

Structure of condensed matter: radiation scattering methods

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This lecture will aim at presenting the main radiation scattering techniques (light, X-ray and neutron) that allow studying the structure of soft condensed matter. The notion of structure covers the average structure as well as its modulations, or defects. Therefore, the lecture will consider the most modern techniques associated with the use of synchrotron radiation and neutron sources, and specifically: anomalous X-ray scattering; specular and off-specular reflectivity; coherent X-ray scattering.

The outline of the lecture could be:

I Introduction

- Structure; dispersed media; significance of the structural studies (structure and topology) for the understanding of the transport or use properties of the matter
- Scattering functions
- Scattering versus microscopy

II Small angle radiation scattering techniques

- Formalism; spatial and chemical resolutions
- Partial scattering functions and contrast variation methods
- General theorems
- Instrumentation

III Applications

From the scattered intensity to the structure of polymers and colloids; form factor and dispersion state of various particles

- Copolymers or heterogeneous particles
- Random Phase Approximation (RPA)

IV Ordered phases: diffraction and diffuse scattering

V Refraction and reflection from interfaces

VI Coherent X-ray scattering and X-ray photon correlation spectroscopy

VII Multiple scattering

Structure des phases condensées : diffusion et diffraction des rayonnements

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Ce cours propose une présentation des techniques de diffusion et diffraction des rayonnements (lumière, rayons X et neutrons) qui permettent d'étudier la structure des phases condensées. Il s'intéresse en particulier aux techniques les plus modernes, associées aux très grands équipements : diffusion ou diffraction anormale, EXAFS, réflectivité et diffusion hors spéculaire.

Dans ce cours, la notion de structure est prise dans son sens le plus large et recouvre aussi bien la structure moyenne que ses modulations, ou défauts. Cela implique également de considérer aussi bien la diffusion statique que la diffusion dynamique.