

Field matters: On the significance of phases in the photoionization of atoms & molecules

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Conventional electron & ion spectroscopy usually disregards the influence of the light field, i.e. its phase, on the observables in a photoionization process. In contrast, we will consider two classes of experiments, where the light phase governs the ionization yield and the electrons' spectral distribution: i) Two precisely phased vacuum-ultraviolet pulses of the same wavelength focused into a target of free molecules establish nonlinear autocorrelation, disclosing ultrafast dissociation within a few optical cycles with evidence of a dephasing with time. ii) With the atomic streak camera, which synchronizes an extreme-ultraviolet pulse with a strong terahertz field, evidence is found of a field-enabled interference of two fine-structure split partial Auger electron waves. Finally, the status of an experiment will be reported, where ultrashort laser pulses interact with the matter wave of a BEC.