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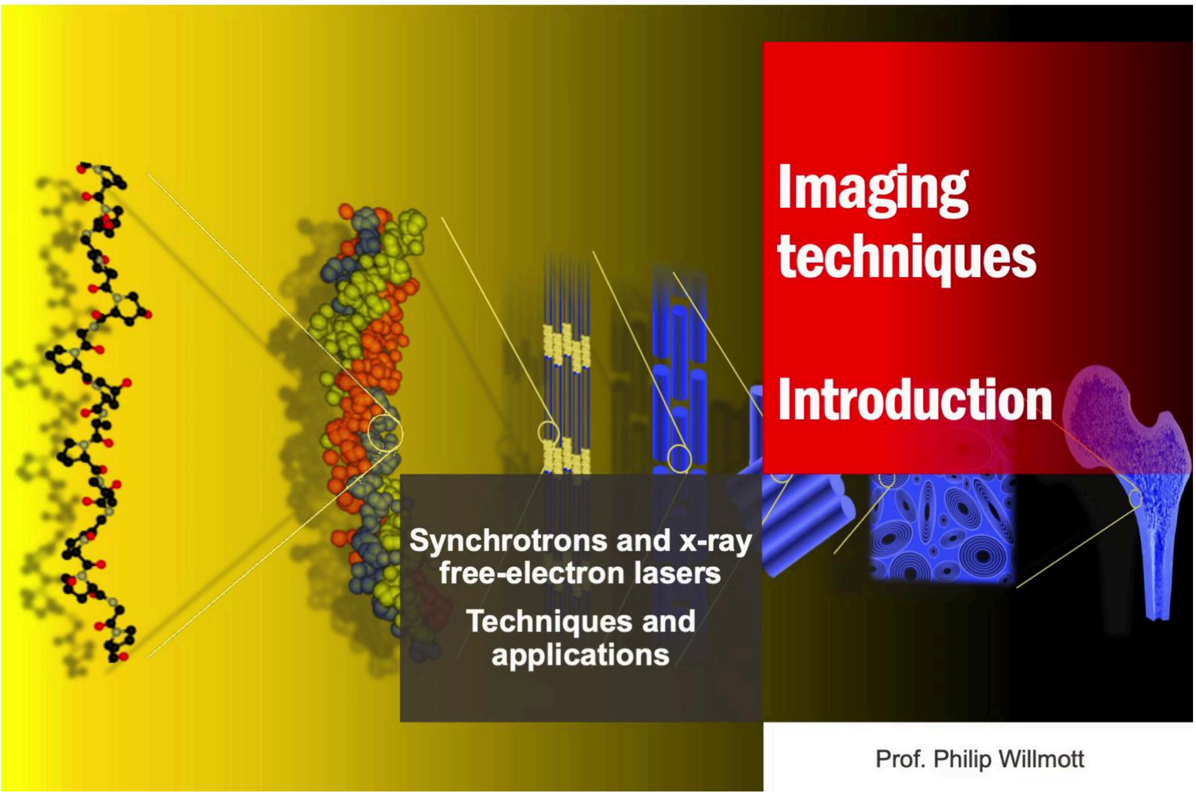

