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Short Wavelength Laser Source Program Team

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For further information on the Short Wavelength Laser Source Program team and their work please cont

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One of the long-term possibilities being investigated by CXS is the use of X-ray free-electron laser sources in imaging applications. Such facilities are under development in both Germany and the USA. While we expect to be able to gain at least limited access to XFEL sources when they become available, there are currently no plans for similar resources to be built in Australia. They are hugely expensive facilities involving the construction of linear accelerators more than one kilometre in length.

In the meantime, the short-wavelength laser source groups based at Swinburne University of Technology and the University of Melbourne are developing a tabletop source of highly coherent vacuum-ultra-violet or soft X-rays using high harmonic generation techniques. An intense pulse of visible or UV wavelength light is allowed to interact with an atomic plasma to form a highly coupled radiation-matter system. In the de-excitation process, pulses are created corresponding to multi-photon absorption by the plasma followed by the coherent emission of a photon whose wavelength is perhaps fifty times shorter than that of the incident laser.

The Centre is engaged in the development of these compact short-wavelength sources to investigate alternatives to the use of XFELs in coherent diffractive imaging. The significance of this research goes far beyond just the production of the source, since their use in any process involving the interaction of the highly coherent intense pulse produced by high-harmonic generation raises fundamental issues concerning the modelling of the electronic processes involved. Investigation of the nature of these non-linear physical processes in laser-molecule interactions forms an integral part of the activities of the Short Wavelength Laser Source Program.