Ultrafast electron dynamics in atoms: observables and experimental techniques

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The field of attosecond metrology with the first pioneering experiments reporting the characterization of the temporal profile of trains [1] and isolated [2] attosecond pulses has paved the way for the investigation of the electronic processes occurring in atoms [3, 4, 5]. In this tutorial, I will illustrate a few examples of time-resolved investigation of ultrafast electronic dynamics in atoms triggered or probed using attosecond waverforms. I will focus the attention on the description of the processes initiated inside the atomic systems, showing which experimental observables (photoelectron(s), photoion(s), or transmitted photons) can be used to resolve in time the dynamics following the initial trigger. Depending on the observables, different experimental techniques ranging from angular and energy resolved photoelectron spectroscopy to coincidence measurements of photoelectron(s) and photoion(s) and transient absorption spectroscopy, can be implemented to extract information about the ultrafast electronic motion. A common thread of all the investigations is the implementation of a pump-probe scheme in which the temporal resolution is determined by the duration of the pulses and by the control of their relative delay.

References

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