Generation of circularly polarized isolated attosecond pulses

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High-order harmonic generation (HHG) is considered one of the most reliable sources of coherent radiation extending from the EUV to the soft X-ray regime [1], in the form of attosecond bursts. It is simply understood in semiclassical terms: an electron is tunnel ionized from an atom by an intense linearly laser field, then accelerated, and driven back to its parent ion, releasing the kinetic energy acquired form the field in the form of EUV/X-ray radiation upon recollision. If driven by a circularly polarized field, the electronic wavepacket does not recollide with the ion, and it was believed impossible to generate bright circularly polarized EUV light by HHG. This precluded many applications such as X-ray magnetic circular dichroism.

We present a novel scheme to produce circularly polarized harmonics through noncollinear mixing of counter-rotating, circularly polarized driving lasers of the same color (NCP-HHG) [2]. This technique maximizes the cutoff photon energies and simultaneously produces separate beams of R and L polarization for each harmonic, enabling precision differential measurements of circular dichroism.

In this contribution we perform advanced theory show that NCP-HHG generates circularly polarized attosecond pulses. We show that, if driven by few-cycle laser pulses, NCP-HHG is the first scheme that allows for the generation of isolated circularly polarized attosecond pulses. In addition, we show that polarization gating techniques can be easily implemented to produce isolated circularly polarized attosecond pulses driven by longer driving pulses [3].

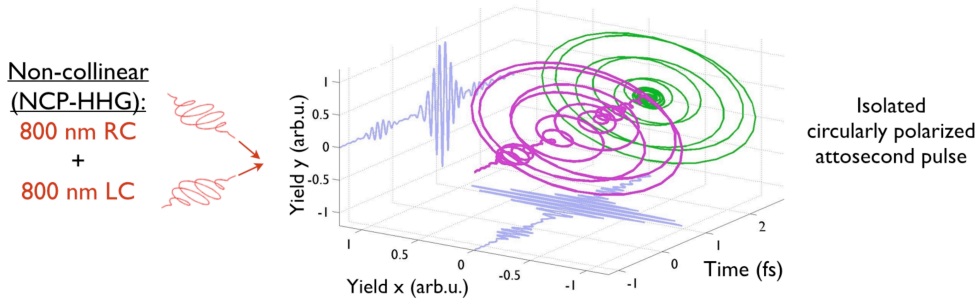

Figure: Isolated circularly polarized attosecond pulse when driving HHG by non-collinear, one-color (800 nm R circular + 800 nm L circular), few-cycle (3 fs) laser pulses. Light blue lines show the projections into *x* and *y* components, and green lines shows integration over time.

References

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