



## Ph-D proposal in Physical Chemistry @ Lille University (FRANCE)

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# Single particle fluorescence spectroscopy of innovative nanoparticles designed for super-resolution biological imaging

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### Context

Lanthanide-doped inorganic nanoparticles present the unique feature of being able to emit light up to the blue region of the visible spectrum while being excited in the near infrared (NIR). Because biological samples have limited absorption in the NIR, these so-called up-converting nanoparticles (UCNPs) are attractive candidates for biological imaging applications.

### Project description

The research project aims at characterizing the photo-physical properties at the single particle level of innovative UCNPs designed for super-resolution fluorescence imaging.

To control the emission fluctuation that is needed for super-resolution fluorescence microscopy, UCNPs will be covered by fast negative photochromic dyes that are synthesized in the group of Pr. J. Abe (Japan) in the frame of the LIA Nano-Synergetics. The characterization of these up-conversion nanoparticles will lead to complex emission spectra (maxima and lifetime) that depend on excitation power and nano-environment. The tasks of the thesis will be to:

- 1) characterize the emission spectra, polarization and lifetime of new up-conversion switchable nanoparticles;
- 2) characterize the luminescence fluctuation properties of these nanoparticles within cells;
- 3) analyze the results by multivariate and parametric methods in order to understand and rationalize emission fluctuation to get innovative UCNP nanoparticles for bio-nano-imaging.

This work will be conducted within the frame of the ANR Blink project (<http://coudret.wixsite.com/blink>) and the LIA Nano-synergetics in the DyNaChem team of LASIR, which gathers spectroscopists and chemometricians interested in nanometric imaging of photo-active systems for fluorescence microscopy and high resolution bio-imaging.

**Keywords.** Up-converting nanoparticles; single particle spectroscopy; super-resolution; bio-imaging.

**Candidate profile.** The candidate must have a Master degree in Physical Chemistry, Chemistry or Physics. A good level of English is required to read and write scientific publications. No requirement is needed for French language.

**Funding and Inscription Fees.** Funding from CONACYT program. Inscription Fees (ONLY 400 \$ /YEAR)

### PhD thesis supervisor (contact)

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### LABORATORY WEB PAGE

<http://lasir.cnrs.fr/dynachem/>