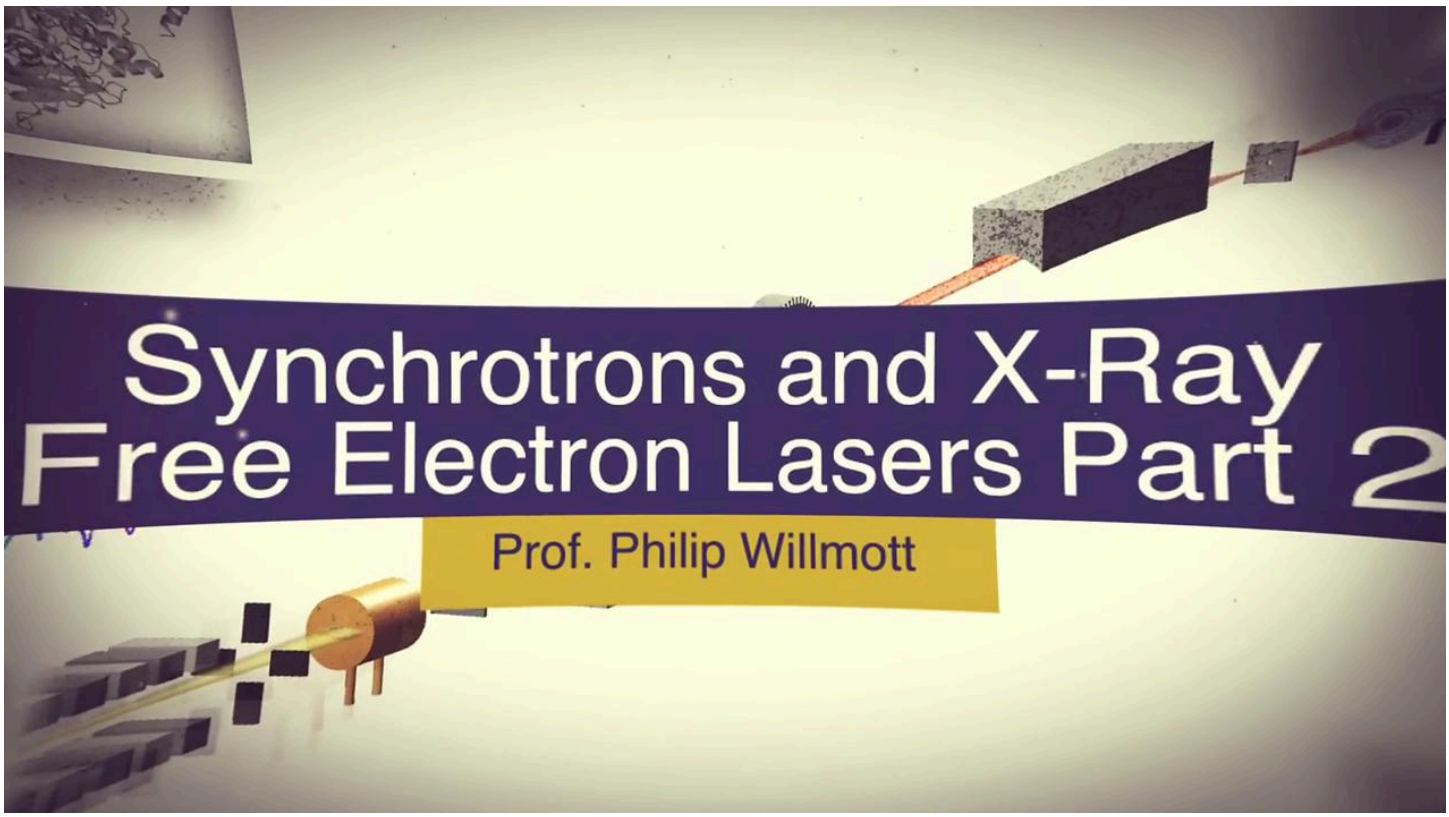
