

2024-25 Internship proposal at G2Elab/LMGP Lab.

Novel nanoparticle magnetophoresis in custom micro-channels

Abstract

Our G2Elab & LMGP teams collaborate to the development of Magnetophoresis as a promising technique in passive micro-fluidic manipulation and molecular detection. We investigate it for its efficacy in transporting magnetic nanoparticles (MNPs) through a channel. The original work from several previous internships has proved the capability of Magnetophoresis to displace MNPs in various liquids without complex micro-fluidic systems (no valves, no pumps...). Using bio-functionalized MNPs provides an effective means for biomolecular transport (Fig. 1).

However, several significant challenges currently remain: reproducibility issues, unreliable efficiencies in biomolecular transport, and possible contamination risks. A key observation indicated that the fluidic separation of the two parts of the channel likely underpins most of these challenges.



The present internship aims at solving these problems so as to progress one step closer to practical applications in (hopefully commercialized) biomedical devices.

Project description

In this project, we will explore, imagine and implement potential solutions to the many issues at fluid interface (Fig. 2):

First steps:

- study fluid, separation and merging in various channel geometries (microscopy, solution colouring) ;
- observe MNP magnetophoresis at interface (fluorescence, various types of MNPs, magnetic/mechanic device) ;
- explore impact of various hydrophilic/-phobic coatings on fluidic behaviour, both at bottom surface and on channel walls ;

Second steps:

- implement promising solutions from 1st steps ;
- develop upgrade fluidic plastic channel ;
- determine magnetophoresis efficiency for transporting MNPs through interface ;
- determine biomolecular transportation via functionalized MNPs;

Scientific & technical environment

The candidate will work within a small G2Elab team on the CIME/Nanotech interdisciplinary platform, in collaboration with LMGP. We are located in the heart of an exceptional scientific environment @MINATEC with various research labs & teams. The work will be performed in the framework of an existing collaboration with MagiA Diagnostics, a startup based in Echirolles.

Profile & requested skills

We look for a highly motivated student with experimental and basic practical lab skills. A background in microfluidics, physical chemistry or magnetism will be an additional asset. The student should exhibit creative thinking and team work capabilities.

Subject could be continued with a PhD thesis: *to be discussed*

Allowance Internship allowance will be provided (5 to 6 months)

Contact To apply, please send a CV and motivation letter to orphee.cugat@grenoble-inp.fr and franz.bruckert@grenoble-inp.fr.

Reference

- Victor Vieille PhD 2019 www.theses.fr/2019GREAT121
- Delshadi, S et al. . « Innovative Multiplexed Point-of-Care Immunoassay Applied to Hepatitis B Screening ». Clinica Chimica Acta 493 (juin 2019): S644-45.