Title:

Ultrafast nonlinear optics for high-order harmonic generation

Abstract:

Coherent radiation spanning the extreme-ultraviolet (XUV) to soft X-ray spectral range, produced through high-order harmonic generation (HHG) in gases, has emerged as a versatile tool across a wide array of applications. Gas HHG requires a driving femtosecond (fs) laser pulse focused to high intensity in the generation medium. Today, HHG sources are operated with a large variety of driving femtosecond laser technologies, including Titanium-Sapphire and Ytterbium chirped pulse amplifiers, possibly with post-compression of the pulses, optical parametric chirped pulse amplifiers and other frequency conversion schemes, with wavelengths from the ultraviolet to the mid-infrared.

Depending on the specific application, the optimization of the XUV source may focus on various attributes, such as overall conversion efficiency, temporal structure, coherence properties, or the ability to tightly refocus the beam to reach high peak intensity. The experimental conditions for HHG, such as laser wavelength, pulse duration, beam profile, wavefront shape, gas medium density, atomic species, and the position of the generation medium relative to the laser focus, play a pivotal role in determining the characteristics of the resulting radiation.

Recently, we have been studying the interplay of different parameters of the fs laser driver for HHG using technological advances such as pulse post-compression in compact multi-pass cells or the generation of multi-color laser fields with tailored waveforms. A few experimental examples will be shown together with the resulting understanding gained in the context of XUV light generation.