Attosecond Physics with Nanotips

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Strong-field ionization of sharp metallic nanotips is a showcase scenario for exploring the classical and quantum aspects of ultrafast light-driven electronic motion in near-fields. In this talk I will discuss how the emission of both direct and re-scattered electrons from ultrasharp nanotips under ultrashort pulses opens up new avenues to trace and control attosecond electron dynamics. Regarding direct electrons, sub-cycle sensitivity of ponderomotive acceleration arises for electrons injected into the strong near-field gradient of a very sharp tip in a few-cycle optical waveform [1]. This effect results in near-field-induced low-energy stripes (NILES) that allow the tracking of direct and re-scattered electron emissions on sub-cycle timescales. For single-cycle pulses, cross-process interference (CPI) between direct and re-scattered electrons is predicted via TDSE simulations that will be discussed in connection with a quantum trajectory model to reveal the sub-cycle information on the near-field acceleration dynamics contained in the CPI fringe pattern [2]. Perspectives for novel metrologies for waveform characterization as well as ultrashort electron pulse generation will be discussed [3,4].

References

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