INTERNSHIP PROPOSAL

Laboratory name: Laboratoire de Physique des Solides / ENS Paris-Saclay
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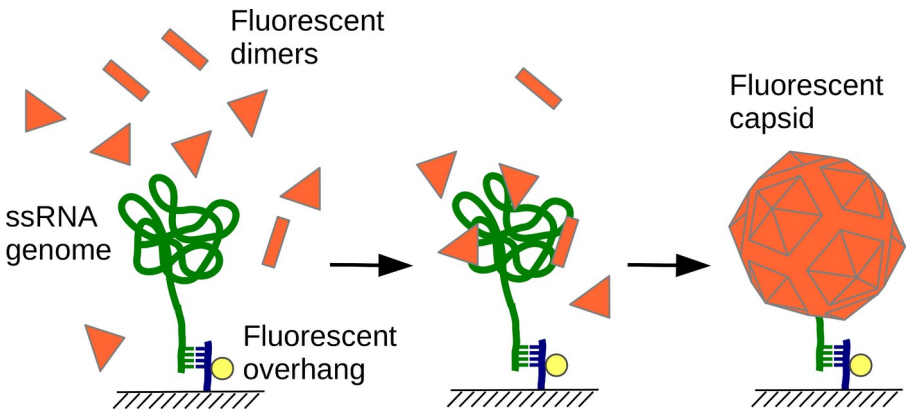
Location: Université Paris-Saclay
Possibility to continue in PhD: Yes
Envisaged scholarship: École doctorale « Physique en Ile-de-France »

Visualizing the assembly of icosahedral viruses at the single particle level by total internal reflection microscopy

Viruses are astonishing biological agents in which hundreds of molecular blocks are integrated with atomic precision into the final structure. Their regularity is all the more remarkable that for many viruses, it occurs **spontaneously**, through an efficient self-assembly process, whether in host cell or in test tube. The nonequilibrium dynamics remains elusive until now, whereas its knowledge would allow a better understanding of the viral life cycle and may help design novel, bio-inspired nanovectors for drug or gene delivery.

The project aims at elucidating the nonequilibrium dynamics of genome packaging into icosahedral viral capsids at **the single particle level**. The molecular components will be produced in-house from viruses infecting plants. Viral or exogenous RNA will be grafted on the bottom side of a microfluidic channel and fluorescently-labelled capsid proteins will be continuously flowed at various flow rates. The binding of capsid proteins on RNA will be monitored in real time by **total internal fluorescence microscopy (TIRFM)** and thus, the self-assembly of dozens of single viral particles will be simultaneously probed with an unprecedented accuracy. We have already investigated dynamical phenomena on empty capsids and loaded viruses by synchrotron X-ray scattering. A continuation in PhD will aim at constructing elaborate physical models and refining the experimental setup in order to mimick better the host cell environment. The project will be carried out in collaboration with experts in single-molecule microscopy at École Normale Supérieure Paris-Saclay. The student must have a background in **general physics** with a strong motivation for **biophysics**.



To learn more:
M. Chevreuil *et al.*, *Nat. Commun.* **9** (2018) 3071 (doi.org/10.1038/s41467-018-05426-8)
G. Tresset *et al.*, *Reflets de la Physique* **52** (2017) 22-26 (doi.org/10.1051/refdp/201752022)