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Multiphoton ionization schemes using bicircular laser pulses

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The new generation of light sources has allowed us to access detailed information on atomic and molecular ionization events. Dichroic phenomena in photoionization, i.e., the different response of a system to changes of the polarization state of the incoming light, have shown a high sensitivity to the dynamics of the underlying processes. In this talk, I will present a variety of multiphoton ionization schemes using bicircular light and describe their intrinsic characteristics. First, I will show that circularly polarized bichromatic XUV radiation, as for instance produced by free-electron lasers (FELs), can be used to control the direction of photoelectron emission. The cases of H and Ne will be studied for co- and counter-rotating bichromatic light, as well as for a mixture of linear and circular light. Circular dichroism (CD) will then be considered in order to investigate dichroic properties of electronic systems and chiral matter in general. Using XUV circular light, an atom can be prepared in a polarized resonant state, and an optical field, co- or counter-rotating with the XUV light, can subsequently ionize the oriented atom through a multiphoton process. We will consider two recent CD experiments on He^+ and Li atoms, and investigate the origin of the strong CD in both systems. For He^+, the variation of the CD over a wide range of IR intensity will be analyzed for the cases of overlapping and non-overlapping XUV and IR fields. Circularly-polarized high XUV harmonics can also be employed in the circular holographic ionization-phase meter (CHIP) method, a new RABBITT-like attosecond spectroscopic technique to retrieve, from a single time-delay measurement, the phase of photoemission amplitudes by angularly resolved photoelectron detection. We will focus on resonant states in He, and the effects of the pulse duration and intensity will be analyzed. Finally, I will present some of our recent advances to describe photoionization schemes involving simple chiral molecules, using accurate multi-electron calculations in the single-electron continuum obtained via the time-dependent perturbative Complex Kohn (TDPT-CK) method.