Internship/PhD project

Optical sequencing of digital polymers for molecular data storage

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Molecular data storage relies on the ability to write and read digital information encoded onto large molecules. Recently, digital synthetic polymers have been introduced offering interesting perspectives for data storage due to a larger versatility and variety. However, sequencing of macromolecules, *i.e.* reading the digital information they contain, is a major challenge for molecular data storage. Nowadays, the main characterization techniques are based on mass spectrometry or electrical current detection. Despite their high sensitivity, these methods remain restricted to specific polymers and low level of parallelization.

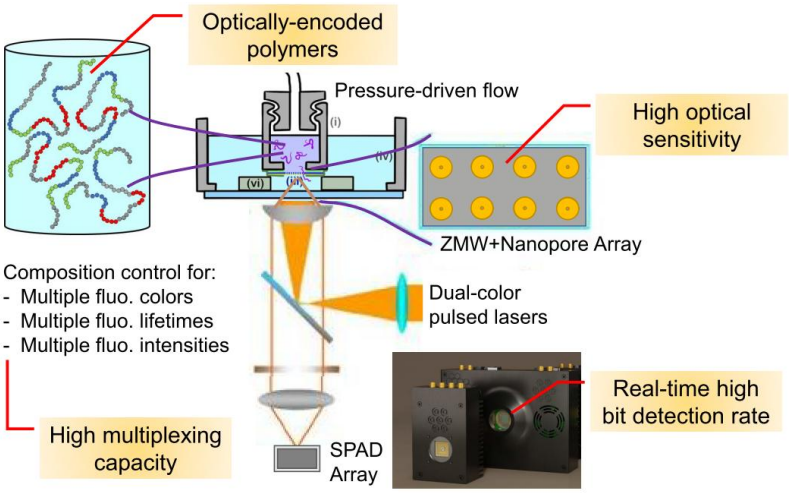

Figure 1. Optical sequencing of fluorescently-encoded polymers at the single-molecule level

Our transdisciplinary consortium of 3 laboratories (Ingénierie des Matériaux Polymères, Lyon; Laboratoire de Physique ENS de Lyon / CNRS ; Institut Fresnel, Marseille) aims to explore a novel approach involving the development of fluorescently encoded synthetic polymers and also DNA origamis, combined with an optical sequencing technique that enables faster reading of their controlled sequence. Our main goal is to set up an innovative platform based on the real-time optical sequencing of digital synthetic and natural polymers (Figure 1).

Adapted polymer chains will be synthesized by the IMP partner in Lyon, using fluorescent dyes that offer a high degree of freedom to encode several bits of information in intensity, color/spectrum and/or lifetime. DNA origamis will be synthetized in LPENSL. LPENSL and IF will develop an innovative platform for sequencing fluorescently-encoded synthetic polymers at the single molecule level.

While optical detection is generally performed on diffraction-limited microscopes, recent advances in nanophotonics open new means to overcome the diffraction limit and concentrate light at a spatial scale well below the optical wavelength. However, such integration remains a burgeoning field, mostly driven by DNA sequencing applications for biosensing and diagnosis. The applications for molecular information storage remain largely unexplored. Our vision is to build a high throughout device with high sensitivity for real-time detection of the information encoded into synthetic polymers for information storage.

Additional information:

- PEPR project website: https://pepr-molecularxiv.fr/
- Keywords: Nanophotonics, Fluorescently-encoded polymers, Time-resolved optical sequencing, Nanopores
- Salary: grants will be allocated for internships > 8 weeks according to current regulation
- Begin/End dates: to be discussed
- May be continued by a PhD thesis with existing funding