



Title: Semiconductor quantum dots and 2D building blocks for scintillators

Lab: Institute of Light and Matter

Team: Luminescence (<http://ilm.univ-lyon1.fr/luminescence>)

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Scintillators are materials able to convert ionizing radiations into visible or UV photons. They play a major role in a wide range of applications in fundamental physics -such as particle physics, astrophysics, search for dark matter- but also to address major societal challenges in the domain of health (medical imaging), homeland security, environment and energy (e.g. oil well logging, nuclear waste survey). Nanostructures have been barely explored in scintillation despite they offer a wide range of opportunities to engineer the properties needed to develop next generation materials.

We propose in this internship to investigate a new generation of nanoscintillators based on semiconductor quantum dots and/or 2D nanostructures embedded in a halide matrix. The first component acts as the light emitter (recent works in the optical field has demonstrated their potentialities as fast emitters [1]). The halide matrix is devoted to the radiation absorption, and to convert and transfer the energy to the light emitter through a complex energy cascade. The ensemble forms a nanostructured composite, for which chemical routes have already been demonstrated [2].

During this internship, after dedicated training, the student will synthesize these innovative materials and analyze their fluorescence and scintillating properties. In particular, the charge carriers recombination dynamics will be probed using fast ($<1\text{ns}$) luminescence decay measurements under visible and x-ray excitations.

The topic is very ambitious, and we plan to propose a PhD project at the end of the internship. Several directions are possible for the PhD project depending of the preliminary results obtained during the master project.

1. Grim, J. Q. *et al.* Continuous-wave biexciton lasing at room temperature using solution-processed quantum wells. *Nat. Nanotechnol.* **9**, 891–895 (2014).
2. Otto, T. *et al.* Colloidal Nanocrystals Embedded in Macrocrystals: Robustness, Photostability, and Color Purity. *Nano Lett.* **12**, 5348–5354 (2012).