Elaboration of Ln$^{3+}$-doped $\alpha$-La(IO$_3$)$_3$ thin films

**General Scope:**
Iodate crystals ($\alpha$-La(IO$_3$)$_3$) present a high dielectric susceptibility ($\chi^2$), leading to promising applications in piezoelectricity and non-linear optics.\(^1\) In addition, the possibility of substituting La$^{3+}$ ions by some trivalent luminescent lanthanide ions adds up the photoluminescence as a new functionality. In this context, we have successfully developed Er$^{3+}$-doped $\alpha$-La(IO$_3$)$_3$ nanocrystals (size <100 nm), exhibiting both Second Harmonic signal and up-conversion luminescence under a near-infrared excitation.\(^2\) One of the biggest challenges is now to be able to deposit these compositions as thin films for a good integration in electronic devices.


**Research topic and facilities available:**
Lanthanide-doped $\alpha$-La(IO$_3$)$_3$ nanoparticles are currently synthesized by microwave-assisted hydrothermal technique with a typical size comprised between 50 and 100 nm. They will be shaped as thin films by different methods, in particular by Pulsed Laser Deposition (PLD). The deposition conditions will be optimized to ensure the formation of the right phase, as well as a high crystal quality.

The nanocrystals and the obtained films will be characterized by X-ray Diffraction (powder and at grazing angle, both available at the Institut Néel), as well as by Scanning Electron Microscopy. The nanocrystal and film photoluminescence will be quantitatively studied in the lab using a spectrofluorimeter. The Second Harmonic Generation (SHG) will be qualitatively studied at the Institut Néel. More advanced SHG characterizations will be performed in collaboration with the Symme Laboratory (Annecy).

**Possible extension as a PhD:**
Yes if funding

**Required skills:**
Good skills in Materials Sciences (chemical synthesis, characterization techniques: XRD, SEM)
Good writing and oral skills

**Starting date:** February-March 2019

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