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Abstract for an Invited Paper
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Non-linear attosecond and femtosecond probes of chiral structures and dynamics

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We will consider non-linear approaches to probing chiral structures and dynamics using two complementary types of measurements: high harmonic generation and photoelectron spectroscopy. Chiral discrimination with high harmonic generation (cHHG method) has been introduced in our recent work [1]. In its original implementation, the cHHG method works by detecting high harmonic emission from randomly oriented ensemble of chiral molecules driven by elliptically polarized field, as a function of ellipticity. Ref [1] also used the high harmonic spectra to resolve the electronic chiral response with 0.1 femtosecond temporal resolution. We will discuss future perspectives in the development of this novel method, the ways of increasing chiral dichroism using tailored laser pulses, new detection schemes involving high harmonic phase measurements, and concentration-independent approaches to chiral discrimination. We will then discuss physical origins of chiral dichroism in femtosecond pump-probe schemes focussing on detection of photoelectrons and consider the role of bound and continuum state chirality, the possibility to distinguish between them and present a simple physical picture which allows one to predict the strength of chiral response and understand the salient interplay of bound and continuum chiral contributions. We will also show how intrinsic and extrinsic chirality can serve as a sensitive probe of electronic and vibrational coherence. [1] R. Cireasa et al, Nature Physics 11, 654, 2015