CFEL SCIENCE

SEMINAR

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Developing a lab-based XUV source for coherent lensless imaging

Coherent Extreme Ultraviolet (XUV) and soft X-ray radiation between 50eV and 1 keV can be generated via a laboratory-based non-linear laser interaction, a process known as High Harmonic Generation (HHG). HHG is becoming a viable route to a high-flux, lab-based coherent X-ray source. This talk will discuss the development of such high harmonic sources at the Optoelectronics Research Centre, University of Southampton, and one particular application - XUV microscopy.

The high absorption and low phase shift of most materials require the use of zone plates as objective lenses for traditional microscopy in the XUV & soft X-ray region. The technical limitations of zone plate production limit the achievable resolution. HHG sources provide an ideal source of spatially-coherent soft X-rays for the implementation of Coherent Diffractive Imaging (CDI), with potential for diffraction-limited resolution of the order of the X-ray wavelength. CDI allows lensless microscopy by collecting the scattered radiation from a sample on a CCD. The electric field distribution in the sample plane is then reconstructed iteratively by computationally retrieving the phase, using particular constraints on the sample geometry or illumination

This talk will present an overview of HHG sources, and some recent results in their uses for lensless imaging in the XUV. Recent reconstructions of a 2 µm binary test object show 90 nm resolved detail when illuminated with probe radiation centred at 27nm. A qualitative discussion of the impact of illumination by a partially incoherent high harmonic probe will be given, with this result being presented as the current limiting case for multiple wavelength CDI. Finally, techniques to combat this problem are outlined; monochromation and polychromatic algorithm development, and progress with these techniques are reported upon.

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Host: Saša Bajt – FS-ML Group