

Proposta de disciplina do PPGFis  
FIP10604 - Física da Matéria Condensada: Magnetismo

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- **Semestre:** 2023/2
  - **Carga horária semanal:** 4
  - **Créditos:** 4
  - **Pré-requisitos:**
  - **Professor/Responsável:** Miguel A. C. Gusmão
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## Súmula

Magnetic units; atomic magnetic moments; exchange interactions; spin Hamiltonians; magnetic order; spin waves; magnetism in metals; coexistence of localized and itinerant magnetic moments; macroscopic aspects of magnetism.

## Objetivos

Discussion of basic concepts related to magnetic properties of solids, introducing usual models and methods, with emphasis on comparison of theoretical results with experimental observations.

## Programa

- **Introduction:** magnetic moment, magnetization, magnetic susceptibility; unit systems; diamagnetism, paramagnetism, types of magnetic order.
- **Localized magnetic moments:** atomic magnetic moments; paramagnetism of independent magnetic moments; crystal-field effects; exchange interactions; spin Hamiltonians: Heisenberg, Ising and similar models; low-temperature magnetic order: spin waves; mean-field approximation; high-temperature series; exact solutions of low-dimensional systems.
- **Itinerant magnetic moments:** Pauli paramagnetism; Hartree-Fock approximation for interacting electrons; Stoner criterion; magnetic order in metals; elementary excitations in the ordered phase.

- **Impurities and alloys:** magnetic impurities in metals; coexistence of localized and itinerant magnetic moments; Anderson and Kondo models; RKKY interaction; magnetism in correlated-electron systems.
- **Macroscopic aspects:** dipolar interaction; magnetic domains; anisotropy effects; demagnetizing field; magnetic hysteresis: remanence and coercivity; measurement techniques for magnetic properties.

## Método de Trabalho

Regular lectures; lecture notes (distributed via web page); suggested problems; seminars.

## Avaliação

According to the University rules, the students will receive grades A, B, C, or D. They will be evaluated individually, on the basis of their participation in classes, performance in the solution of suggested problems, and presentation of a seminar on a current research topic related to the course contents.

## Bibliografia

- M. CYROT et al., *Magnétisme* (Vol I)
- D. C. MATTIS, *The Theory of Magnetism*
- S. FONER, *Magnetism, selected topics*
- D. H. MARTIN, *Magnetism in Solids*
- Additional bibliography suggested during the course.

## Observações