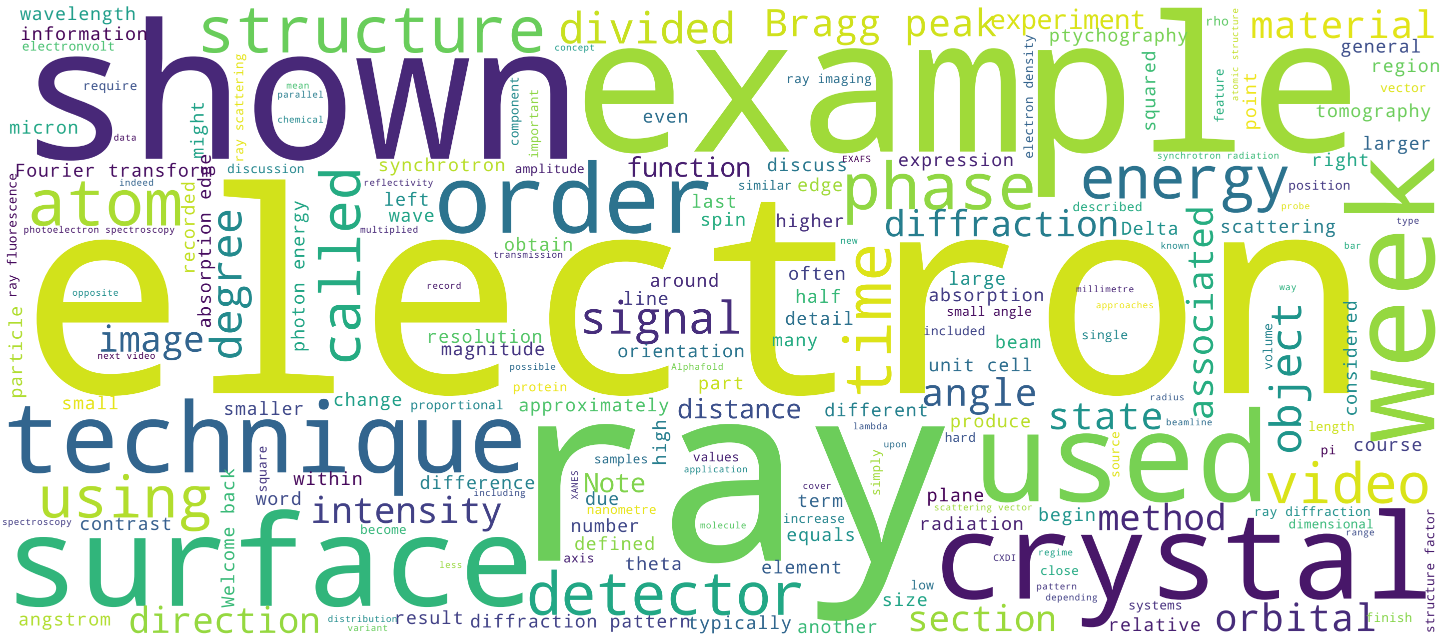

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Search MOOC

Video

Contents and objectives of this video

- What defines imaging in synchrotron science?
- Hierarchy of imaging
- Techniques covered these two weeks

Welcome back to the fifth week of this introductory course on synchrotron radiation, in which we discuss, along with next week, the last of the 3 overarching techniques discussed in this course, namely X-ray imaging. As we will argue in our summary of the techniques included in these two weeks at the end of this video, Trying to define a clean imaging/ non-imaging divide in synchrotron science is perhaps a fool's errand. Only one or two methods can be clearly described as definitely not being associated with imaging. Even ARPES, with nanoscale scanning could be argued to be an imaging method, while the opposite is also true, that only variations of tomography need their own imaging chapter, as they would otherwise sit extremely uncomfortably if described as either spectroscopic or pure scattering methods. As we'll see, imaging can focus on the smallest atomic structures of materials or pan out to see how ever larger features combine in meso and macro-scaled objects of increasingly structural complexity Here's a synchrotron imaging gallery in its most inclusive sense.

