Regulation of gene expression in bacteria : a single-molecule study

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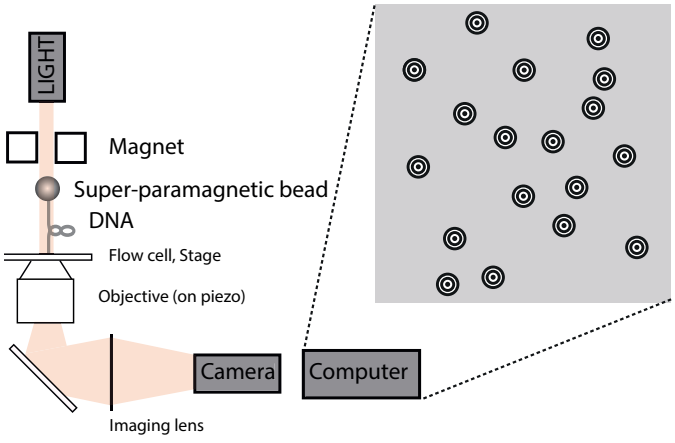
Background

Bulk bio-chemical measurements (e.g. gel shift assays) yield important information but usually fail to observe reaction intermediates or determine rate-limiting steps (simply because average characteristics are measured). In contrast, single-molecule based techniques circumvent the need for synchronizing many molecules at a time. Therefore, they can directly probe reaction intermediates without the need for detecting conformational changes or measuring the release of products (Chemla, Phys. Chem. Chem. Phys. 12 (2010)). Among the different single-molecule techniques, Magnetic Tweezers experiments still attract a lot of attention as they allow performing highly parallel measurements (on tens or hundreds of molecules) (De Vlaminck and Dekker, Annu. Rev. Biophys. 41 (2012)).

Project

In this project, we aim at understanding the detailed mechanisms that control the replication of plasmids. To this end, we propose to use a **state-of-the art Magnetic Tweezers** (capable of tracking 50 beads at 400 Hz) to address specific questions such as: (i) what is the dynamics of the initiation of replication? and (ii) what are the factors (e.g. proteins, RNA) that regulate this mechanism ?



Magnetic Tweezers : Single beads (single-molecules) can be tracked at high-temporal resolutions