Description of Funded Research Projects
1st Call for H.F.R.I. Research Projects to support Post-Doctoral Researchers

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Research Project Title:

Generation and applications of intense circularly-polarized extreme ultraviolet radiation

Principal Investigator:
Emmanouil Skantzakis

Popular Title:
Intense circular polarized XUV radiation and applications

Scientific Field:
Physical Sciences

Host Institution:
Foundation for Research and Technology, Hellas (FORTH)

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Research Project Summary

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, we propose the generation of laser driven intense short-pulse coherent XUV radiation of controlled polarization. The energy content of this radiation was initially in the pJ energy range. 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.

Project Impact on Society

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.

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Funding from H.F.R.I. gives me the opportunity to create my own research team in my country and expand my research activity. It gives me the opportunity to buy new equipment that is very important for conducting the research. It opens up new horizons by helping me attend conferences, where the cutting edge of research is being presented, and present my work within them, in this way promoting my research activity.

The Principal Investigator,
Emmanouil Skantzakis

Funding

Amount: **198,356 €**

Duration: **36 months**

Foundation: **H.F.R.I.**

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