

PHY624A: 2023-24

Magnetism in materials

Instructor: Soumik Mukhopadhyay

Objectives:

Magnetism is a branch of condensed matter physics which is constantly evolving in terms of fundamental new discoveries as well as in terms of possible wide-ranging applications. This course will serve as an introduction to the foundational aspects of magnetism in solids. The course will also aim at providing the students with the requisite understanding of the current major research areas in the field of magnetism. The theoretical content will be supplemented by experimental details, wherever necessary.

Course contents:

Non-interacting spin systems; Isolated magnetic moments, Spin-orbit interaction and crystal field effects, paramagnetism of localized moments, Itinerant paramagnetism, Landau diamagnetism; Interacting spin systems, Phase transitions and magnetic long range order; Magnetic long range order in local and itinerant spin systems; Quantum magnets; Low energy excitation: spin waves; Heavy Fermion Kondo systems; Magnetism and topology in solids: topological insulators and semimetals with magnetic long range order; Quantum Spin liquids; Magnetic long range order in 2D van der Waals crystals; Spin polarization; Spin Hall effect; Ferromagnetic resonance and spin pumping; Inverse Spin Hall effect.

Prerequisites:

It will be assumed that the students have already taken an introductory course on solid state physics.