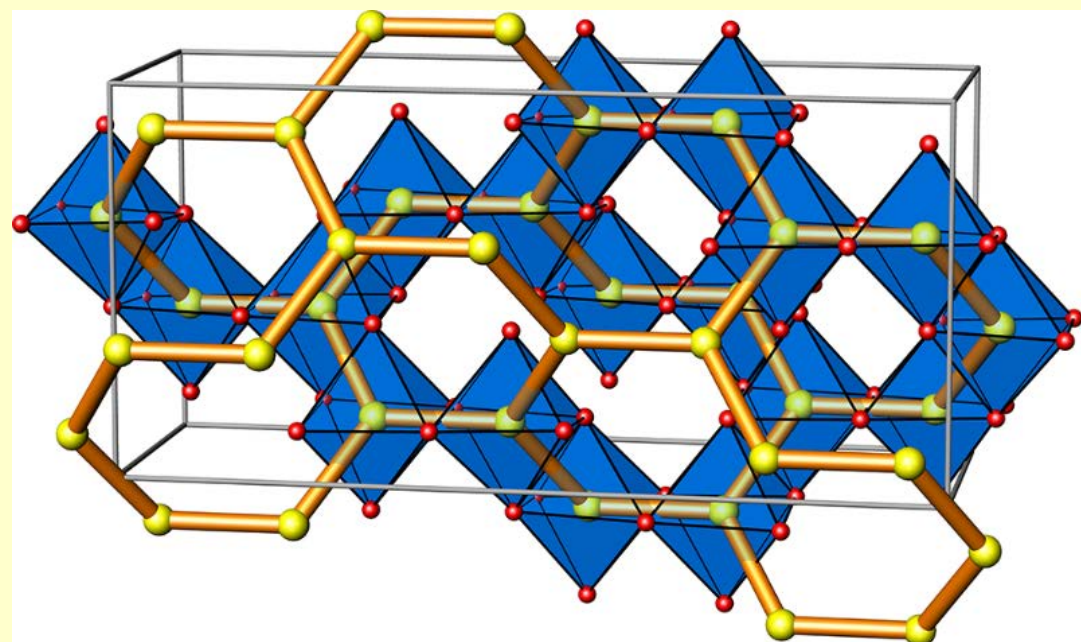
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Transition metal oxides with 3d elements have been long a major playground for the science of strongly correlated electron systems (SCES). Recently, 5d transition metal oxides (TMO), in particular iridium oxides, emerged as a new paradigm in SCES research, 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 in 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, even comparable to the Coulomb repulsion [1,2]. In this talk, we would like to demonstrate the exotic ground states in Ir<sup>4+</sup> 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  $J_{\text{eff}}=1/2$

Heisenberg antiferromagnetism in the layered perovskite Sr<sub>2</sub>IrO<sub>4</sub> [1-4], Kitaev-type quantum spin liquid state in the honeycomb based a- and b-Li<sub>2</sub>IrO<sub>3</sub> [4,5] and correlated Dirac node semi-metal state in the perovskite SrIrO<sub>3</sub> [6,7].



- [1] B. J. Kim *et al.*, *Phys. Rev. Lett.* **101**, 076402 (2008).
- [2] B. J. Kim *et al.*, *Science* **323**, 1329 (2009).
- [3] S.S. Fujiyama *et al.*, *Phys. Rev. Lett.* **108**, 247212 (2012).
- [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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