

Advanced Topics in Magnetism and Superconductivity

Docente/i: **Lorenzana Jose** - jose.lorenzana@cnr.it ISC-CNR, Sapienza Dipartimento di Fisica Sapienza ISC-CNR

crediti: 3 - *periodo/nizio:* Estimated start: March 10th. /

The course will cover aspects of magnetism and superconductivity often not covered in undergraduate programs. The tentative program will be adapted according to the interests of the students.

Estimated start: March 10th.

- Orbital and spin magnetism spin-orbit interaction.
- Exchange, superexchange and double exchange
- Goodenough-Kanamori-Anderson rules
- Models by Zener and De Gennes
- Landau and Ginzburg–Landau theory of phase transitions
- Ferromagnetism and Antiferromagnetism
- Spin waves
- Magnetism in Metals, Itinerant Ferromagnetism. Stoner criterion
- Landau levels and quantum Hall effect
- Topological Insulators
- Dynamical effective interactions and superconductivity (Migdal-Eliashberg theory, lectures by Maria Navarro Gastiasoro)
- Kosterlitz-Thouless transition

Bibliography:

- Quantum Theory of Solids, C. Kittel
- Magnetism in Condensed Matter, S. Blundell
- Lecture Notes on Electron Correlation and Magnetism, P. Fazekas
- Hasan, M. Z. & Kane, C. L. Colloquium: Topological insulators. *Rev. Mod. Phys.* 82, 3045–3067 (2010).
- Many Particle Physics, G. Mahan
- Principles of Condensed Matter Physics, P.M. Chaikin and T.C. Lubensky