UE Soft Matter I

Niveau d'étude
Bac +4

ECTS
3 crédits

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

Période de l'année
Printemps (janv. à avril/mai)

Diplômes intégrant cet élément

- Master Nanosciences et nanotechnologies

Langue(s) d'enseignement: Anglais

Ouvert aux étudiants en échange: Oui

Code d'export Apogée: PAX8NFAG

Présentation

Description

Goal: This course proposes an introduction to soft matter physics. The physics of soft matter is governed by weak interactions which are at the source of the generic characteristics of soft matter systems: nanoscale self-organisation at room temperature, importance of entropy and fluctuations, high susceptibility and response to stimulii, specific structures at surfaces and interfaces, slow dynamics. The course is organized in two parts. The first part describes the interactions at work in soft matter systems and their measurements. The second part develops on the particular system of polymer melts and solutions, the generic characteristics of soft matter systems and the physical tools needed to modelize them.

Objectifs

Content
Part I. Interactions at the colloidal scale.

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

Van der Waals/Casimir interactions, Hamaker constant.
Electrostatic interactions, Debye's-Huckel and Gouy-Chapman double-layers.
Depletion interactions ; Helfrish interactions between membranes.
Measurements of weak interactions.

Part II. Basics concepts in soft matter : the case of polymer chain.
The ideal chain : properties of a random walk.
Effect of short range interactions : mean-field model.
Structure factor and diffusion of electromagnetic waves.
Scaling laws : examples in polymer solutions.
General theory of brownian motion. Langevin and Fokker-Planck equations ; Einstein law of fluctuation-dissipation.
The Rouse model of polymer dynamics.

Heures d'enseignement

CMTD	Cours magistral - Travaux dirigés	22,5h

Pré-requis recommandés

General physics of the Bachelor Level. Electromagnetisms ; thermodynamics.
Maths : Fourier series, Fourier transforms, Dirac function, and their use for solving linear partial differential equations.
A first course in statistical physics.

Période : Semestre 8

Bibliographie

Molecular and Surface forces, J.K. Israelachvili
Introduction to polymer physics, M. Doi

Infos pratiques

Campus

Grenoble - Domaine universitaire

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