

LUNDS UNIVERSITET Naturvetenskapliga fakulteten

> **X-ray microscopy** Swedish title: Röntgenmikroskopi

Second Cycle / Avancerad nivå, 3 credits.

Time: One week full time

Goal

The course gives a thorough introduction to the physics and applications of X-ray interaction with matter, with an emphasis on imaging methods.

Learning outcomes

On completion of this course, the students should be able to:

- Explain the X-ray interaction with matter at the atomic scale
- Explain how the X-ray interaction with matter is exploited for different microscopy techniques
- Describe the common principle and experimental realization of all the X-ray microscopy methods presented.
- Evaluate the strengths and limitations of different X-ray microscopy techniques and compare these to other X-ray and non-X-ray based microscopy techniques.

Course content

- Introduction to X-rays: nature, properties, generation, interactions with matter.
- Transmission X-ray microscopy, absorption contrast
- Tomography
- Scanning X-ray Fluorescence (XRF) microscopy
- Scanning Diffraction microscopy
- Phase contrast imaging
- Coherent X-ray microscopy methods: Holography, Coherent diffraction imaging and ptychography.

Teaching

- Lectures
- Experiment at MAX IV
- Data analysis

Assessment

For passing grade: Participation in minimum 80% of lectures Participation in experiment Approved experimental report.

Grading scale Marking scale: Fail, Pass

Language The course is given in English

Literature

No literature is needed or used, but this book gives an excellent introduction to X-rays: *Elements of Modern X-ray Physics*, 2nd ed., Jens Als-Nielsen and Des McMorrow It is available free online: <u>http://onlinelibrary.wiley.com/book/10.1002/9781119998365</u>

Entry requirements

The course is open for PhD students from any faculty. No special pre-knowledge is assumed.