

INTERNSHIP PROPOSAL

Laboratory name: Institut des NanoSciences de Paris (INSP) & Laboratoire de physique de l'École Normale Supérieure (LPENS)

CNRS identification code: UMR 7588 & UMR8023

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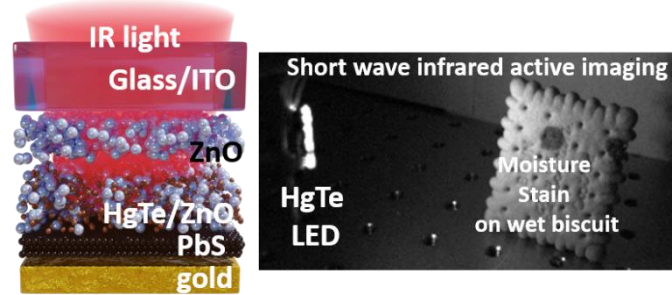
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Infrared electroluminescence using nanocrystals

Nanocrystals are semiconductor nanoparticles with tunable optical features from UV to THz. They have become key building blocks of optoelectronics with their integration as light sources in displays. The INSP team is working on **narrow band gap nanocrystals and their applications for infrared optoelectronics**.

In this project, we work with HgTe nanocrystals presenting light emission in the 1-5 μm range. The goal of the project is to design/fabricate and characterize light emitting diodes from these nanocrystals. We have obtained some promising preliminary results (ref 1-3) and now aim to push toward longer wavelength. Current performances remain modest and LED design will benefit from new strategies. Here we target to develop strategies where multiple photons can be obtained per injected charge. A second aspect of the project will deal with light extraction and require to integrate at the LED level some light management strategies (4) based on nanoantenna.

The internship and the PhD thesis that will follow will be performed jointly at INSP for the fabrication and characterisation of the diodes, and at LPENS for the study of light management strategies and the characterisation of the corresponding structures.



Scheme of a nanocrystal-based LED (left) and infrared image of a scene illuminated by the LED (right)

Ref from the group on the topic

1. Mercury Chalcogenide Quantum Dots: Material Perspective for Device Integration, **Chemical Reviews** 121, 3627 (2021)
2. Electroluminescence from nanocrystals above 2 μm , **Nature photonics** 16, 38 (2022)
3. Electroluminescence from HgTe Nanocrystals and its Use for Active Imaging, **Nano Letters** 20, 6185 (2020)
4. Plasmon-Assisted Directional Infrared Photoluminescence of HgTe Nanocrystals, E Bossavit et al, **Advanced Optical Materials**, 2300863 (2023)