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## BAM02 : Physics, one (bio)molecule at a time

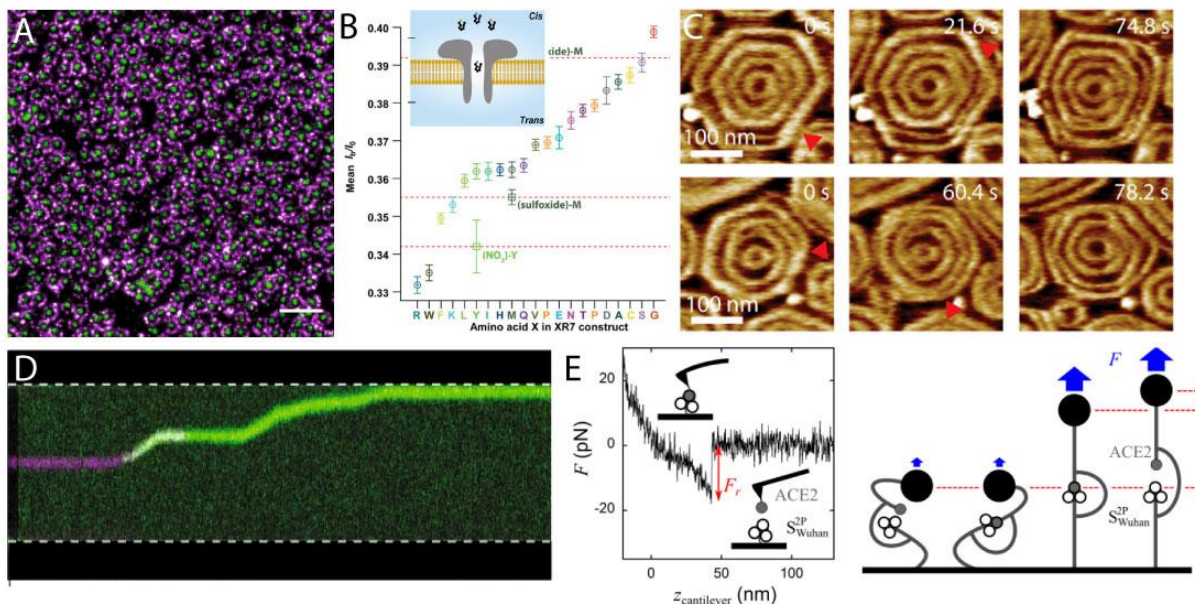
**Organizers:** Fabien Montel (LPENSL), Francesco Pedaci (CBS), Cendrine Moskalenko (LPENSL)

**Invited Speaker:** Terence Strick (IBENS, Paris)

**Sponsors:** GDR Approches Quantitatives du Vivant, SFP Division Physique & Vivant

### Content:

In the last decades, physics of single molecules has been driven by the development of methods that enable to manipulate and observe the dynamics of individual biomolecules such as DNA, RNA or proteins. A wide range of techniques (optical and magnetic tweezers, atomic force spectroscopy, smFRET, spPALM, nanopores, etc) enables now to decipher the complex molecular mechanism of molecular machines but also the conformation of biomolecules and biocondensates. In addition, these tools have also harbored the development of new theoretical framework in out of equilibrium statistical physics (Jarzynski, Crooks) and molecular dynamics. Current approaches combining fluorescence and force control open new avenues to investigate molecular processes in real time and/or inside living organisms.



**A) Optical super resolution (dStorm) of the nuclear pore complex.** Purple : labelling of the luminal ring of the pore; Green : Intrinsically disordered protein network in the central channel of the pore. Scale bar 500 nm. Extracted from : Selles et al. Scientific Reports 2017. **B) Electrical Nanopore characterization of polypeptides of containing different amino acid.** Extracted from : Ouldali et al. Nature Biotechnology 2020. **C) Dynamics of filament splitting and fusing in two Snf7 spirals (rows) observed by High Speed-AFM.** Arrowheads show displacement of the splitting points. Extracted from : Chiaruttini et

al., Cell, 2015. D) **Transcription by a single RNA polymerase observed in real time.** Kymograph showing the polymerase position on the DNA template, indicated by RNA (magenta) and probe (green) signals, as a function of time. Extracted from : Wang et al., Nature Struct. and Mol. Biology 2025. E) (left) **Example of AFM force–distance curve recorded on an S2P Wuhan/ACE2 complex** and showing how the rupture force,  $F_r$ , is determined. (right) **Force-cycling procedure applied with magnetic tweezers to S2P Wuhan and ACE2 engrafted on J-DNA.** Extracted from : Saha et al. Nature Nanotechnology 2025..