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PhD Thesis Abstract

XUV Metrology: Focussing and Optimization of the Wavefront

The goal of this PhD is to produce record peak brightness in the Extreme Ultraviolet (XUV) at the Free Electron Laser (FEL) FLASH (DESY, Hamburg, Germany) over 1016 Wcm-2 by realizing an optimized focus and coherent wavefront. FELs offer high brilliance and coherence levels in femtosecond duration pulses. This opens up research opportunities in the area of non-linear optics, fundamental studies on atoms, ions and molecules using single-shot techniques, studies on warm dense matter, diffraction imaging of nanoparticles and the development of advanced photon diagnostics and experimental techniques. In the Laboratory for Intense Lasers (L2I) of the Group of Lasers and Plasmas (GoLP) of IPFN at IST, the objective is to achieve diffraction limited resolution for the High Harmonics generated (HHG) XUV source for the purpose of pump-probe experiments with unprecedented resolution. This will be achieved by creating an adaptive Kirkpatrick-Baez mirror setup. The FEL FLASH offers a higher photon flux compared to HH pulses. With the knowledge acquired at IST, during the secondment at DESY a newly acquired KB-system will be optimized for peak brightness experiments in order to study non-linear XUV-matter interaction at unprecedented intensity. By spatial shaping of HHG full control of the injection level of a seeded FEL could be pursued.