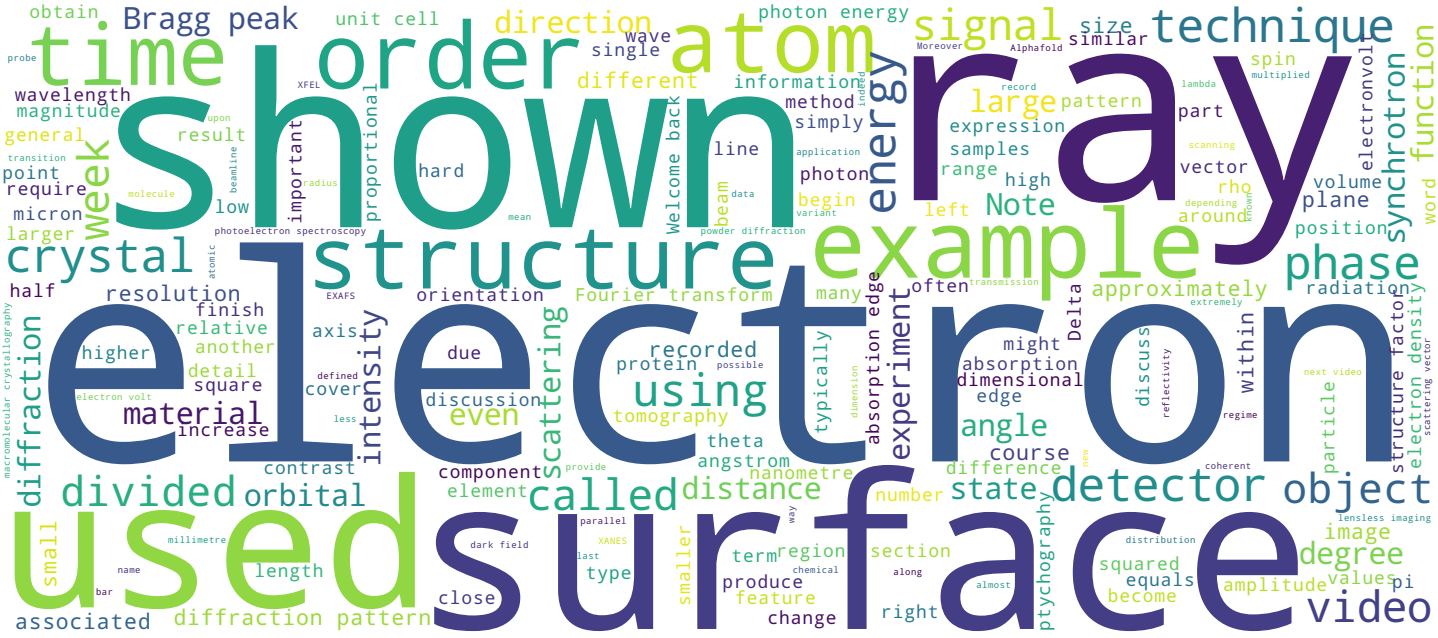

