

Labex MATISSE

Axe

Understanding magnetic properties under pressure using hard X-ray spectroscopies

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Diamond anvils that achieve very high pressures

Hosting laboratories, teams and and thesis supervisors names:

IMPMC, team MIMABADI : Amélie Juhin and Philippe Saintavit
IMPMC, team TQM : Christian Brouder
SOLEIL, Ligne Ode : François Baudelet

Research project (10 lines)

X-ray Magnetic Circular Dichroism (XMCD) is the difference, for a magnetic material, between the absorption of left and right circularly polarized X-rays; it is a powerful tool for the element-specific study of the magnetic structure of complex systems. It is a combined effect of magnetic ordering and spin-orbit coupling. Under pressure, XMCD provides a unique insight into the behavior of materials under extreme conditions and allows addressing fundamentals issues on electron systems. On synchrotron beamlines, Diamond Anvil Cells, which are highly absorbing, are used to reach high pressures and therefore high energy X-rays are required to perform the experiments. I am working on the understanding of the XMCD spectra at the K edge (i.e., with a 1s core hole in the final state), as well as the connection between the dichroic signal and magnetic properties. Thus, my approach is both experimental and theoretical.

Summarize your scientific results & impacts (5 lines)

I obtained K-edge XMCD spectra of Fe and Ni using a monoelectronic formalism based on the Density Functional Theory developed in collaboration with Uwe Gerstmann (University of Paderborn, Germany).
I was also involved in five weeks of synchrotron experiments of RIXS-MCD (of liquid ferrofluids, magnetite and CrO_2) and XMCD. For example, at SOLEIL we measured FeCo Prussian Blue Analogues XMCD spectra under pressure, in collaboration with Anne Bleuzen (ICMMO, France).

Main key facts (for instance publications / prizes / oral presentations)

Poster presentations: *Ab initio calculation of K-edge XMCD spectra*, N. Mas, A. Juhin, Ph. Saintavit, Ch. Brouder, M. Calandra and F. Baudelet

- 10th Soleil Users' Meeting (January, 2015)
- ESRF Users Meeting 2015 (February 2015)

Work selected for an oral contribution at the 12th ETSF Young Researchers' Meeting (Paris, 1-5 June 2015)