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Elisabeth A. Hillard

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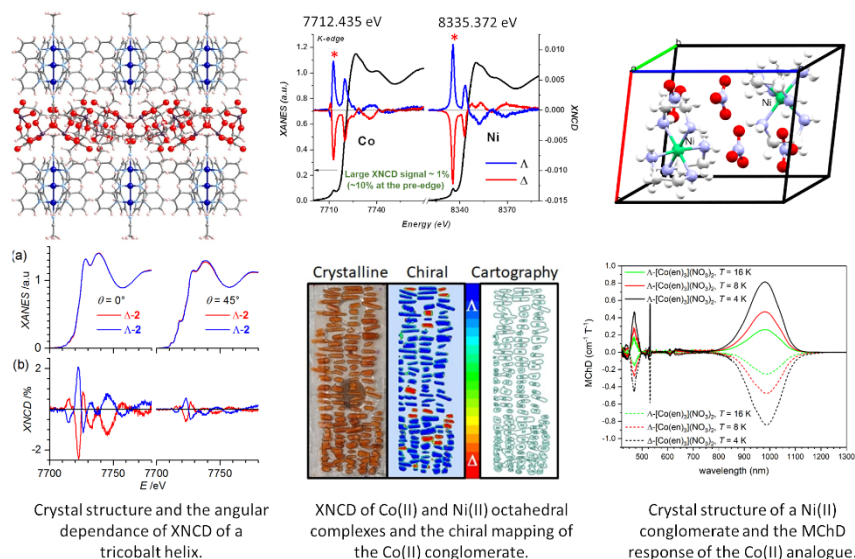
Contributions of coordination chemistry to chiroptical spectroscopies

Elizabeth A. Hillard

CNRS, Univ. Bordeaux, Bordeaux INP, ICMCB, UMR 5026, F-33600 Pessac, France

Chiral molecules are fascinating substances, giving rise to rich manifestations of the light-matter interaction and being central to questions about the origin of life on Earth. As is well known, enantiomers possess identical physical properties, except when interacting with other chiral influences, such as circularly polarized light. For this reason, an array of spectroscopic techniques, such as electronic and vibrational circular dichroism and circularly polarized luminescence, have become essential tools for unveiling chiroptical responses important to chemistry and biology.

This lecture will showcase our recent explorations of lesser-known chiroptical phenomena: X-ray Natural Circular Dichroism (XNCD), Raman Optical Activity (ROA), and Magnetochiral Dichroism (MChD). These investigations provide new insights into the mechanisms governing light's interaction with chiral molecules. To detect these intriguing signals, we utilize the adaptability of coordination chemistry to produce helicoidal model compounds, featuring diverse three-dimensional geometries and electronic structures. By focusing on 3d transition metal complexes, we have synthesized enantiopure materials through the resolution of racemic mixtures, using diastereometric and conglomerate crystallization, as well as self-assembly on chiral nanoplatforms. These materials,



studied in solution, solid form, and as thin films, display intense chiroptical anisotropy across vibrational, electronic, and core-shell transitions, and even induce chirality in otherwise achiral molecules.

The presentation will delve into the synthesis of these chiral materials, highlighting: (1) the chiroptical properties of polynuclear

helices and their capability for inducing chirality in achiral media [1,2], (2) XNCD as a novel tool for probing optical activity in single crystals [3], (3) the critical role of vibronic coupling in the MChD response [4], and (4) the induction of chirality in achiral objects self-assembled on silica nano-helices and minerals [5].

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