Special Topics Course
PHY690N - Correlated Electrons and Quantum Magnetism
Semester : 2019-II, Credits [9]
Instructor: Avinash Singh

Course Objective: Microscopic understanding of magnetic ordering and excitations in terms of realistic multi-orbital correlated electron models. Focus will be on many body theory including self energy and vertex corrections, and understanding detailed momentum dependence of magnetic and electronic excitations probed experimentally using Inelastic Neutron Scattering, Angle Resolved Photo Emission Spectroscopy, Spin Polarized Electron Energy Loss Spectroscopy, Resonant Inelastic X-ray Scattering.

Topics will include:

1. Quantum Antiferromagnetism and Hole Dynamics (Cuprates)
2. Quantum Corrections in a Metallic Ferromagnet (3d Transition Metals)
3. Ferromagnetism in Diluted Magnetic Semiconductors ($Ga_{1-x}Mn_xAs$)
4. Spin-Charge-Orbital Ordering in Doped Manganites ($La_{1-x}Sr_xMnO_3$)
5. 120^0 AFM Ordering in Triangular Lattice Systems ($HoMnO_3$, $YMnO_3$)
6. Magnetic Frustration and Excitations in FCC Lattice Systems (MnS_2)
7. Multi-Orbital Quantum Antiferromagnetism (Iron Pnictides)
8. Triplon Excitations in a Quantum Spin Liquid ($TlCuCl_3$)
9. Strongly Spin-Orbit-Coupled 5d Systems (Iridates and Osmates)
10. Spin-Orbital Entanglement and Magnetic Excitations (Sr_2IrO_4)
11. Spin-Orbit Coupling and Magnetic Anisotropy (bilayer Iridates)
12. Spin-Dependent Hopping and Kitaev-Heisenberg Model (Na_2IrO_3)
13. Pseudo-Spin Rotation Symmetry of Coulomb Interaction Terms.