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Watching molecular transport in nanoconfined polymeric liquids

Post-doctoral position: 24 months.
Start date: Fall 2025. Position opened until filled

Hosting team:

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in collaboration with Micromégas team (Lydéric Bocquet, LPENS PSL, Paris, France)
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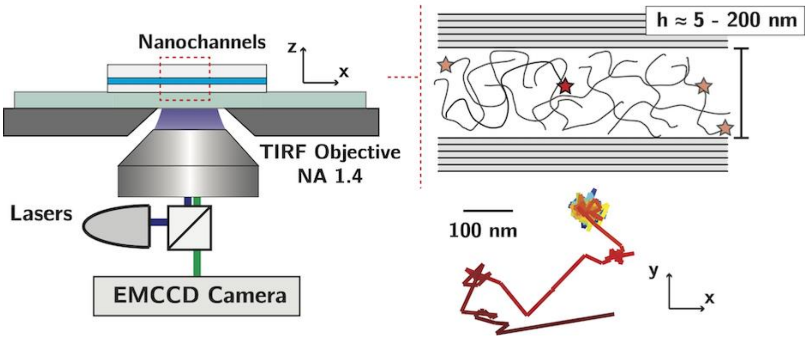

Envisioned experimental methodology. Super-resolution fluorescent microscopy set-up, allowing single-molecule observations of the dynamics of polymeric liquids confined in nanochannels. Few chains are end-tagged with a fluorophore, allowing to track their local dynamics and trajectories.

Liquids confined to nanometric scales can exhibit a range of exotic behaviors, with broad relevance from biology to engineering. Significant progress in our understanding have been achieved in recent years, driven in particular by experimental efforts in the fabrication of nanofluidic devices that reach exquisite control over the degree of liquid confinement down to sub-nanometric length-scales [1]. However, transport dynamics in these sophisticated systems are still probed by macroscopic and ensemble-averaged approaches, which are unable to reveal sub-continuum transport effects in a clear and direct manner.

In this project, we aim to bridge this gap by developing novel experimental approaches to directly visualize and quantify molecular motion in nanometrically confined liquids, focusing on polymeric liquid melts as model systems. We will achieve this aim through the combination of two complementary experimental strategies developed within PSL university, namely super-resolution optical microscopy for single-molecule tracking [2-4] and nanochannel fabrication by Van der Waals assembly of 2D materials [1]. This combination will allow us to address key long-standing questions related to the role of confinement in anomalous molecular transport, dynamic heterogeneities and mobility gradients. By revealing previously invisible molecular motion, our approach will unveil a new molecular perspective on nanoconfined liquid transport.

We are looking for a highly motivated experimentalist with a background in soft matter physics, optics or related fields. Previous experience in interfacial physics, nanofluidics, optics or polymer physics would be an asset.

[1] *Science, 379*(6628), 161-167 *(2023)*. https://doi.org/10.1126/science.adc9931
[2] *Nature Nanotechnology*, *15*(7), 598-604 *(2020).* https://doi.org/10.1038/s41565-020-0695-4
[3] *Science Advances*, *7*(40), eabg8568 *(2021).* https://doi.org/10.1126/sciadv.abg8568
[4] *Nature Materials*, *22*(10), 1236-1242 *(2023).* https://doi.org/10.1038/s41563-023-01658-2

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