Structured Light Topology in Ultrafast Nonlinear Optics

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The development of structured ultrafast laser sources is a key ingredient to advance our knowledge about the fundamental dynamics of electronic and spin processes in matter. It has been widely recognized the relevance of ultrafast sources structured in their spin angular momentum (SAM, associated to the polarization of light) and orbital angular momentum (OAM, associated with the transverse phase profile, or vorticity of a light beam) to study chiral systems and magnetic materials in their fundamental temporal and spatial scales. In that scenario, structured coherent extreme-ultraviolet (EUV)/soft x-ray pulses are emerging thanks to the highly nonlinear process of high harmonic generation (HHG) [1-4].

In this talk we will review several works that have triggered the field of ultrafast structured EUV pulses during the last decade. We will compare the interplay of light and matter topology in HHG in gases and in crystalline targets, paying special attention to the latter ones, which stand as particularly appealing targets in HHG due to their characteristic symmetries. In particular, we demonstrate that HHG in 2D materials allows for unprecedent study of the nonlinear dynamics through the study of light's topology. This scenario opens the route towards high-order harmonic spectroscopy techniques based on the topology of the EUV/soft x-ray harmonic radiation [5].

References

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