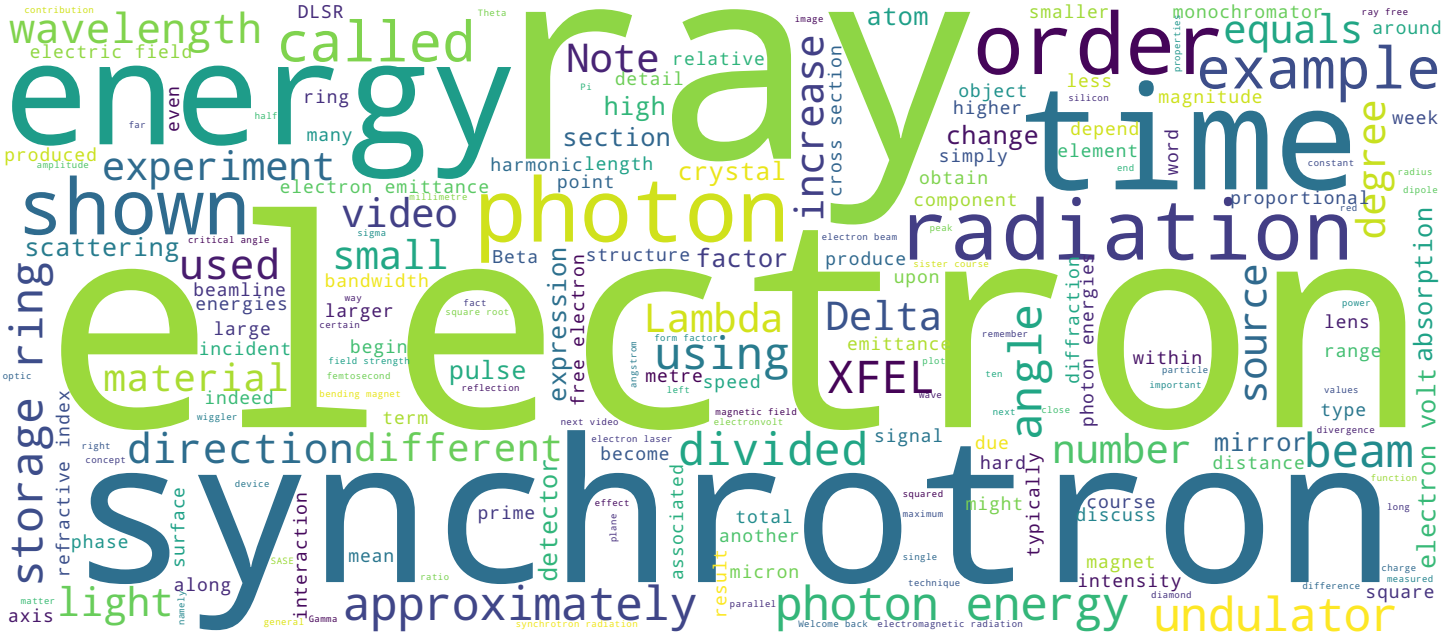
