



Course unit English denomination	Elements of X-ray Physics
Teacher in charge (if defined)	Sun, Peihao Maurizio, Chiara Monaco, Giulio
Teaching Hours	24
Number of ECTS credits allocated	3
Course period	02/2025 – 06/2025
Course delivery method	☒ In presence ☐ Remotely ☐ Blended
Language of instruction	English
Mandatory attendance	☒ Yes (50% minimum of presence) ☐ No
Course unit contents	In this course, we will discuss theoretical and practical aspects of modern X-ray sources and their current use in the study of materials. The course program is divided into three parts: 1. X-ray sources: synchrotron radiation, undulators, coherent sources. 2. X-ray scattering theory: theory of X-ray – matter interaction, diffraction from amorphous materials, diffraction from crystals (kinematic theory and dynamical theory), refraction and reflection. 3. X-ray applications: X-ray optics, imaging (tomography, CDI, ptychography, etc.), XAS, dynamics (IXS, XPCS).
Learning goals	The goal of this course is to acquire a deeper understanding of the physics of X-rays starting from first principles, as well as a basic knowledge of various X-ray measurement techniques, so that the students will be prepared for X-ray experiments at modern synchrotron facilities.
Teaching methods	Frontal lectures with exercises.
Course on transversal, interdisciplinary, transdisciplinary skills	☒ Yes ☐ No
Available for PhD students from other courses	☒ Yes ☐ No
Prerequisites (not mandatory)	Knowledge of electrodynamics, optics, special relativity, quantum physics, and solid state physics.
Examination methods	Oral presentation on a topic of the student's choice relevant to the course.



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(in applicable)

Suggested readings

Elements of Modern X-ray Physics (Jens Als-Nielsen & Des McMorrow)
X-Ray Diffraction (B. E. Warren)
Lecture notes to be distributed during the course

Additional information
