Internship proposal

Orientation Super-Resolution Microscopy & DNA Organization

Internship supervisor: Bassam HAJJ, bassam.hajj@curie.fr , Phone number: 01 56 24 63 15
Internship location: Laboratoire Physique des Cellules et Cancers, Institut Curie, 11 rue Pierre et Marie Curie, 75005 Paris

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:

- Simulating how molecular emissions behave through our optical setup.
- Developing or fine-tuning algorithms for 3D image reconstruction.
- 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, optics or biophysics**. 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]**

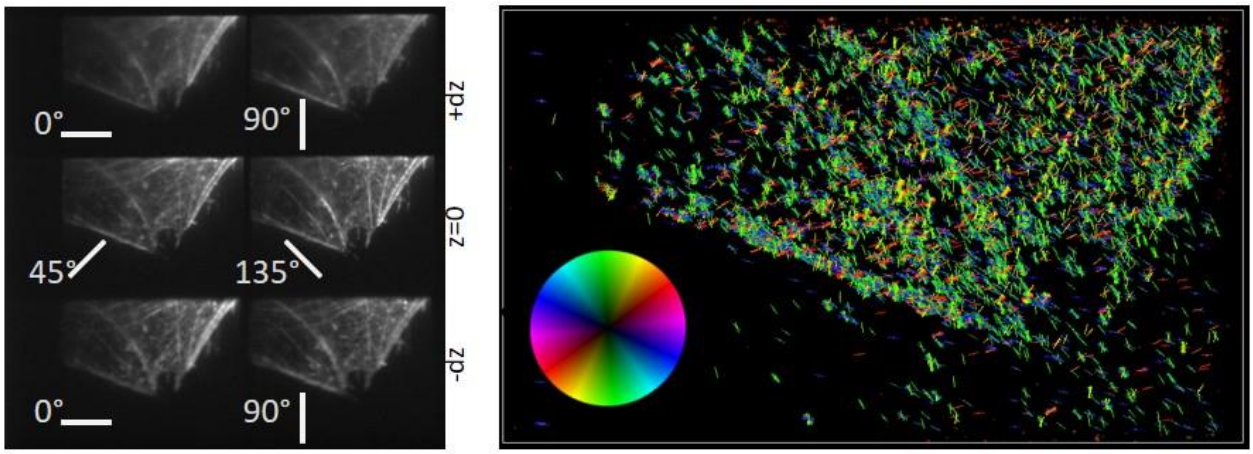

Figure 1: *Polarimetric projection of the multiplane images of actin filament on different polarization directions. Single molecule localization and orientation retrieval of the same field of view (Color code for the SM orientation).*

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 microscopy (STORM).Nat Methods, 2006.

[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.