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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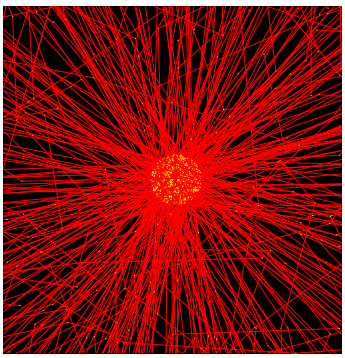
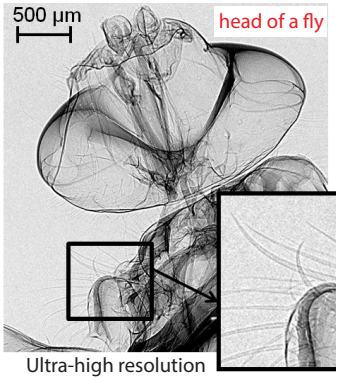


Energy deposition of a 10kEV electron in a nanoparticule



Ultra-high resolution x-ray imaging with a scintillator

***Project*:** 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). Some of these applications, such as PET (positron-emission tomography) imaging, requires systems with an extremely fast response (10ps), difficult to achieve with conventional scintillators. 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, particularly toward the **fast timing** applications.

We propose in this internship to investigate the time response of several types of semiconductor quantum dots when changing their shapes and core/shell structure. During this internship, after dedicated training, the student will synthetize these **innovative materials** and analyze their fluorescence and **scintillating** properties. In particular, the charge carriers recombination dynamics will be probed using fast (<1ns) luminescence decay measurements under visible and x-ray excitations. The project has 2 sides: 1 clearly oriented material science in order to tend toward functional materials and the other more connected to the scintillation response measurement and analysis. The student will have freedom to focus on one of these 2 aspects.

The topic is broad and 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. This project will be carried out in collaboration with teams in **CERN (Geneva)** and the institute of Physics of Prague (Czech republic)