A 1: Tutorial Strong Light-Matter Interaction with Ultrashort Laser Pulses (joint session AKjDPG/A)

Time: Monday 11:00–13:00 Location: AKjDPG-H18

Tutorial A 1.1 Mon 11:00 AKjDPG-H18
Atoms and molecules in strong fields and how to observe times and phases — •Manfred Lein — Institute of Theoretical Physics, Leibniz University Hannover

The interaction of strong laser fields with atoms and molecules leads to a number of nonlinear, i.e., multiphoton processes such as above-threshold ionization, high-harmonic generation, or frustrated tunnel ionization. This talk reviews the fundamental mechanisms and theoretical methods related to these processes. We will also review schemes for observing the spatiotemporal properties of strong-field dynamics, including for example ionization times, target structure, and the phases of electron wave packets.

Tutorial A 1.2 Mon 12:00 AKjDPG-H18
Ultrafast light-matter interaction: Measuring and controlling quantum dynamics with attosecond and femtosecond flashes of light — •Christian Ott — Max-Planck-Institut für Kernphysik, Saupfercheckweg 1, 69117 Heidelberg, Germany

Ultrafast light-matter interaction is an exciting aspect of modern quantum physics, directly resolving the fastest motion of electrons inside and in between atoms and molecules that constitute the matter that is surrounding us, where the coherence times can be as short as femtoseconds or even attoseconds. Strong laser fields are available as pulsed flashes of light, with durations of only a few optical oscillation periods in the single-digit femtosecond regime, and an electric field strength that becomes comparable to the electromagnetic binding forces within atoms and molecules. These pulses allow one to measure, understand and control the electron dynamics in natural quantum systems at a fundamental level. In combination with new attosecond light sources at extreme ultraviolet and x-ray wavelengths, derived from high-order harmonic generation or at (x-ray) free-electron laser facilities, this allows one to obtain dynamic fingerprints that are very specific for each atomic species (i.e., time-resolved ultrafast x-ray spectroscopy).

In this lecture I will give a basic introduction into this research topic with focus on absorption spectroscopy of atoms and molecules, and how the resonant transmission of ultrashort and intense light pulses through an absorbing target can be modified and controlled with strong fields and how the control of the dipole response of light-matter interaction develops on the ultrafast timescale.