Notes

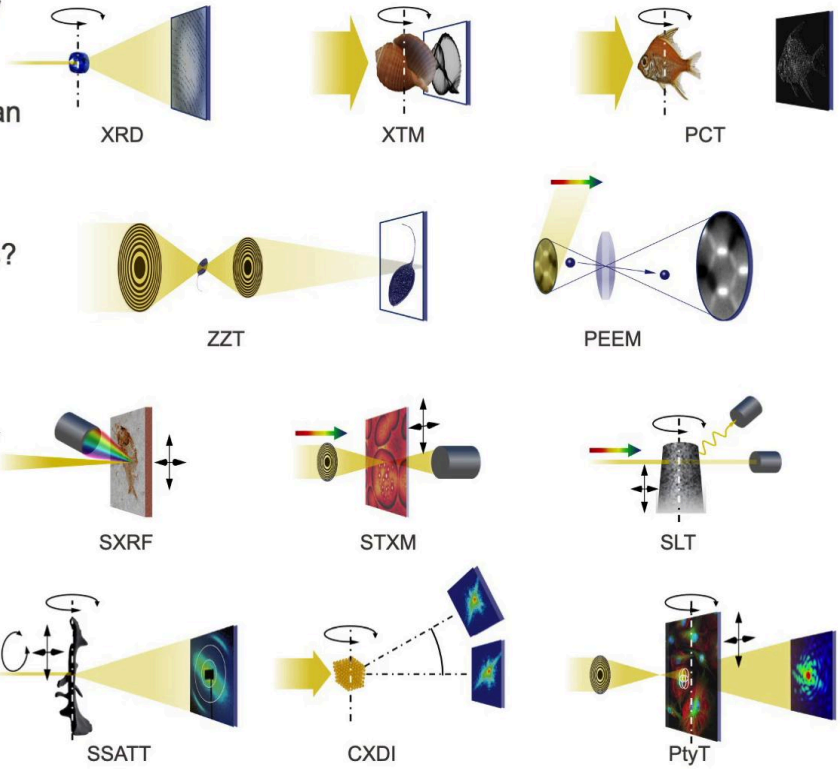
Summary

0m 05s

An imaging gallery

- Most (though not all) SR techniques can be described as imaging methods
- What aspect of the applications described in these last two weeks qualifies them as “imaging” techniques?
- Choice is quasi-arbitrary
  - Some techniques already described
    - XRD, PEEM, SXRF, STXM
  - Some techniques don’t fit comfortably under either scattering or spectroscopy
    - X-ray tomography (XTM and PCT)
    - Zernike zoom tomography
  - Some techniques closely coupled to XTM and PCT
    - SLT, PtyT, SSATT, CXDI, (XPCS)

Techniques that always exploit tunability of SR



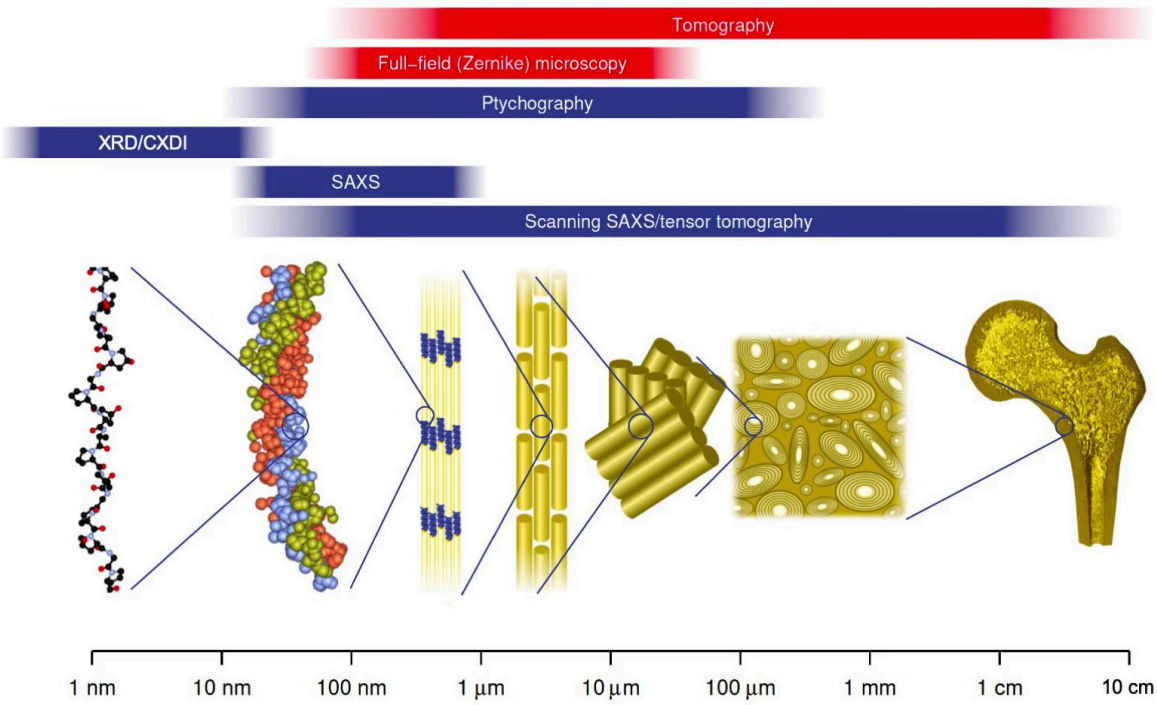
As I've already intimated, most techniques can to some degree be considered as being imaging. For example, x-ray diffraction in its most classical application is used to image the atomic structure of the unit cells of crystalline materials. Similarly, small angle X-ray scattering provides lower resolution information on individual particles, both amorphous and crystalline. Many of the techniques shown here we have already covered, such as X-ray diffraction, photoemission electron microscopy, scanning X-ray fluorescence, and scanning transmission X-ray microscopy.

