EDOM
Ecole Doctorale Ondes et Matière

INSTITUT d'OPTIQUE GRADUATE SCHOOL

UNIVERSITÉ PARIS SUD
Comprendre le monde, construire l'avenir®

Subject of the thesis

Thesis Advisor

First Name : POLACK Surname : François
Phone : E-mail : : francois.polack@synchrotron-so
joint advisor : Sébastien de Rossi sebastien.derossi.institutoptiquefr 0164533192

Laboratory : : Synchrotron SOLEIL

Director : Jean DAILLANT Phone : 0169082473
Web site : http:/www.synchrotron-soleil.fr E-Mail : jean.daillant@synchrotron-soleil.fr
Address : L'orme des merisiers, BP 48, Saint-Aubin 91192 Gif-sur-Yvette
Place of work : Saint-Aubin

THESIS TITLE :
Spectral and temporal shaping of XUV ultra-short pulses with optical gratings

ABSTRACT :
The generation of ultra-short pulses of short- wavelength radiation is developing fast thanks to the interaction of intense pulsed lasers on gases. Using such sources for experimental applications remains however limited by the properties of the optical elements employed to transport and focus this light onto the sample, and select an appropriate spectral bandpass while keeping the pulse length close to the Fourier limit.
To this aim, new optical scheme have been recently proposed. They rely on employing reflective optical gratings in a conical (off-plane) diffraction scheme. High enough diffraction efficiencies are then expected which would allow cascading several gratings in pulse length compensating or pulse length compressing set-ups.
Off-plane diffraction geometry is not however completely mastered in its modeling aspects because the two polarization states remain intrinsically coupled. The CARPEM code which is used at SOLEIL, is therefore not applicable. The RETICOLO code of IOGS remains usable but is not well conditioned to optimization tasks. Before starting to optimize the proposed grating set-ups, appropriate modelling tool will have to be developed.
Workplan :
A theoretical part will consist in setting-up , from available publications and computing codes, a code allowing to model and optimize the soft-x-ray and EUV behavior of multilayer coated lamellar or triangular profile gratings, in off-plane geometry. A special interest will be devoted to the spectral phases of harmonic wavelengths of the excitation laser source. Their optimization in view of temporal compression will be studied.
Experimental studies will be conducted in parallel, on the soft x-ray branch of SOLEIL Metrology beamline, on which specific beamtime will be reserved. Test gratings will be in part provided by the Horiba Jobin-Yvon Company (Palaiseau). The optical coatings will be deposited at the CEMOX technology facility (IOGS). In order to characterize the diffractive structures, one could also rely on the nano-topographic means of SOLEIL metrology laboratory.
Context
The proposed subject is part of a common interest of several laboratories of the Paris-Saclay Campus toward ultra-short pulses of EUV and soft x-ray radiation, either generated by lasers, either produced by electron-beams (LEL). This common interest has motivated a joint research project, Lidex OPT2X, which has been approved and is granted by IDEX Paris-Saclay. The financial support for the 3 years of the present doctoral position is guaranteed through this program. The main working place will be at Synchrotron SOLEIL (Optics group). Part of the work will be done at IOGS (XUV Optics group).

Keys words :
Ultra-short pulses ; XUV ; Monochromators ; Gratings ; Conical diffraction ; Pulse duration

Financial support ensured through the OPT2X research project