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Magneto-chiral Dichroism: Going Beyond the Early Demonstrations

Cyrille Train,[a,*] Matteo Atzori,[a] Elizabeth A. Hillard,[b] G L. J. A. Rikken[a]

a. Laboratoire National des Champs Magnétiques Intenses (LNCMI), Univ. Grenoble Alpes, INSA Toulouse, Univ. Paul Sabatier, EMFL, CNRS, Toulouse & Grenoble, France
b. CNRS, Univ. Bordeaux, Bordeaux INP, ICMCB, UMR 5026, F-33600 Pessac, France

* email : cyrille.train@lncmi.cnrs.fr

Chirality and magnetism are interesting *per se* but having them interact leads to simply fascinating effects. On an optical point of view, they were studied separately from the nineteenth century with the discoveries of natural optical activity in chiral systems and magnetically-induced optical activity in magnetized ones. Because he has neglected the symmetry differences between them, Louis Pasteur searched in vain the direct link between these two phenomena. In the 1980s, these symmetry arguments were used to forecast the existence of a large class of non-reciprocal magneto-chiral effects, that can be observed in chiral systems possessing a magnetization, either spontaneous or induced by a magnetic field.

Their optical manifestation features an absorption or emission of unpolarized light named magneto-chiral dichroism (MChD) that depends on the relative orientation of the magnetization with respect to the direction of light propagation and on the absolute configuration of the system. The first observations of MChD in the visible range came in the 1990s [1]. They were extended to most of the electromagnetic spectrum, underlining the universality of this effect. Moreover, they have stimulated the chemists towards the challenging synthesis of strongly magnetized enantiopure chiral systems [2]. The welfare of molecular systems they can design and synthesize opens the way towards a systematic study of MChD, hence, by combining experiments and theory, to its microscopic understanding through a clear identification of the parameters governing MChD [3]. Moreover, MChD could be measured in chiral Prussian Blue Analogs with Curie temperature up to 40 K and in chiral lanthanide complexes, hopefully behaving as Single-Molecule Magnets (SMM), paving the way for using MChD to read out magnetic data.

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[2] C. Train*, et al.,* Nature Mater. 7 (2008) 729.
[3] M. Atzori*, et al.,* J. Am. Chem. Soc. 142 (2020) 13908; M. Atzori*, et al.,* Sciences Adv. (2021)
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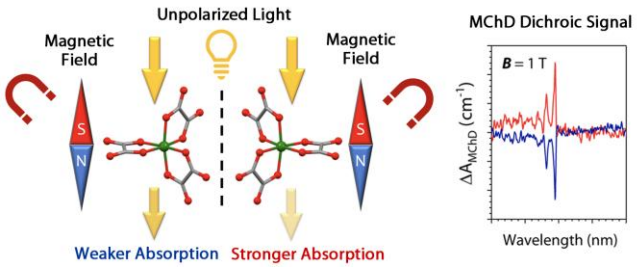

Figure: Principle of MChD in a chiral magnetized system (left) and typical MChD spectra (right).