Notes

Summary

1m 25s

Hierarchy of structures



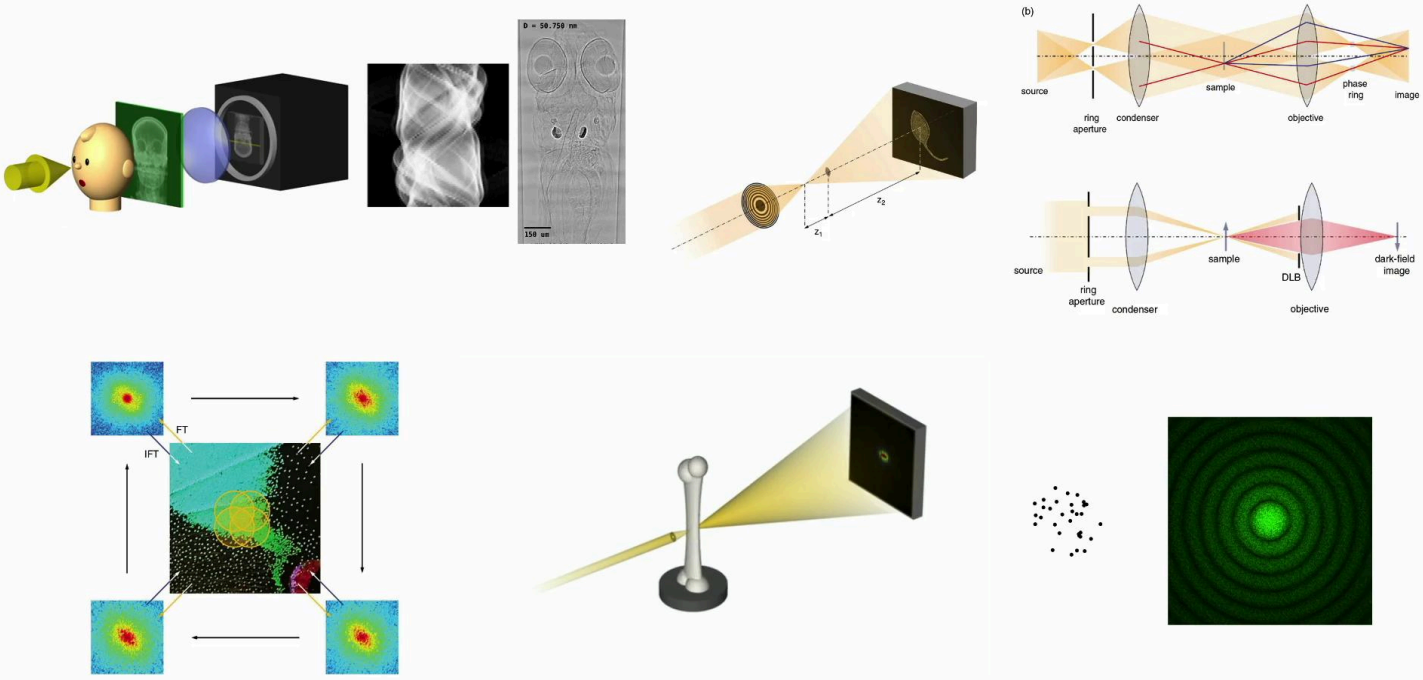
An important aspect of X-ray imaging, is its ability to cover large ranges of characteristic lengths, by combining different approaches to the same sample. In this way, the superstructural description of systems such as bone can be considered over length scales spanning some eight orders of magnitude.

Notes

Summary

2m 08s

Techniques covered in Weeks 5 and 6



Now, it could be argued that the contents of these two weeks are thus somewhat arbitrary. Synchrotrons are often sold to the public as being gigantic microscopes, so what makes the methods which are described in these last two weeks deserving of being considered as imaging techniques. Okay, my reasoning goes as follows. The first technique we will discuss, X-ray computed tomography, even its phase contrast variance, are certainly difficult to classify as being spectroscopic or purely elastic in nature, elastic scattering in nature. Clearly, they fit neatly into this classification of X-ray imaging. The same applies to Zernike and dark-field microscopies. From here on in, however, the remaining techniques are included more by association with tomography. Coherent X-ray diffractive imaging, or CXDI, for example, could be included in our first two weeks in which we discuss scattering. However, the extension of this method with scanning of extended samples with dimensions far in excess of typical X-ray coherence lengths in the rapidly burgeoning technique of ptychography has many common features and approaches as those used in tomography. Hence, both CXDI and ptychography are included in these last two weeks. For good measure, we also include scanning, small angle, tensor tomography and X-ray photon correlation spectroscopy.

Notes

Summary

2m 28s

In the next video...

In the following video, we make some introductory remarks and provide basic insights regarding X-ray tomography, which we concentrate on now for the remainder of this first section of Week Five.

Notes

Summary

4m 08s