PHYS-637

Electron Matter Interactions in Transmission Electron Microscopy

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Cursus	Sem.	Type
Physics		Opt.

Contact language	English
Credits	2
Session	
Exam	Oral presentation
Workload	60h
Hours	**28**
Lecture	28
Number of positions	

Frequency

Every 2 years

Remark

Next time: Spring 2024

Summary

This course will present the fundamentals of electronâ##matter interactions, as occuring in the energy range available in modern transmission electron microscopes, namely 60-300 keV electrons. Diffraction and high-resolution image formation as well as electron energy-loss spectrometry will be covere

Content

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Week 1: Introduction (CH)
Week 2: Elastic scattering by atoms and crystals. Bloch wave theory. (DA)
Week 3. Elastic scattering: kinematical and dynamical diffraction. (DA)
Week 4: Advanced diffraction, thermal diffuse scattering. (DA)
Week 5: Eastic scattering: phase contrast. (TL)
Week 6: Phase contrast, high resolution imaging. (TL)
Week 7: Phase contrast, holography and other phase retrieval methods. (TL)
Week 8: Simulation software for imaging and diffraction. (TL and DA)
Week 9: Inelastic scattering, introduction. (CH)
Week 10: Inelastic scattering: core loss spectroscopy, experiments and theoretical simulations. (CH)
Week 11: Inelastic scattering: low loss EELS. (CH)
Week 12: Inelastic scattering: super low loss, EELS for plasmonics and nanophotonics. (DA)
Week 13: Special applications of EELS, cathodoluminescence; time-resolved EELS and PINEM. (DA and TL)
Week 14: Angular-resolved EELS and its applications in core and low losses. (CH)

Learning Prerequisites

Recommended courses

Solid state physics
general physics 1 2 3 4
Quantum mechanics

Expected student activities

By the end of the course, the students will be able to understand and discuss the physics behind current publications around advanced transmission microscopy in materials science and physics.

Resources

Moodle Link

- https://go.epfl.ch/PHYS-637