

INTERNSHIP PROPOSAL

Laboratory name: INSP

CNRS identification code: UMR7588

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Internship location: 4 place jussieu, 75005 Paris

Thesis possibility after internship: YES

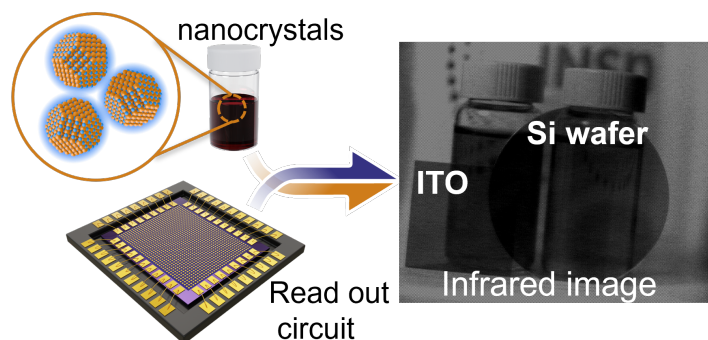
Funding: YES

If YES, which type of funding: ERC AQDtive

Nanocrystal-based infrared camera

Summary Traditionally, infrared imagers rely on epitaxially grown semiconductors, which require lattice-matched substrates. This approach, however, raises many issues, such as the need for lattice matching and complex later coupling to the read-out integrated circuit.

Nanocrystals are solution-processable. Quantum confinement makes them spectrally tunable, and with relevant materials, they can cover the entire infrared range. The INSP team handles every step of the process, from the synthetic growth of the particles to image formation, as depicted in the figure below. Such cameras are appealing for cost-effective infrared imaging, as required by applications like drones and smartphones.



Despite demonstrations, several challenges remain:

***Better light-matter coupling:** The polycrystalline nature of the film leads to a trade-off between absorption and charge collection. One strategy to achieve strong absorption is to introduce photonic structures that trap light. Such an approach can also be used to tune the spectral response or even make it bias-reconfigurable. This capability is highly interesting for switching from basic imaging configurations to hyperspectral imaging. The device then acts as an ultra-compact spectrometer. For this task, the work focuses on electromagnetic design and advanced cleanroom fabrication for the photonic structures.

***Better photodiode structure:** Charge extraction and collection strongly depend on the surroundings of the absorbing layer. Rational optimization of this task can be conducted using X-ray photoemission to unveil the electronic structure of quantum-confined nanocrystals.

Depending on the background and nationality (some restrictions of topic may apply for non-European) of the applicants one or several of the aspect may be covered.

Condensed Matter Physics: YES Soft Matter and Biological Physics:NO

Quantum Physics: YES

Theoretical Physics:

NO