X-ray quarter wave plate for magnetic dichroism


Abstract
This project’s goal is to develop experimental stations in the current synchrotron light source that can be moved, without modifications, to the new synchrotron light source under construction. The main goal of this project is to use a X-ray 1/4 wave plate, unique in the world, to convert linearly polarized X-rays into circularly polarized for efficient X-ray magnetic circular dichroism experiments. The complete experimental set-up to use the X-ray 1/4 wave plate was designed and it’s already been commissioned, so XMCD experiments at magnetic fields of up to 6 T will be feasible with dispersive optics in the next few months.

Key words:
Scientific instrumentation, magnetism, X-ray spectroscopy.

Introduction
The main goal of this project is to use a X-ray 1/4 wave plate¹ 2 3 to convert linearly polarized X-rays into circularly polarized for efficient X-ray magnetic circular dichroism experiments. This plate is made of birefringent material, single crystalline diamond in this case, so its refraction index depends on the incidence angle and generates a phase retardation of 90º between the horizontal and vertical components of the electrical field. This instrumentation is motivated by the need to have the total control of the polarization and a fast helicity switching, besides the improvement of the polarization rate and beam intensity, today limited to 70% circularly polarized and ~1/3 of the initial intensity.

Results and Discussion
We have designed a complete experimental set-up to use the 1/4 wave plate at two beamlines of LNLS, and one beamline of the future synchrotron Sirius.

Conclusions
With preliminary experiments, we have successfully generated 98% rate of circularly polarized X-rays with a diamond quarter wave plate at the goniometry currently available at the XDS beamline. We are currently commissioning the final set-up to allow efficient XMCD experiments at magnetic fields of up to 6 T in the next few months.

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