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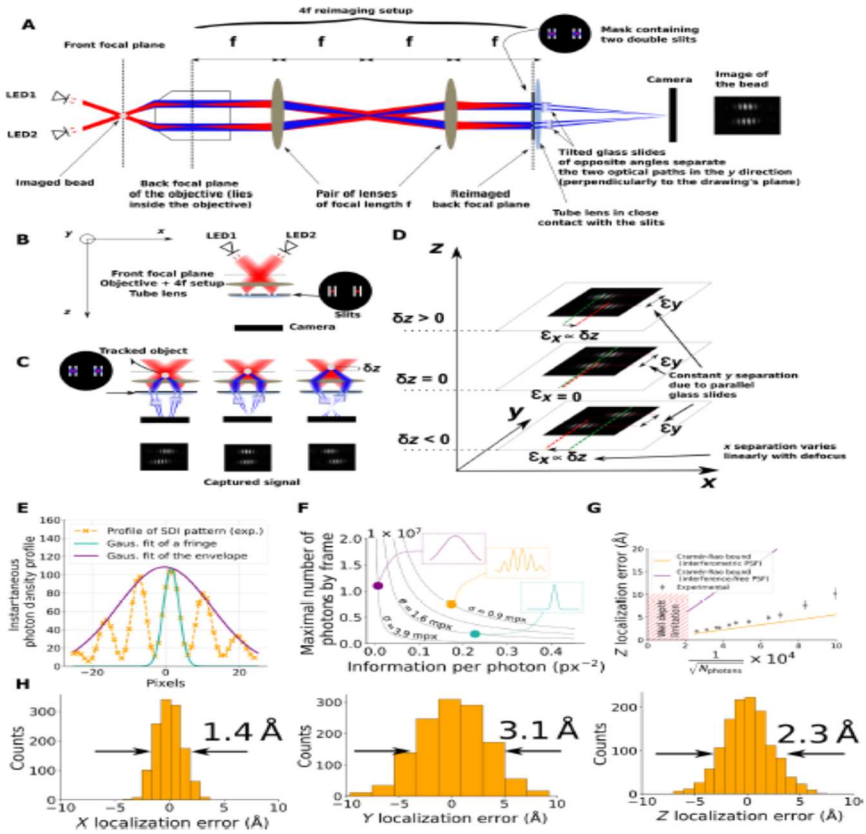
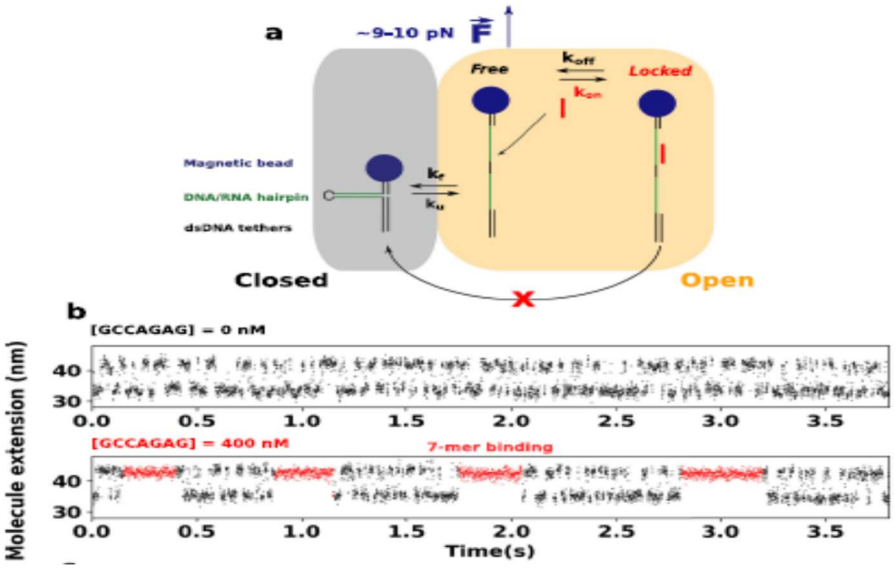
Nucleic acid/Proteins interactions at the single molecule level.

Our team was a pioneer in single molecule micromanipulations. Our magnetic tweezers technique allowed us, and others, to exert forces and torques on single DNA molecules [1,2]. We could then get information on the elastic properties of DNA and on DNA/proteins interactions[3,4]. In particular we could study molecular motors moving along DNA[5–8] while modifying its structure. Helicases[9–11], molecular motors that unwind DNA and so transform the Watson-Crick double helix into two single-stranded DNA are a good example.



Recently [12]we proposed a new detection scheme (see figure above) that allows measurements of DNA extension with a sub-nanometer resolution and with an acquisition rate around the kHz. The initial applications were dedicated to the study of kinetics and thermodynamics of unprecedented studied short DNA sequences(see second figure) [13].

The experimental internship/thesis project will be dedicated to the improvement/use of this new technique mostly with RNA that was much less studied than DNA at the single molecule level.



Depending on the candidate skills and interests the internship/thesis will be oriented towards instrumentation by moving to a faster camera or improving the stability/usability of the setup, and/or study of RNA helicases, like NSP13 the SARSCOV2 helicase, and its coupling with the polymerase and/or the effect of roadblocks along its trajectory, or EJC complex, a study for which our group was recently awarded an ANR grant in collaboration with the group of Hervé le Hir (IBENS, ENS).

The applicants are expected to have an interest in experimental physics, instrumentation, statistical physics, data analysis and basic knowledge in biology.

Funding : if a PhD is considered the applicant will have to apply to the EDPIF for funding. The team will also search for alternative funding.

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