Synchrotrons and X-Ray
Free Electron Lasers Part 2
Prof. Philip Willmott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Synchrotrons and XFELs are large-scale research facilities that provide intense beams of X-rays that are used in almost all walks of scientific and technological endeavours, from advanced manufacturing to aeronautics, cultural heritage to catalysis, biological imaging to bacteriology, embryology to electrochemistry, neuroscience to nanotechnology, and palaeontology to protein crystallography, to name just a few alliterative examples. With over 200,000 users globally today and counting, the ubiquity of these strong, contemporary tools is only growing. The fundamentals of how X-rays interact with matter, the physics involved in creating synchrotron and XFEL radiation, and the tools required to harness these potent radiation sources to meet user needs at experimental stations were all covered in the sister course to this MOOC. The experimental methods and applications employed at synchrotron and XFEL facilities are addressed in detail in this MOOC, part two of the course. My name is Phil Willmott, Titular Professor of Physics at Zurich University and Science Coordinator for the upgrade of the Swiss Light Source Synchrotron Facility at the Paul Scherrer Institute in Switzerland.

Notes

Summary

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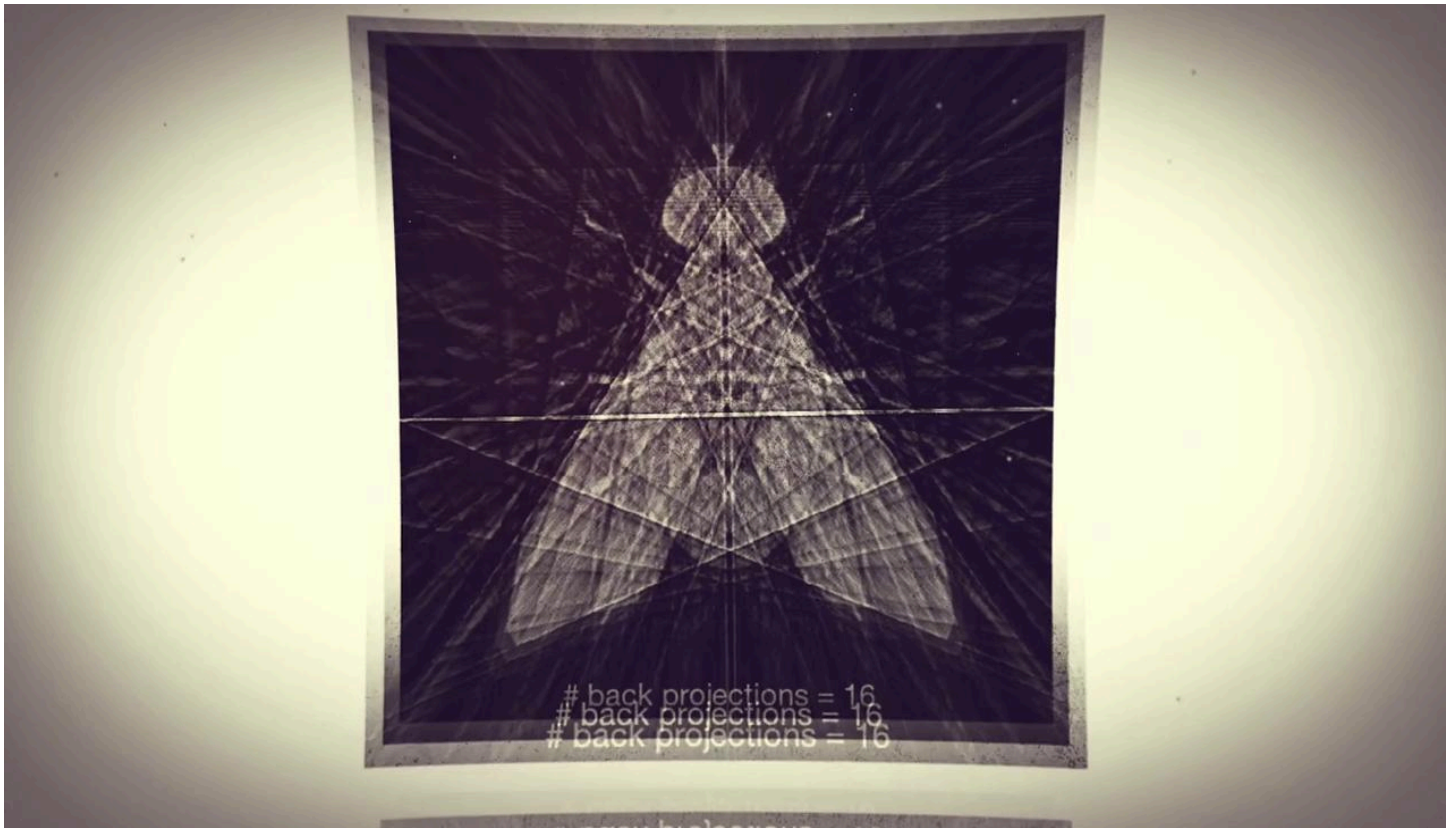

Over this six-week MOOC, I will introduce you, the student, to the techniques brought to bear on many fields of the natural and engineering sciences. These are broken down into three overarching methodologies of elastic scattering and diffraction, X-ray spectroscopies, and X-ray imaging, each lasting two weeks. In the first two weeks, we delve into the world of crystallography and elastic scattering, beginning with the theoretical backgrounds of crystallography and diffraction before we progress to the different approaches of single-crystal diffraction, including macromolecular crystallography, powder diffraction, surface diffraction, and small-angle scattering. The following fortnight concentrates on spectroscopic techniques, some of which can only be performed at synchrotrons. We start with some basic theoretical concepts required to understand the different techniques we will cover. These include various forms of absorption spectroscopy, fluorescent spectroscopy, and photoelectron spectroscopies. In the final two weeks, we discuss the somewhat nebulously defined area of imaging techniques. After all, most synchrotron techniques can, in one way or another, be thought of as kinds of imaging.

