

Coherent X-ray Science

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The coherent output of x-ray sources is increasing at a massive rate and, in about two years, true x-ray lasers, based on accelerator technology, will be available. These x-ray free electron laser (XFEL) sources will produce pulses in the femtosecond range that are fully spatially coherent and will have a brightness some eight orders of magnitude greater than existing synchrotron sources. These facilities are being developed at SLAC in the USA, DESY in Germany and at the SPring8 synchrotron laboratory in Japan.

In parallel, new laboratory scale coherent soft x-ray sources are being developed using high harmonic generation (HHG) methods, as well as high brightness sources based on Compton scattering of lasers.

The science that can be done with these sources is wide ranging. The current emphases are ultrafast techniques that probe matter with vastly increased precision; and the possibility of observing the structure of single bio-molecules without the need for crystallisation, thereby broadening the scientific ambit of structural biology.

At the ARC Centre of Excellence for Coherent X-ray Science (CXS) we are developing coherent x-ray methods for synchrotron sources, HHG laser methods and an involvement in the international XFEL projects in both SLAC and SPring8. We have a team of physicists, chemists and biologists with the goal of developing and applying x-ray biophysical imaging methods to the study of cellular physiology and structural biology,

In this talk I will review the international developments in coherent x-ray sources and place them in the context of the work of the CXS.