Master 2 Internship

Title: Light-induced microfluidic sorting of chiral entities

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Project:

Many objects with which we deal in our daily life are not superimposable with their mirror image, that is to say they have so-called property of chirality. The chemical, photonic, mechanical and other properties of the same object but of different chirality may dramatically differ. This is why the sorting of chiral entities is of a great interest for pharmaceutical, photonic and many other applications. In the 19th century Pasteur sorted two forms of a chiral material by mechanically picking the crystals of a different shape. Nowadays with the advancement of technologies, the process of chiral sorting at industrial scale must be fast and robust. It is mostly based on the discriminatory interaction of opposite chiral forms on external stimuli.

In our group we suggested a few proof-of-principle approaches to optomechanical sorting of chiral entities using the resonant light scattering on chiral objects [1,2,3]. In the framework of this internship we suggest to build the experimental realization of the optical chiral sorting in a microfluidic chip as a continuation of [1]. The student will be involved in all the processes of this multidisciplinary project. The first stage will be dedicated to manufacturing and spectral characterization of chiral resonant reflectors – chiral liquid crystal (CLC) droplets (see the microscope images of the microfluidic channel and the generated LC droplets in Fig.1a,b). In the second stage the microfluidic chip and a laser-operated sorting setup will be developed and tested (see image of a typical microfluidic chip in Fig.1c). In the third stage the discriminatory light reflection will be used to sort the manufactured reflectors in the "optical chiral conveyer" (see the sketch of the "conveyer" in Fig.1d).

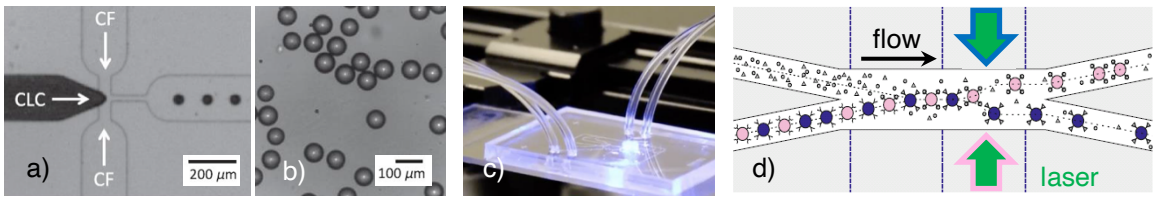

Figure 1. Microscope images of (a) microfluidic channel and (b) generated CLC droplets. Image of a typical microfluidic chip connected to the tubing (c). Sketch of the "optical chiral conveyer" (d).

1. G. Tkachenko and E. Brasselet. Optofluidic sorting of material chirality by chiral light. Nat. Commun. 5, 3377 (2014).
2. N. Kravets, A. Aleksanyan, H. Chraibi, J. Leng and E. Brasselet. Optical enantioseparation of racemic emulsions of chiral microparticles. Phys. Rev. Appl. 11, 044025 (2019)