Master internship

Synthesis and characterization of luminescent lanthanide nanoparticles for upconversion

Lanthanide nanoparticles (Ln-NPs) are an important class of photoluminescent probes for advanced biosensing and bioimaging.[1] Their unique properties arising from 4f-4f electron transitions (long luminescence lifetimes, resistance to photobleaching, large Stokes or anti-Stokes shifts, and narrow emission bands) make them well suited to sensitive analytical applications.

Our team has been working for several years on the design of photoluminescent inorganic lanthanide nanoparticles (NPs) [2,3] for (bio)analytical applications, [4–6] and one of its new areas of research concerns the design of Ln-NPs for upconversion. UC is an anti-Stokes process during which the energy of at least two photons is absorbed by a compound, followed by the emission of a unique photon of higher energy than the incident light (Figure 1).[7] This fundamentally interesting process has various applications in biomedical imaging, light source and display technology, and solar energy harvesting.

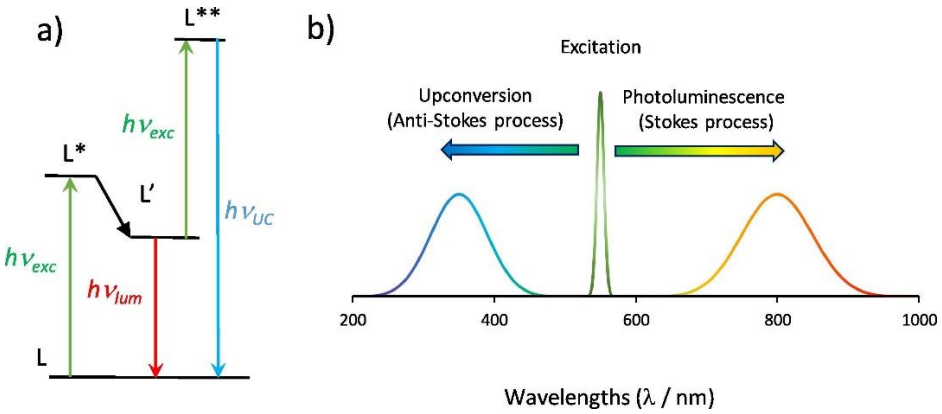

Figure 1: a) Schematic representation of the phenomenon of photoluminescence and upconversion. b) Wavelength dependence of the luminescence phenomena.[7]

We are looking for a motivated master intern to work on the synthesis of lanthanide doped LnF_3 nanoparticles for upconversion. The selected candidate will prepare various NPs by changing the nature and ratio of sensitizer and activator Ln ions and will investigate the spectroscopic properties of the obtained NPs in order to identify the optimal doping conditions for upconversion. Various analytical techniques will be employed for this project: dynamic light scattering (DLS) and zeta potential measurements for characterization of the size and charge of the NPs, and luminescence spectroscopy (both photoluminescence and upconversion).

To apply or for any question, contact **Clémence Cheignon**. Please include the following in your application: a resume, a cover letter and the exam transcripts from 1st year of master. The internship is expected to start in January-February 2025.

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References:

1 C. Cheignon, A. A. Kassir, L. K. Soro and L. J. Charbonnière, *Nanoscale*, 2022, **14**, 13915–13949.
2 J. Goetz, A. Nonat, A. Diallo, M. Sy, I. Sera, A. Lecointre, C. Lefevre, C. F. Chan, K.-L. Wong and L. J. Charbonnière, *ChemPlusChem*, 2016, **81**, 526–534.
3 M. A. Rahali, C. L. Heinritz, A. Hagège, P. Ronot, A. Boos, L. J. Charbonnière and C. Cheignon, *Inorg. Chem.*, 2024, **63**, 12548–12555.
4 A. A. Kassir, C. Cheignon and L. J. Charbonnière, *Anal. Chem.*, 2024, **96**, 2107–2116.
5 C. Cheignon, M. Heurté, R. C. Knighton, A. A. Kassir, A. Lecointre, A. Nonat, A. Boos, C. Christine, Z. Asfari and L. J. Charbonnière, *European Journal of Inorganic Chemistry*, 2021, **2021**, 3761–3770.
6 C. Charpentier, V. Cifliku, J. Goetz, A. Nonat, C. Cheignon, M. Cardoso Dos Santos, L. Francés-Soriano, K.-L. Wong, L. J. Charbonnière and N. Hildebrandt, *Chem. Eur. J.*, 2020, **26**, 14602–14611.
7 A. M. Nonat and L. J. Charbonnière, *Coordination Chemistry Reviews*, 2020, **409**, 213192.