Four-wave mixing with multi-color laser in extreme ultraviolet region

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Studies of the generation and propagation of a light field in the extreme ultraviolet (XUV) region can provide an insight of the fundamental interaction of atoms in high energy levels and ionized atom [1]. In this paper, we present experimental results of nonlinear four-wave mixing processes using a combination of XUV radiation and optical pulses in Argon gas. The XUV pulses are obtained by phase-matched high-order harmonic generation. The phase-matching optimization of collinear multiple-cycle laser pulses with incommensurate frequencies (800 nm, 1400 nm and 560 nm) is used to indicate the different pathways of third-order and fifth-order nonlinear responses in the mixing process with a single gas cell configuration. A perturbative nonlinear optics approach can be used to explain our cascaded wave-mixing pattern [2]. Our results reveal that the time-dependent spectral features of the mixing fields are associated with auto-ionization processes. Overall, the intensity and frequency modulation of the wave mixing fields can provide a new technique to investigate the dynamic evolution of electronic wave-packets in atomic and molecular gases [3].

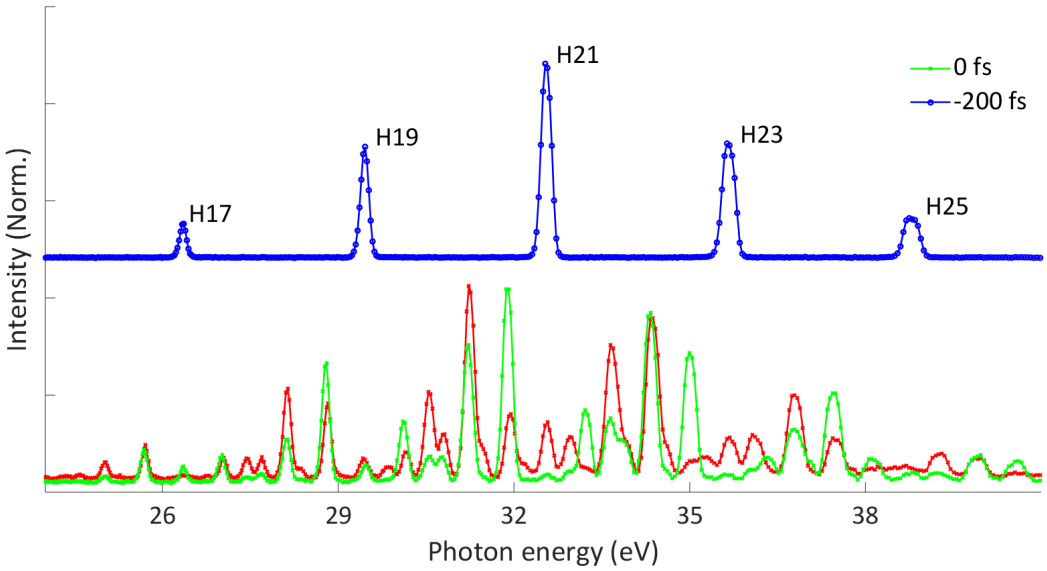

Figure 1: Phase-matched HHG at long delay, -200 fs, [blue line], and phase-matched wave-mixing induced by two-colour fields (800nm and 1400nm) [red line] and three-colour fields (800nm, 1400nm and 560nm) [green line] at zero delay.

References

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