ONE- AND TWO-COLOUR PHOTOIONIZATION EXPERIMENTS AT FLASH

M. Meyer, LIXAM, Orsay

Abstract

Photoionization processes induced by femtosecond extreme-ultraviolet (XUV) pulses of the Free Electron Laser in Hamburg (FLASH at DESY) were investigated in He, Ar, Kr and Xe by means of photoelectron spectroscopy. The well-known photoionization cross sections of rare gases enabled us to determine for each individual FEL pulse the importance of higher orders (0.5 - 1%) of the fundamental wavelength (32, 25 or 13.7 nm)[1]. In a second series of experiments, the FEL was combined with a synchronized optical laser of 12 ps or 120 fs temporal width. ATI (Above Threshold Ionization) processes induced by the optical laser are giving rise to 'sidebands' in the photoelectron spectrum. Their intensity exhibits a characteristic dependence on the relative time delay between both pulses and provides an inherent time marker for time-resolved pump-probe experiments. The results are in excellent agreement with theoretical predictions and allow a first analysis of two-colour ionization processes[2]. Finally, the temporal stability, i.e. the jitter of the FEL pulses with respect to the optical laser, was determined by measuring cross correlation curves with the ps- (523 nm) or the fs-laser (800 nm).

[1] S. Düsterer et al., Opt. Lett. 31, 1750 (2006)
[2] M. Meyer et al., Phys. Rev. A (Rap. Comm.) submitted.