Technique for Circularly Polarized Coherent Soft X-Rays with High Harmonic Generation

Lewis Z. Liu
Ultrafast Group, Department of Physics, University of Oxford

High harmonic generation (HHG) is an attractive table-top source of coherent, bright, and ultrafast XUV and Soft X-ray radiation with applications in coherent diffractive imaging, ultrafast holography, and time resolved measurements. Moreover, circularly polarized HHG may find additional applications in nanolithography, ultrafast spin dynamics, and magnetic circular dichromism. By focussing an intense driving laser pulse on order of $10^{14}$ W/cm$^2$ into a gaseous medium, very high order harmonics of the driving pulse can be generated. However, HHG suffers from the phase mismatch of the driving field and harmonic field, which significantly limits the growth of the harmonic intensity over the propagation axis. Various techniques including phase matching and quasi-phase matching (QPM) have been developed to address this problem. Up to now, all previous phase matching and QPM schemes produce linearly polarized harmonic pulses. We will discuss a recently proposed novel technique using a circular birefringent system in a hollow-core waveguide that not only addresses the phase-mismatch problem, but also enables the generation of circularly polarized high harmonics. Numerical simulations and potential experimental techniques will also be explored.

References: