Generation and applications of intense circularly-polarized extreme ultraviolet radiation.

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ABSTRACT

The generation of extreme ultraviolet (XUV) pulses with circular or elliptical polarization by using table-top sources is currently a hot research topic, due to the important applications of these pulses. Circularly-polarized XUV radiation is extensively used for the analysis of the structural, electronic and magnetic properties of matter employing various experimental techniques: e.g. photoelectron circular dichroism for the investigation of chiral molecules, angle-resolved photoemission spectroscopy (ARPES) with circularly-polarized XUV pulses and X-ray magnetic circular dichroism (XMCD) spectroscopy for the study of magnetic materials. Synchrotron radiation is typically used for these applications. Table-top sources of pulses in the XUV with circular polarization and ultrashort duration (from tens of femtoseconds to hundreds of attoseconds) would produce an enormous boost for the investigation of ultrafast processes involved in chirality-sensitive light–matter interactions. Based on previously implemented strategies[1,2,3], we propose the generation of laser driven intense short-pulse coherent XUV radiation of controlled polarization. The energy per pulse of this radiation measured at Attosecond Science and Technology Laboratory of FORTH-IESL is at the level of few pJ per pulse[1]. Here we propose the enhancement of the conversion efficiency of the HHG process by means of loose focusing configuration. The energy content of this radiation is expected to be in the nJ energy range which in conjunction with tight focusing configuration is sufficient to induce nonlinear phenomena. The intense circularly-polarized XUV irradiation will be applied as a proof of principle experiment in single photon circular dichroism in Xe i.e. the differences between the single photon double ionization triply differential cross section obtained using left circularly-polarized light and right circularly-polarized light in Xe. The present project had received funding from the Hellenic Foundation for Research and Innovation (HFRI) and the General Secretariat for Research and Technology (GSRT), under grant agreement No [645].

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