

PHYS8777.01

Magnetism and Magnetic Materials (MMM)

Instructor: Prof. Fazel Tafti, Higgins 330A, fazel.tafti@bc.edu

Lectures: Tuesdays and Thursdays, 9:00 am, Higgins 263

Office hours: Tuesdays 4-6 pm, Higgins 330A

Start date: January 16, 2018

Prerequisites: This is an elective graduate course.

Contents:

- Survey on common crystal structures of magnetic materials including perovskite, corundum, garnet, olivine, fluorite, and spinel
- Single atom magnetism, spin-orbit interaction, atomic and molecular diamagnetism, van Vleck diamagnetism, total angular momentum, Lande factor, effect moment, magnetic trends in the periodic table
- Dipolar interaction, Exchange interaction, Oxidation states, Mixed valency
- Heisenberg model, Mott-Hubbard model, Charge transfer, the role of orbitals in magnetism
- Super exchange and Double exchange interactions, magnetic oxide materials
- Coordination chemistry, Bonding, Crystal field effect
- Phenomenological treatment of Paramagnetism, Curie-Weiss law, Brillouin function, Electromagnetic units, Methods of measuring magnetization
- Magnetic order, Ferromagnetism, Antiferromagnetism, and Ferrimagnetism
- Low dimensional magnetism, Ising model, and XY model
- Spin glass, cooperative paramagnets, spin liquids
- Introduction to Neutron scattering, muSR, and NMR

References:

1. Lecture notes will be provided
2. Magnetochemistry by Orchard
3. Lecture notes by Fazekas
4. Magnetism by Blundell

Evaluation: 40% homework, 60% presentation/paper for midterm and final. Each presentation is 15 minutes followed by 5 minutes of discussions. Paper should be 5 pages maximum.