CFEL SCIENCE

SEMINAR

17th November 2021 - 2:00 p.m.

Virtual meeting room in ZOOM (ID: 992 7237 2470 / PW: 755622)

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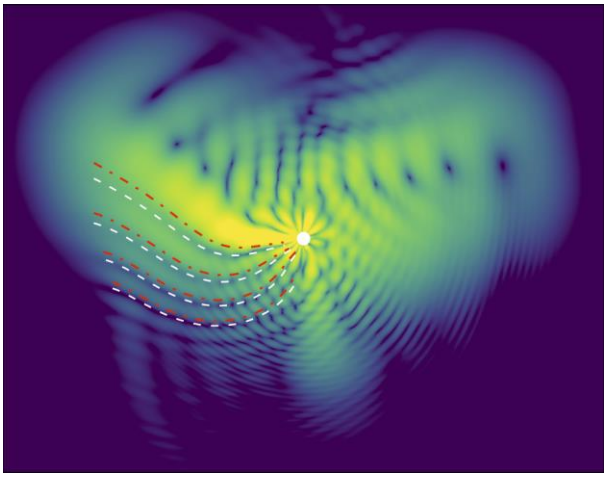
Strong-field photoelectron momentum distributions: influence of Coulomb interaction, molecular structure, Gouy phase, and non-dipole dynamics

Photoelectron momentum distributions from ionization of atoms and small molecules by strong laser pulses are decisively shaped by interference between various types of outgoing electron trajectories. Examples of interference are the presence of above-threshold ionization peaks, photoelectron holography, or interference of long and short orbits in electron rescattering. The relevant phases are highly sensitive to a number of effects going beyond the simple picture of nonrelativistic trajectories driven purely by the laser field.

We review some of the recently discovered influences on the interference patterns. The attractive force of the residual ion not only slows down the outgoing electrons, but causes Coulomb focusing accompanied by a pi/2 Gouy phase shift comparable to the Gouy phase in a focused laser beam. In molecules, the target structure leaves its imprint on the momentum distributions, which can be used to recognize molecular geometry via machine learning techniques. Furthermore, dynamics beyond the electric-dipole approximation, such as the forward radiation pressure, cause small but measurable changes of the distributions. This includes a (potentially counter-intuitive) backward shift of the above-threshold ionization rings and a target-dependent forward shift of the high-energy electrons.

[1] K. Lin, S. Brennecke, et al., arXiv:2110.08601 (2021)
[2] S. Brennecke, M. Lein, PRA 104, L021104 (2021)
[3] S. Brennecke, N. Eicke, and M. Lein, PRL 124, 153202 (2020)



Host: Robin Santra – CFEL-DESY Theory Division