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Electron-Ion covariance mapping of molecules in a double velocity map imaging spectrometer utilizing intense XUV pulse trains

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Intense extreme ultraviolet (XUV) light generated in a high-order harmonic generation (HHG) process or delivered by a Free Electron Laser (FEL) allows the investigation of multiphoton ionization processes on a femtosecond timescale in the gas phase[1,2]. The investigation of the underlying ionization and fragmentation processes can be facilitated by obtaining the correlated momentum information of all photoionization products. One method to retrieve this correlation information is covariance mapping, especially in high count rate scenarios[3]. Various detection schemes utilizing velocity map imaging (VMI) or time-of-flight (TOF) spectroscopy have been demonstrated to gather correlated ion and electron momentum information[4].

The Intense XUV beamline at the Lund Laser Centre features a double velocity map imaging spectrometer (DVMIS) for investigation of angularly resolved ion-electron momentum covariance of photoionized molecules using intense XUV attosecond pulse trains (APT)[5]. The XUV pulses are produced via high-order harmonic generation driven by a Terawatt infrared laser system in a loose focussing geometry. This enables the generation of XUV light with photon energies up to 60 eV and with pulse energies in the μJ regime, which allows to induce multiphoton processes[6].

The employed detection scheme is suitable for the study of ion-electron correlations in molecules, which can readily be extended to larger molecules and time-resolved experiments utilizing HHG or free electron laser XUV light sources[7].

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