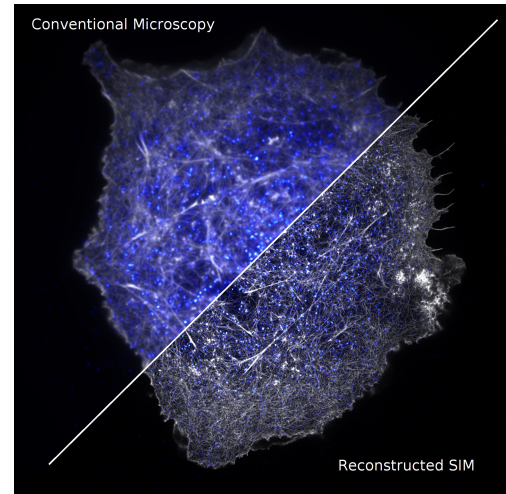


M2 Internship: Image Reconstruction for Structured-Illumination Microscopy

The project. The resolution of a conventional fluorescence microscope is limited by diffraction: two point sources separated by less than roughly half the emission wavelength cannot be distinguished. For visible light this amounts to about 200–250 nm (laterally). Many of the subcellular structures of interest are an order of magnitude smaller, so this limit directly constrains what can be observed in a cell. Super-resolution fluorescence microscopy gathers the techniques developed to circumvent it.

Among these, structured illumination microscopy (SIM) offers one of the best compromises between spatial and temporal resolution: a periodic illumination pattern encodes high-frequency content within the passband of the microscope, and a set of acquisitions at different pattern orientations and phases suffices to recover a twofold resolution gain over conventional systems. This gain is obtained through numerical image reconstruction. SIM is in this respect particularly prone to reconstruction artifacts, due mainly to calibration inaccuracies and biological aspect of samples. Such artifacts can have significant consequences for biological applications in which the structures of interest are comparable in scale to the “grid” artifacts commonly observed in SIM.

We recently developed [FlexSIM](#) to address these issues and deliver faithful reconstructions from challenging data: inhomogeneous illumination, low signal-to-noise ratio in live imaging, and out-of-focus fluorescence. The objective of the internship is to extend its capabilities further by integrating learning-based modules into the reconstruction pipeline.



Comparison of conventional microscopy (Widefield) with SIM (using FlexSIM).

Working environment. The internship will take place at the Institut de Recherche en Informatique de Toulouse (IRIT), under the supervision of Emmanuel Soubies (CR, CNRS) and Paul Escande (CR, CNRS). It will be conducted in collaboration with Louis Romette (PhD student, CNRS) and Christophe Leterrier (DR, CNRS) from the NeuroCyto lab (Institute of NeuroPhysiopathology, Marseille), who use SIM to study the role of the nanoscale periodic spectrin scaffold along axons in neurons.

Reference

[Surpassing Light Inhomogeneities in Structured-Illumination Microscopy with FlexSIM.](#)

E. Soubies, A. Nogueron, F. Pelletier, T. Mangeat, C. Leterrier, M. Unser, and D. Sage. *Journal of Microscopy*, vol. 296, 2024.

About the profile. We warmly encourage applications from candidates pursuing a master’s degree in computational imaging, signal and image processing, or a related field, with solid programming skills in Python and PyTorch. An interest in optics and biology would be a valuable addition.

Application. Please send your CV and your academic transcript for the first year of your master’s degree to both emmanuel.soubies@cnrs.fr and paul.escande@cnrs.fr by November 30 2026.

Key elements :

Application deadline: November 30 2026

Workplace: IRIT laboratory, Toulouse, France.

Type of contract: M2 Internship.

Contract period: 4 to 6 months, starting from February/April 2027.

Remuneration: $\approx$ 600 euros per month.