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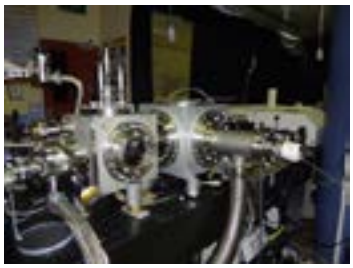
Coherent extreme ultraviolet sources

Lap Van Dao
Swinburne University of Technology, Australia

The high-order harmonic generation process provides methods to produce short pulses of coherent radiation in the extreme ultraviolet and soft X-ray region. Soft x-ray light sources will provide new nonlinear spectroscopic tools that can be used to reveal core-level electronic resonances and their interactions, and permit the creation of no stationary electronic wave-packets and monitoring their dynamics. We investigate the creations of coherent extreme ultraviolet sources with phase-matched generation, wave-mixing and amplification process where two multiple-cycle pulses with incommensurate frequencies (at 1400 nm and 800 nm) are used. A 800 nm, 10 mJ, 30 fs, 1 kHz repetition rate laser beam is split into two beams, with pulse energies of 6 mJ and 4 mJ. The 6 mJ beam is used to pump a three-stage optical parametric amplifier (OPA) system to generate an infrared (IR) pulse at 1400 nm with energy ~2 mJ and duration 40 fs. The 4 mJ beam (800 nm) is used to mix with the 1400 nm field. The high intensity pulse (1400 nm or 800 nm) is used for phase-matched generation of XUV pulses and the other pulse (800 nm or 1400 nm respectively), which is used to control the HHG output and for generation of mixing fields or amplification, is aligned collinear or at a very small angle ($<10^0$) to the direction of the high intensity beam by a dichroic mirror. The time delay between the two pulses is controlled by a motorized delay stage with 0.1 fs resolution. The spectrum and intensity of the XUV radiation generated by the first pulse varies markedly with the influence of the second pulse. The coherence of free electron wave-packet can be obtained by time evolution of mixing fields.



Biography

Lap Van Dao is a Professor and Leader of Ultrafast Laser Science Group at Centre for Quantum and Optical Science, Swinburne University of Technology. His research activities are the development and application of ultrafast and high power laser for imaging and ultrafast time-resolved laser spectroscopy in semiconductor quantum structures and biological systems.

dvlap@swin.edu.au

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