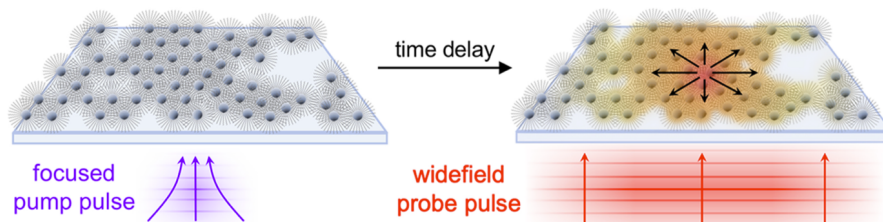


INTERNSHIP PROPOSAL

Laboratory name: **Institut des Nanoscience de Paris (INSP)**
CNRS identification code: **UMR 7588**
Internship director's name: **James Utterback**
e-mail: **james.utterback@insp.upmc.fr**
Web page: <https://w3.insp.upmc.fr/en/insp-page-perso/utterback-james/>
Internship location: **4 place Jussieu, 75005 Paris**
Thesis possibility after internship: **YES**
Funding: **YES**

Pump-Probe Spectroscopy of Charge Carrier Transport in Nanocrystal Optoelectronics

The aim of this experimental project is to use a pump-probe optical microscopy method¹ to spatiotemporally study microscopic charge transport in nanocrystal-based optoelectronics systems. Controlling nanoscale charge carrier transport is fundamental to energy conversion applications from solar cells to LEDs. While advanced spectroscopic methods grant an understanding of excited-state dynamics in isolated materials, many fundamental questions about the microscopic nature of transport in optoelectronics devices remain underexplored. To address this area, one needs a probe of local charge transport with ultrafast and nanosecond time resolution and sub-micron spatial resolution in a material in realistic device conditions. Our approach is to do ultrafast microscopy and fabricate nanocrystal-based optoelectronics. These studies will reveal microscopic structure–property relationships that connect nanoscale carrier dynamics to macro-scale energy conversion. We study fundamental questions, but under applied material conditions.



The internship: During the timeframe of the master's internship, the student will take on one of several possible projects regarding charge transport in colloidal nanocrystal assemblies, and trying to connect this to electrical measurements. The project likely involves optical spectroscopy, some instrumentation, Python simulations, some clean room, and basic chemistry lab prep. The goal is that the student continues on to do a PhD.

The team: The student would be advised by Dr. James Utterback, CNRS Chargé de Recherche at the Institut des NanoSciences de Paris (INSP, Sorbonne Université). The group has expertise in pump-probe optical spectroscopy and microscopy of nanomaterials.^{1,2} The student would also benefit from the environment of the Optoelectronics of Confined Nanocrystals group, whose expertise spans across nanocrystal synthesis, characterization, spectroscopy, and nanocrystal device integration.

Student background and learning: The student will gain expertise in spectroscopy, semiconductor physics, optics, nanoscience, data acquisition, and data analysis. Students with background in the above areas are preferred. Programming skills (Python) are highly valued. The group is international and works in English.

[1] Feldman *et al.* [ACS Nano](#) 2024, 18, 34341.

[2] De Bellis *et al.* [Nano Letters](#) 2025, 25, 7317.

Please, indicate which speciality(ies) seem(s) to be more adapted to the subject:

Condensed Matter Physics: YES

Soft Matter and Biological Physics: NO

Quantum Physics: YES

Theoretical Physics: NO