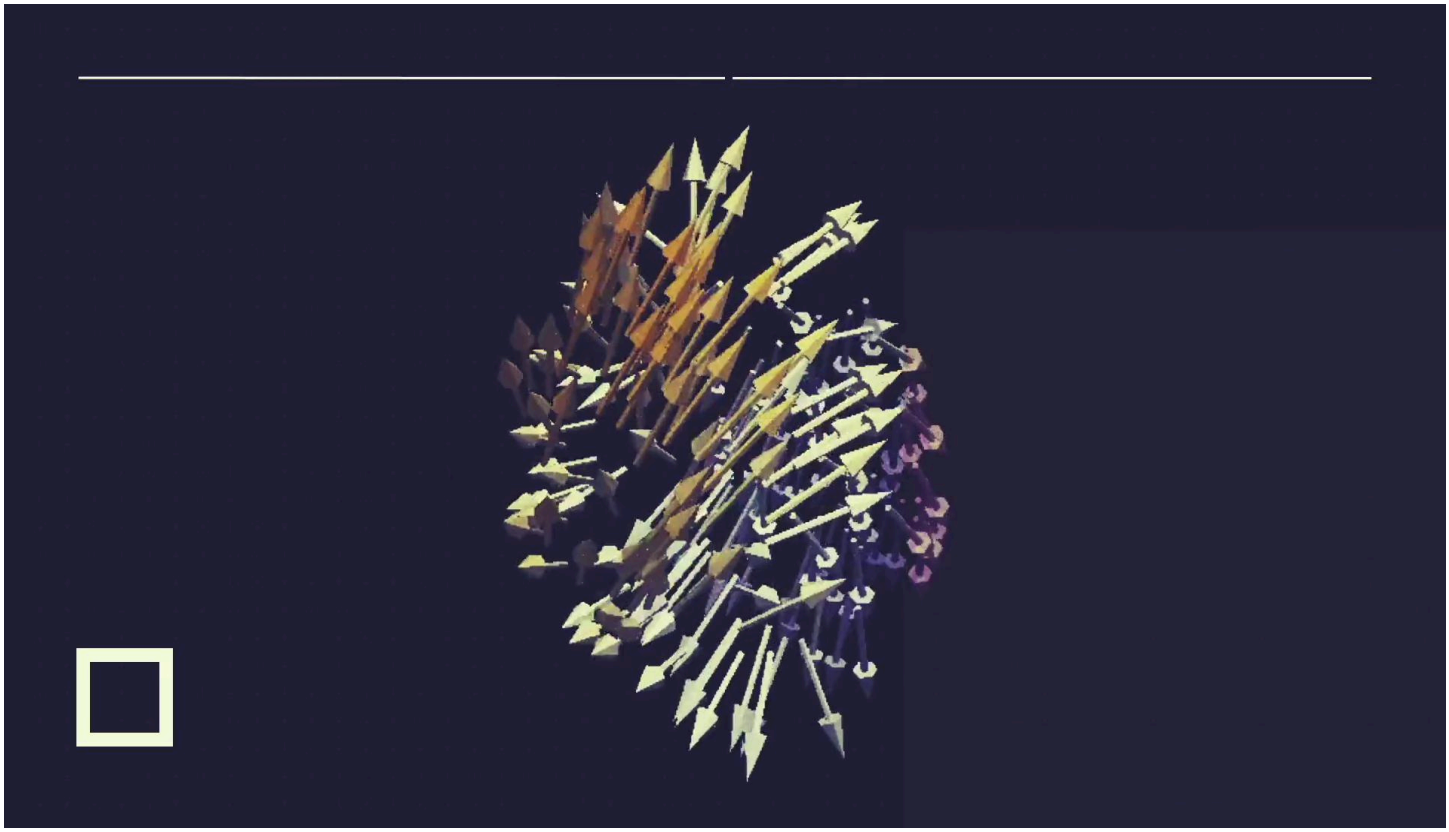


