UE Magnetism and nanosciences

Niveau d'étude
Bac +4

ECTS
3 crédits

Composante
UFR Physique, Ingénierie, Terre, Environnement, Mécanique (PhITEM)

Période de l'année
Automne (sept. à dec./janv.)

Diplômes intégrant cet élément

- Master Nanosciences et nanotechnologies

Langue(s) d'enseignement: Anglais

Ouvert aux étudiants en échange: Oui

Code d'export Apogée: PAX7NQAF

Présentation

Description

Goal: Magnetism is widely present in our daily environment, especially through the use of magnetic materials (motors and actuators, magnetic recording, MRI etc.). It is also a very active field of fundamental research, particularly in Grenoble. Meso- and macroscopic aspects are presented in details and the complex magnetic structures that are the subject of current research are discussed.

Content: This course is based on the following plan.

I) Magnetism at atomic level, magnetic behaviours, magnetic ordering

II) Magnetostatics (electromagnetism, definitions, demagnetizing field, linear magnetism, units)

III) Experimental techniques

IV) Phenomenology, mesoscopic magnetism (anisotropy, magnetization reversal, domain walls)

V) Spin-dependent transport-Spintronics (Electronic transport in ferromagnets, Giant Magnetoresistance (GMR), Spin dependent tunneling, Magnetic tunnel junctions)

Informations non contractuelles.
Dernière mise à jour le 30 juin 2026

Tutorials: Magnetostatics; magnetic orders, magnetic moments ; magnetic anisotropy ; magnetization reversal ; domain walls ; spin dependent transport
Labwork: Students will follow 2 labworks among 4:
Vibrating sample magnetometer (inductive measurement of hysteresis loop for a ferromagnetic sample, anisotropy)
Susceptibility (measurement of temperature evolution of susceptibility, Curie-Weiss law),
SQUID (use of a SQUID magnetometer to measure magnetic fields)
Magnetotransport (extraordinary Hall effect and giant magnetoresistance measurements)
Prerequisites: Knowledge in electromagnetism and solid state physics
Bibliography:
Magnetism vol 1, dir E. de Lacheisserie, PUG (1999)
EDP Sciences Introduction to Solid State Physics,
C. Kittel Solid State Physics
N. Aschroft and N. Aschroft. Mermin Magnetism and Magnetic Materials, J.M.D. Coey

Heures d'enseignement

CMTD	Cours magistral - Travaux dirigés	20h
TP	TP	8h

Période : Semestre 7

Infos pratiques

Campus

Grenoble - Domaine universitaire

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