

Internship proposal

Revealing DNA Organization by Orientation Super-Resolution Microscopy

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Internship location: Laboratoire Physique des Cellules et Cancers, Institut Curie – CNRS, 11 rue Pierre et Marie Curie, 75005 Paris

Possibility for Thesis : Yes **Funding:** ANR

Overview

Join our research team and explore the frontier of biological imaging in the nucleus! This internship focuses on applying **super-resolution (SR) microscopy** to investigate the mechanisms behind DNA organization in cells. By combining **multifocus microscopy (MFM)** with **polarization measurements**, we will capture the 3D positioning and orientation of single molecules, offering new insights into their structural and functional roles.

What You Will Do

As an intern, you will work on:

- Developing or fine-tuning algorithms for 3D image reconstruction.
- Optimizing sample preparation for single-molecule imaging in the nucleus.
- Performing experiments on reference samples and real biological cells.

Your work will contribute to our broader goal of understanding how DNA is organized within cells at the nanoscale level.

What You Will Gain

- Hands-on experience in cutting-edge microscopy techniques.
- Skills in optical imaging and data analysis.
- Exposure to real-world biological research with impactful outcomes.
- Mentorship from experienced scientists in the field.

Who Can Apply

We invite applications from students with backgrounds in **physics, biophysics or biology**. A strong interest in advanced imaging and biological systems is important, and prior experience in microscopy is not mandatory—just a passion for learning and discovery!

How to Apply

Interested candidates should submit a CV and a brief motivation letter to [\[bassam.hajj@curie.fr\]](mailto:bassam.hajj@curie.fr)

References:

- [1] Betzig, E., et al., Imaging intracellular fluorescent proteins at nanometer resolution. *Science*, 2006.
- [2] Rust, M.J., M. Bates, and X. Zhuang, Sub-diffraction-limit imaging by stochastic optical reconstruction

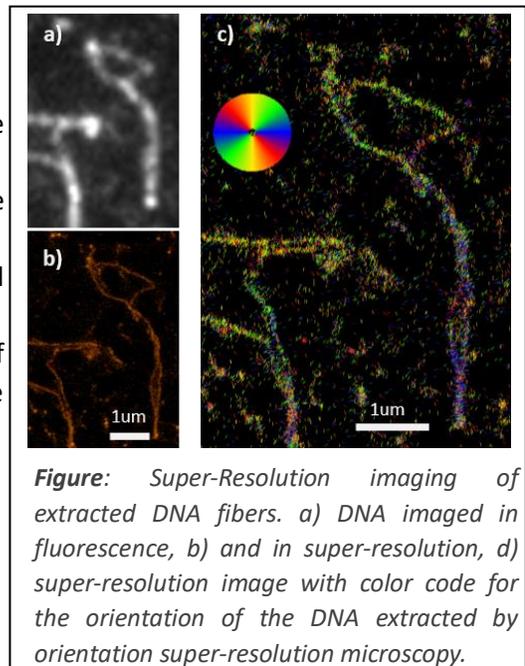


Figure: Super-Resolution imaging of extracted DNA fibers. a) DNA imaged in fluorescence, b) and in super-resolution, d) super-resolution image with color code for the orientation of the DNA extracted by orientation super-resolution microscopy.

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[3] Schnitzbauer, J., Strauss, M., Schlichthaerle, T. *et al.* Super-resolution microscopy with DNA-PAINT. *Nat Protoc*, 2017.

[4] Hajj, Bassam & Wisniewski, Jan & El Beheiry, Mohamed & Chen, Jiji & Revyakin, Andrey & Wu, Carl & Dahan, Maxime. (2014). Whole-cell, multicolor superresolution imaging using volumetric multifocus microscopy. *Proceedings of the National Academy of Sciences of the United States of America*. 111. 10.1073/pnas.1412396111.

[5] Hajj, Bassam & Oudjedi, Laura & Fiche, Jean-Bernard & Dahan, Maxime & Nollmann, Marcelo. (2017). Highly efficient multicolor multifocus microscopy by optimal design of diffraction binary gratings. *Scientific Reports*. 7. 10.1038/s41598-017-05531-6.

[6] Rimoli, Caio & Valades, Cesar & Curcio, Valentina & Mavrakis, Manos & Brasselet, Sophie. (2022). 4polar-STORM polarized super-resolution imaging of actin filament organization in cells. *Nature Communications*. 13. 10.1038/s41467-022-27966-w.