Search MOOC

Video

EPFL

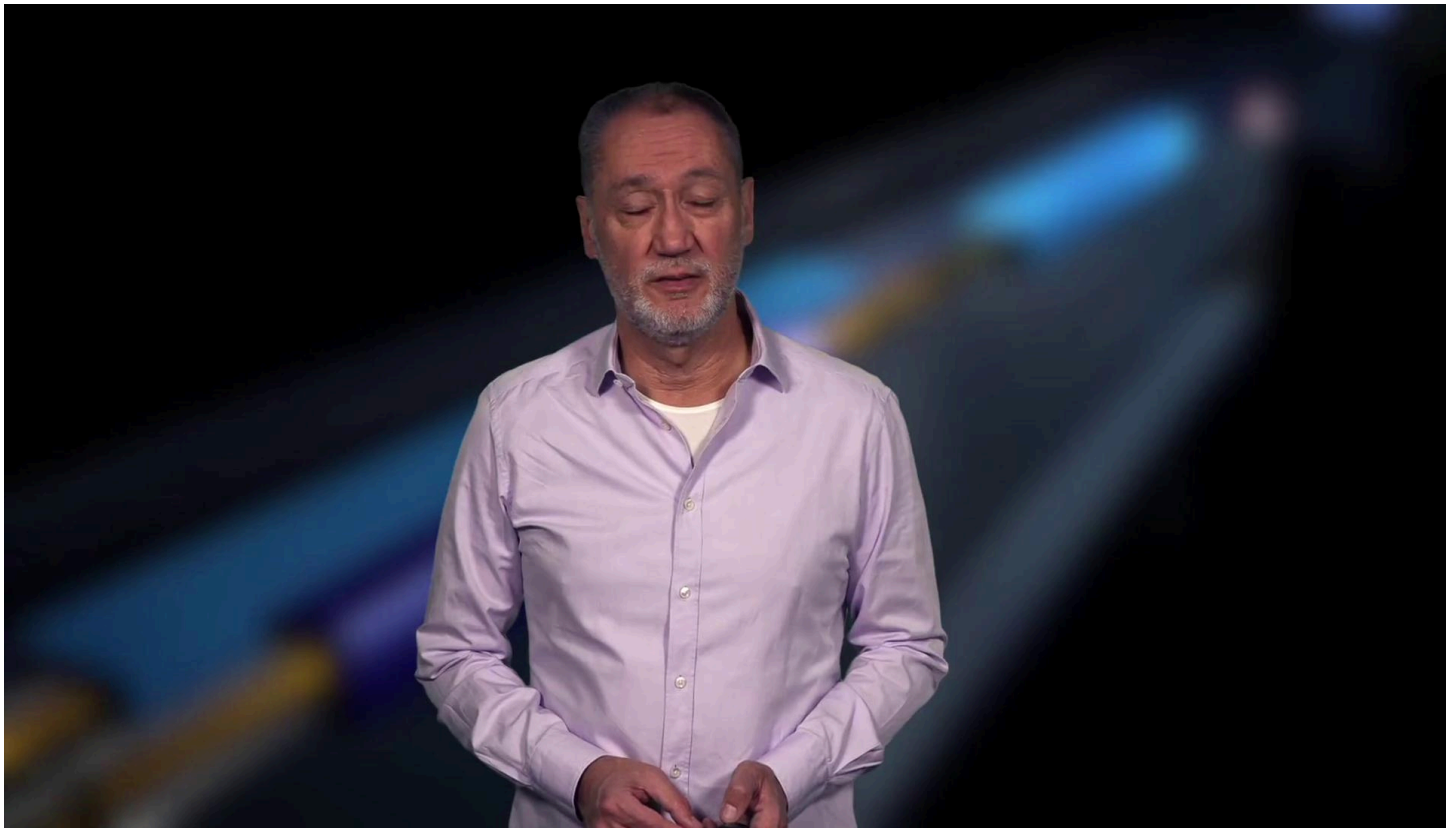


Since their discovery by Wilhelm Roentgen at the end of the 19th century, X-rays have played a pivotal role in almost all branches of the natural sciences and medicine. Synchrotrons and X-ray free electron lasers are large-scale scientific facilities designed to produce extremely powerful beams of electromagnetic radiation, most notably in the wavelength range spanning the ultraviolet all the way to ultra energetic X-rays. As such, synchrotron and XFEL radiation represent perhaps the most powerful and multi-disciplinary modern probes for the study of the structure of matter in fields as diverse as physics, chemistry, biology, materials science, earth sciences, environmental sciences, and even cultural artefact restoration. Why are the synchrotrons and XFELs such a potent tool in the natural sciences? Firstly, X-rays can penetrate deeply into solid matter, allowing the internal architecture and structure of objects to be non-destructively investigated down to the angstrom scale. Secondly, the binding energies of electrons lie in the same range as the photons generated at synchrotron and XFEL facilities, allowing detailed spectroscopic studies of materials, providing insights into their chemistry, electronic structure, and magnetic properties.

Notes

Summary

0m 05s



My name is Phil Willmott, teacher and professor of physics at the University of Zurich and science coordinator for the upgrade of the Swiss Light Source Synchrotron Facility at the Paul Scherrer Institute in Switzerland. Over this six-week, massive open online course, I will introduce the student to basic concepts in synchrotron and excel science. From the interactions of X-rays with matter, including refraction, reflection and absorption, through the production of synchrotron and XFEL beams and their manipulation with X-ray optics, to an in-depth overview of different types of X-ray and electron detectors. This will arm the student with the necessary tools needed to realise the broad experimental approaches of X-ray diffraction and scattering, X-ray spectroscopies and X-ray imaging, which will be covered in detail in the sister course. So I invite you to join me in delving into the fascinating, surprising and burgeoning world of synchrotrons and XFELs that is today, touching an unparalleled vista of scientific disciplines.

Notes

Summary

1m 40s