INTERNSHIP & PHD PROPOSAL

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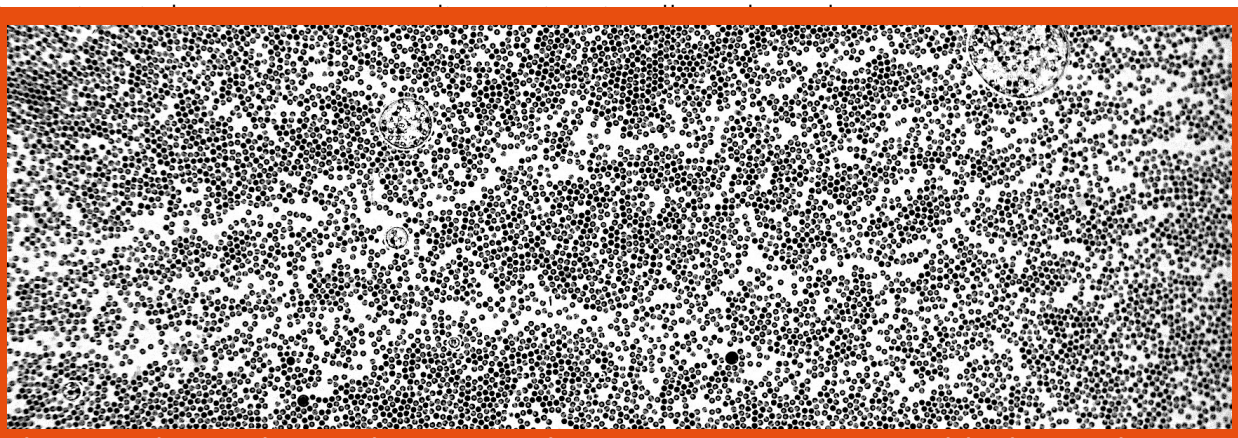
Thesis possibility after internship: YES
Funding: YES Type of funding: CIFRE-TOTALSA

MICROFLUIDIC TRAFIC FLOWS AND HYDRODYNAMIC DEPINNING

Ten thousand meter cube, i.e. the equivalent of three olympic swimming pools: this volume corresponds to the overall oil production during the past sixty seconds only. This phenomenal numbers makes it very clear that building a deep understanding of fluid motion in heterogeneous environment can have a dramatic economical and environmental impact. Despite a hundred years of intense research, however, the basic transport rules of liquid



Réseau de rivières formé par une émulsion advectée dans un dispositif microfludique hétérogène. Diamètre d'une goutte 80 microns. Image: M. Leblay, D. Bartolo (2019).

We aim at rectifying this situation **from a fundamental physics perspective**. **We will experimentally address the collective dynamics of emulsions in model heterogeneous media**, Fig. 1. This trafficking dynamics is intrinsically non-linear and multi scale as a droplet can proceed through disorder only when driven by a sufficiently large local flow, which itself is determined both by the instantaneous positions and velocities of all droplets in the emulsion.

To gain a robust insight on this collective dynamics, we will devise model microfludiic experiments analysed via quantitative image analysis methods. We will then rationalize our results combing concepts and tools from soft-condensed matter, fluid mechanics and statistical physics.