

M2 Internship

Circularly Polarized Luminescence (CPL) of Upconverted Lanthanide Emission

Owed to the unique characteristics of electronic transitions found in trivalent lanthanides such as long excited state lifetime or narrow emission lines, Ln(III) coordination complexes are a material class of high relevance for multiple optical applications.¹ These include upconversion (UC) emission, which defines the emission of photons of higher energy than the light of excitation (Fig. 1a),^{2,3} as well as circularly polarized luminescence (CPL). The latter is a result of the light's unequal interaction with the two units of an enantiomeric complex pair, inducing a differential between left- and right-handed circular polarization (Fig. 1b).⁴ Since Ln(III) complexes constitute such important probes in these domains, the combination of the two phenomena by thoughtful molecular design is an objective of major interest in the field of Ln(III) photophysics.

In previous studies, cyanine-based ligands have shown significant potential as light-harvesting antenna for UC emission,⁵ although they are relatively sensitive towards degradation under light exposure. One priority is to overcome this limitation by chemical modification of the cyanine or its replacement by more photostable antenna. Moreover, introduction of chiral groups on the antenna motif is a desirable aim in order to combine both optical phenomena in one molecule.

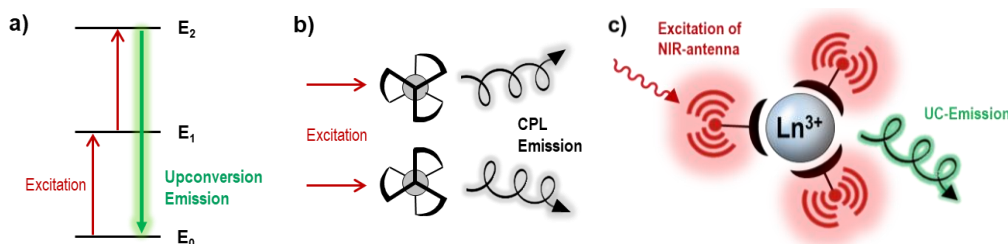


Figure 1: Simplified schematic illustrations of a) the mechanism of UC emission, b) CPL by a pair of enantiomeric complexes and c) a Ln(III) complex designed for UC emission using NIR-active antenna.

Thanks to financial support by the ITI QMat in the frame of their funding instrument 'Soutien QMat à l'Attractivité', we are looking for a master intern motivated to design and study luminescent, Ln(III)-based systems, thereby working at the intersection of organic synthesis, coordination chemistry and photophysics. The selected candidate will prepare suitable light-harvesting antenna by organic and metalorganic synthetic procedures, followed by complexation reactions. Subsequently, he or she will study the photophysical properties of the respective obtained complexes by various spectrofluorimetric techniques, with a focus on the complexes' performance in UC emission.

The internship is expected to start in January-February 2027 and will be realized at the Institut Pluridisciplinaire Hubert Curien situated on a multidisciplinary CNRS campus in the north of Strasbourg. To apply or for any question, contact **Annika Sickinger** or **Loïc Charbonnière**. Please include the following in your application: a CV, a cover letter and the exam transcripts from 1st year of master.

Contact:

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References

- (1) Bünzli, J.-C. G. *Coord. Chem. Rev.* **2015**, 293–294, 19–47.
- (2) Nonat, A. M.; Charbonnière, L. J. *Coord. Chem. Rev.* **2020**, 409, 213192.
- (3) Nadort, A.; Zhao, J.; Goldys, E. M. *Nanoscale* **2016**, 8, 13099–13130.
- (4) Doistau, B.; Jiménez, J.-R.; Piguet, C. *Front. Chem.* **2020**, 8, 1–27.
- (5) Golesorkhi et al. *J. Am. Chem. Soc.* **2021**, 143, 15326–15334.