Experimental projects in biofab lab
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We propose to the interested students to tackle ongoing research problems in the field of complex matter and living systems, nanosciences and nanobiology.

We have three experimental setups that can be used for lab training, they are briefly described in the following :

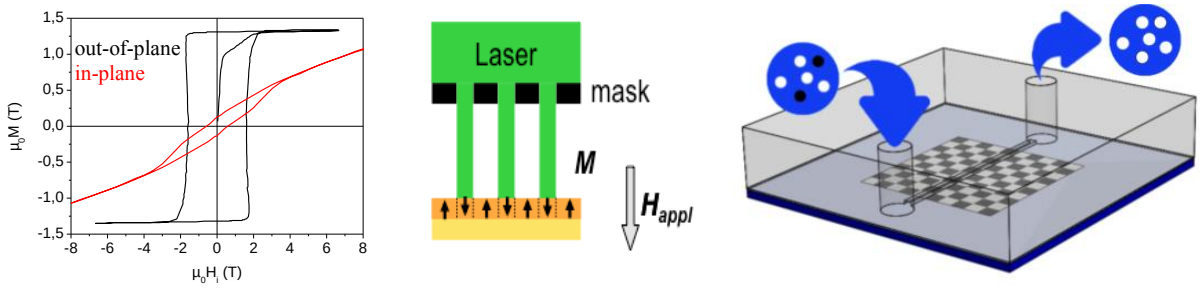
Project 1 : Differential scanning calorimeter to study the thermodynamics of self-assembled DNA nanostructures (8h)

We have a state of the art nanocalorimeter (300 µL of sample volume) that can be used to measure the thermodynamic properties of self assembled nanostructures.
We propose to the students to perform DSC on short synthetic nanostructures and to analyse the data. Complementary investigations using AFM and gel electrophoresis will allow the student to build a thermodynamic picture of the system.

The students will also learn how to design more complex structures and characterize standard nanostructures using AFM.

After the project the students will have hand-on experience on methods and concept used in the promising field of DNA nanotechnologies.

Project 2 : Fabrication of a micro-fluidic device with integrated hard magnetic micro-flux sources for particle manipulation (8h)



Left: Hysteresis loops of a 5 µm thick NdFeB film; **centre:** local patterning of a hard magnetic film using the TMP technique; **right**: PDMS µ-fluidic device with integrated µ-magnets for particle manipulation.

- The first part (4h) of the practical is dedicated to the fabrication of thick hard magnetic NdFeB films by high rate triode sputtering their micro-patterning using the Thermo-Magnetic-Patterning (TMP) technique, and their characterization.
- The second part (4h) of the practical is dedicated to the fabrication of polymer-based micro-fluidic channels, their integration above micro-patterned hard magnetic films and the specific capture of magnetic micro-particles in the micro-fluidic device.

Project 3: Manipulation of micro and nanoparticules with optical tweezers (8 h)

Since their discovery in 1986, optical tweezers are becoming a standard tool for non-invasive manipulation in interdisciplinanry fields such as biology, chemistry and physics. Optical tweezers are based on the extreme focalization of a laser beam and can be integrated into a

conventional optical microscope. They are particularly well adapted to manipulate nano to micro sized dielectric particles such as polystyrene or glass beads.

In the training, students will trap particles by focalizing the laser beam by using the homemade optical microscope assembled in the biofab lab. They will align the optical setup, perform the trapping, record and analyze videos of trapped particles.

This experimental work will gives students hand-on knowledges regarding the interaction of light with matter, signal processing, brownien motions and programming with an opensource software.