

Title: Reconfigurable quantum optoelectronic Devices

Keywords: nanocrystal, infrared, photonic, light detector, camera

Scientific description: Traditional design for infrared camera rely on coupling an absorbing layer to a cmos circuit. However, this approach, though highly efficient suffer from many limitations. Among them a high fabrication cost, difficulty to reduce the pixel size and limited spectral tunability. To overcome these bottleneck strategies based on colloidal nanomaterial that can directly functionalized the Cmos surface are being developed. However, to become fully efficient, especially to absorb most of the incident light, nanocrystal film benefits from being coupled to photonic structure. Basic concept is to introduce the nanocrystal slab into a cavity and match the resonance of the cavity with the nanocrystal band gap. Such strategy enables to enhance the light absorption magnitude but also give a new degree of freedom to shape the spectral response. Now we aim to go even one step further and develop active coupling. The goal is to be able the spectrum and tune using a bouton as simple as a bias. To do we need to design new cavity that magnify the inhomogeneity of the incident electric field. The applicant will be first trained to the design of basic nanocrystal based infrared detector and will in parallel start to design suited photonic cavity. A clear goal is to develop strategy that can later be transferred at the camera level. This goal set additional constrains such as the non-transparency of the substrate and finite size of the pixel. The project includes chemistry (with support of an engineer), optics, fabrication and optoelectronic aspect. There is no need to be specialist of all those topic, but you must be willing to discover them.

Techniques/methods in use: clean room, optoelectronic device characterization, electromagnetic simulation.

Applicant skills: a good background in semiconductor physic is necessary. The project is highly pluridisciplinar with chemistry, physics and engineering, thus additional background may include nanocrystals, device fabrication, electronic transport. Applicant must speak English

Industrial partnership: yes, group is highly connected (New Imaging technologies, Lynred, CNES, CEA...)

Internship supervisor(s) (name, email, phone, webmail): Emmanuel Lhuillier (el@insp.upmc.fr) – 01 44 27 43 55

Internship location: INSP tower 22

Possibility for a Doctoral thesis: Yes and actually applicant willing to do thesis are highly preferred. **FUNDING** through ERC AQDtive IS SECURED