Master 2 Internship

Title: Soft deformation of biomimetic object induced by light

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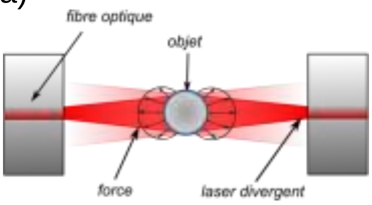
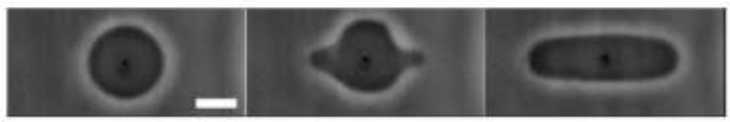
Project:

Characterizing the deformation properties of soft objects at the micron scale is a major challenge both from a fundamental point of view and at an industrial level. At these scales (typically 1-10 µm), the slightest contact with the object can modify the overall viscoelastic response. We have developed a double optical trap integrated into a microfluidic device (see figure 1) to study the rheological properties of biomimetic objects (such as vesicles) or drops of fluids **without any contact**. Such an optical trap, also called an **optical stretcher** [1], consists of two optical fibers facing each other. It is then possible to trap and deform the object at higher power without any contact.

a)





Deformation of a vesicle in a dual wavelength optical stretcher that enables to stretch and heat the vesicle below and above the transition temperature

a) Optical stretcher setup *b) Optical deformation of a vesicle*

The first goal of the internship (and the PhD) will be to carry out an experimental and theoretical investigation of droplet deformation of low interfacial tension in this double optical trap. This will give a first detailed characterization of optical forces inside this trap. What is the maximum deformation ? Can optical radiation pressure induce breakup ? The second challenge will be to deform soft biomimetic objects such as vesicles (see figure 2) or polymersomes to characterize the rheological properties, their maximal deformation, their permeability under deformation. The results of this project will be part of the Frontiers of Life Project of University of Bordeaux (in close collaboration with LCPO Lab) and will be compared to numerical predictions performed in the Optofluidics team.

[1] U. Delabre et al. **Deformation of phospholipid vesicles in an optical stretcher**, Soft Matter (2015)
[2] **Manipulation and biophysical characterization of GUVs with an optical stretcher** Gheorghe Cojoc, Antoine Girot, Ulysse Delabre, Jochen Guck, The Giant Vesicle Book , Editors C. Marques and R. Dimova