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Generation and characterization of coherent soft X-ray source

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Abstract

High order harmonic generation (HHG) produced by the interaction of an intense laser pulse and a gas medium can provide a table-top scale coherent radiation source in the short wavelength range from the ultraviolet to the soft x-ray region. The generation of highly spatial and temporal coherent sources is an important requirement in some time-resolved spectroscopy applications, and especially in coherent diffractive imaging. High efficiency (up to 10^{-5}) can be obtained by using 800 nm driving pulse in the wavelength rang 30 nm – 9 nm from argon, neon or helium gas. When 1400 nm driving pulse is applied, HHG radiation above the carbon K-edge (4.4 nm) is obtained from a helium gas with. The interplay between the single-atom response and the macroscopic response are analyzed by investigation of the influence of the driving laser intensity on the spectral features of the harmonics. The Young double-slits (YDS) are used to extract information about the degree of spatial coherence. The YDS and the pinhole array have also been used for the purpose of retrieving the spectrum of the harmonic light source. This method allows in-situ precision spectral characterization and, in particular, allows one to probe the spectrum at any part across the harmonic beam. The few high order harmonics generated can be used as a coherent extreme ultraviolet source in coherent diffraction imaging. Spatial resolution of ~ 50 nm can be archived with 4 harmonic orders at ~ 13 nm.

Biography

Lap Van Dao is Leader of Ultrafast Spectroscopy group in the Centre for Atom Optics and Ultrafast Spectroscopy at Swinburne University of Technology and Program Leader and Member of Executive Committee of Australian Research Council Centre of Excellence for Coherent X-Ray Science. His research activities are the development and application of ultrafast and high power laser for imaging and ultrafast time-resolved laser spectroscopy.