CFEL SCIENCE

SEMINAR

21th November 2019, 10:00–11:00h

CFEL – Building 99, seminar room I and II (ground floor)

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Semiclassical models and time-resolved holography with photoelectrons

Semiclassical models applying a classical description of an ionized electron are one of the widely used approaches in strong-field, ultrafast and attosecond physics. The semiclassical simulations can help to identify the specific mechanism responsible for the phenomena under consideration and provide an illustrative picture in terms of classical trajectories. The semiclassical two-step model (SCTS) for strong-field ionization describes quantum interference and accounts for the ionic potential beyond the semiclassical perturbation theory [1]. We analyze application of the SCTS model to strong-field holography with photoelectrons [2], which is a new and promising technique for time-resolved molecular imaging [3, 4]. Furthermore, we extend the SCTS model to include multielectron polarization effects [5]. We find a pronounced narrowing of the longitudinal momentum distributions due to the focusing of the photoelectrons by the induced dipole potential. The polarization of the core also modifies interference patterns in the electron momentum distributions. Finally, we applied the SCTS model to describe ionization of the hydrogen molecule. We predict significant deviations in the photoelectron momentum distributions as compared to the case of atomic hydrogen [6].

[1] N. I. Shvetsov-Shilovski, M. Lein, L. B. Madsen, et al., Phys. Rev. A 94, 013415 (2016).

[2] Y. Huismans, A. Rouzée, A. Gijsbertsen et al., Science 331, 61 (2011).

[3] S. G. Walt, N. Bhargava Ram, M. Atala et al., Nat. Commun. 8, 15651 (2017).

[4] N. I. Shvetsov-Shilovski and M. Lein, Phys. Rev. A 97, 013411 (2018).

[5] N. I. Shvetsov-Shilovski, M. Lein, and L. B. Madsen, Phys. Rev. A 98, 023406 (2018).

[6] N. I. Shvetsov-Shilovski, M. Lein, and K. Tőkési, Eur. Phys. J. D 73, 37 (2019).

Host: Jochen Küpper/ CFEL Molecular and Ultrafast Science Seminar