



Course unit English denomination	Elements of X-ray Physics
SS	<b>PHYS-03/A</b>
Teacher in charge	Peihao Sun Chiara Maurizio Giulio Monaco
Teaching Hours	24
Number of ECTS credits allocated	3
Course period	March - June 2026
Course delivery method	<input checked="" type="checkbox"/> In presence <input type="checkbox"/> Remotely <input type="checkbox"/> Blended
Language of instruction	English
Mandatory attendance	<input checked="" type="checkbox"/> Yes (50% minimum of presence) <input type="checkbox"/> No
Course unit contents	<p>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:</p> <ol style="list-style-type: none"><li>1. X-ray sources: synchrotron radiation, undulators, coherent sources.</li><li>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.</li><li>3. X-ray applications: X-ray optics, imaging (tomography, CDI, ptychography, etc.), XAS, dynamics (IXS, XPCS).</li></ol>
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.



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Course on transversal,  
interdisciplinary,  
transdisciplinary skills

☒ Yes

☐ No

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Available for PhD  
students from other  
courses

☒ Yes

☐ No

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Prerequisites  
(not mandatory)

Knowledge of electrodynamics, optics, special relativity, quantum physics,  
and solid state physics.

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Examination methods  
(if applicable)

Oral presentation on a topic of the student's choice relevant to X-ray  
physics.

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Suggested readings

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

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Additional information

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