Notes

Summary

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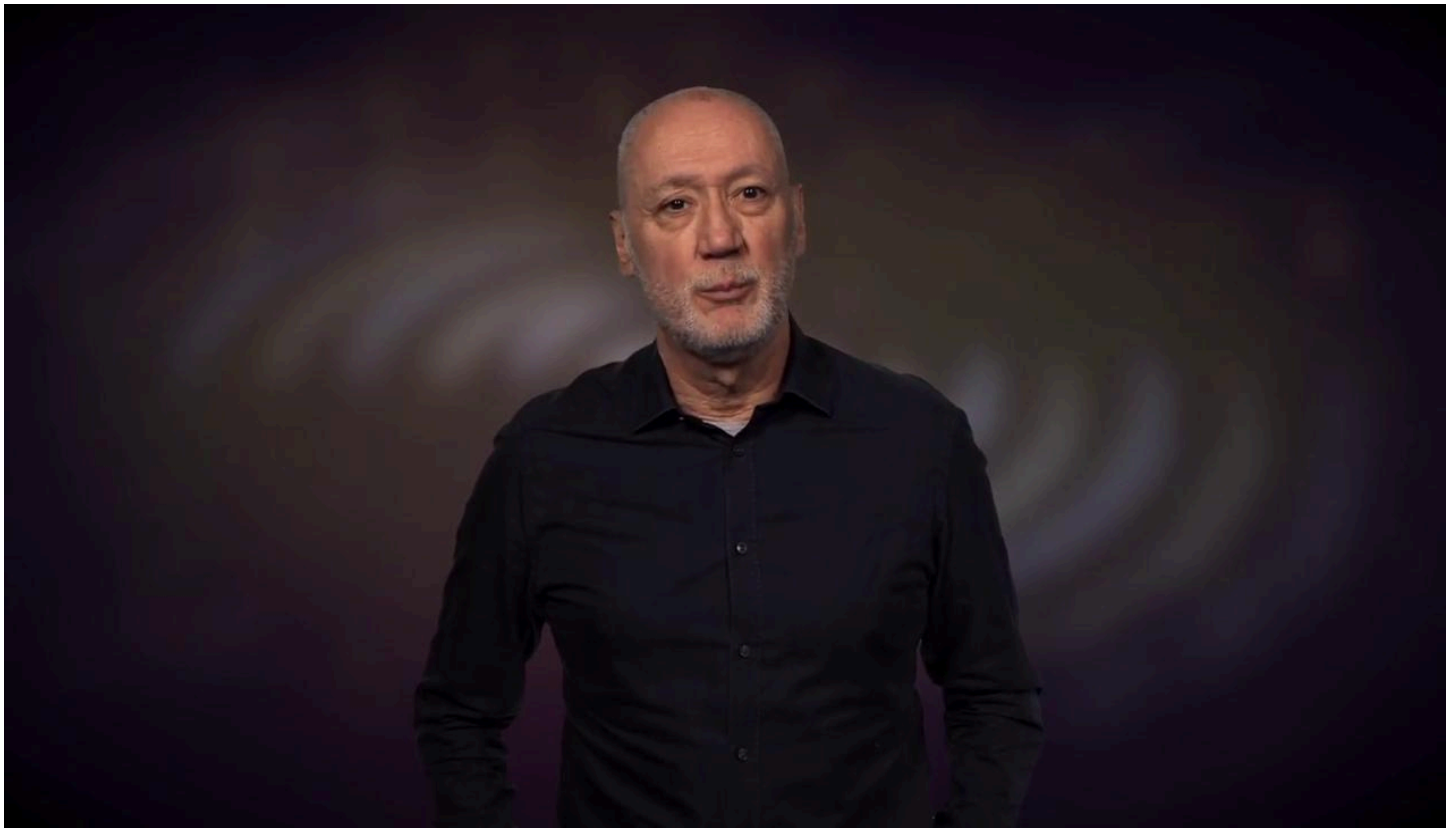

This part covers X-ray tomographies, Zernike and dark field microscopies, and lensless imaging, including the burgeoning technique of ptychography. I therefore invite you to join me in delving into the fascinating, surprising and burgeoning world of synchrotron and XFEL science that is today touching an unparalleled vista of scientific disciplines.

Notes

Summary

2m 46s