MSE-435

Material science at large scale facilities

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Cursus	Sem.	Type
Materials Science and Engineering	MA1, MA3,	Opt.

Language of teaching	English
Credits	3
Session	Winter
Semester	Fall
Exam	Oral
Workload	90h
Weeks	14
Hours	**3 weekly**
Courses	2 weekly
Exercises	1 weekly
Number of positions	

Summary

This course provides a broad introduction into materials research using synchrotron X-rays, neutrons and myons. After an introduction into large scale facilities, we will dive into the different methods, including application examples from various fields of materials science.

Content

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- Interaction of X-rays/Neutrons with Matter
- Large-scale facilities and instrumentation
  - Synchrotron, X-ray free electron laser, and neutron sources
  - Beamlines & Detectors
- Scattering
  - Diffraction
  - Small-Angle Scattering
  - Magnetic Scattering
- Spectroscopy
  - Fluorescence spectroscopy
  - X-ray Absorption Near-edge Structure
  - Extended X-ray Absorption Fine Structure
  - Photo-emission electron spectroscopy
  - Muon spectroscopy
- Imaging and Tomography
  - X-ray absorption and phase contrast Imaging
  - Neutron Imaging
  - Coherent imaging
  - Scanning Imaging

The exercies will include the writing of a beamtime proposal for one specific material system

Keywords

X-rays, Neutrons, Imaging, Spectroscopy, Scattering, Diffraction

Learning Prerequisites

Required courses

Basic understanding of materials science

Teaching methods

Lectures (2h) and Exercises (1h), excursion to PSI visiting the large scale facilities
The nature of the exercises will vary, depending on the topic at hand. For one selected material science application example the students should write a beamtime proposal according to the typical guidelines used at synchrotrons.

Assessment methods

One student project on beamtime proposal which will be presented within the last two weeks of the semester and one oral examination. The oral exam counts for 75% the student project 25%.

Resources

Bibliography

An Introduction to Synchrotron Radiation: Techniques and Applications, Philip Willmott (2019), Wiley, DOI:10.1002/9781119280453
Neutron Imaging: From applied materials science to industry, Markus Strobl, Eberhard Lehmann (2024), IOP Publishing, DOI: 10.1088/978-0-7503-3495-2

Ressources en bibliothèque

- Find the references at the Library

Moodle Link

- https://go.epfl.ch/MSE-435