Post-doctorat offer : Experimental study of supercavitating flows thermal behavior

Description of the work:

Since a few years, ILM and LEGI partners have developed experimental tools dedicated to the study of thermal effects in cavitating flows inside micro-diaphragms or micro-steps [1]. The measurement of local temperature in the flow is performed using the two colors ratiometric laser induced fluorescence method coupled with the confocal microscopy.

The first objective of this work is to extend this technique to the study of supercavitating flows (low cavitation number) around micro-metric size objects placed in a channel. Measurements of the gas pocket volume, length and position will be performed thanks to recent development based on laser intensity analysis [2]. The thermal behavior of such flow is still an open question. Since supercavitating flows are characterized by high mass flux, strong temperature gradients can be expected. Different geometries will be investigated such as, round, rectangle, beveled 2D objects or hydrofoils (Fig. 1).

The second objective of this work is to investigate thermal effect trough supercavitating a micro-step geometry [3] for the optimization of the process of liquid degassing using the same kind of experimental tools.

All those experimental results will be compared to numerical simulations performed at Pprime institut but also to complementary experiments made at LEGI.

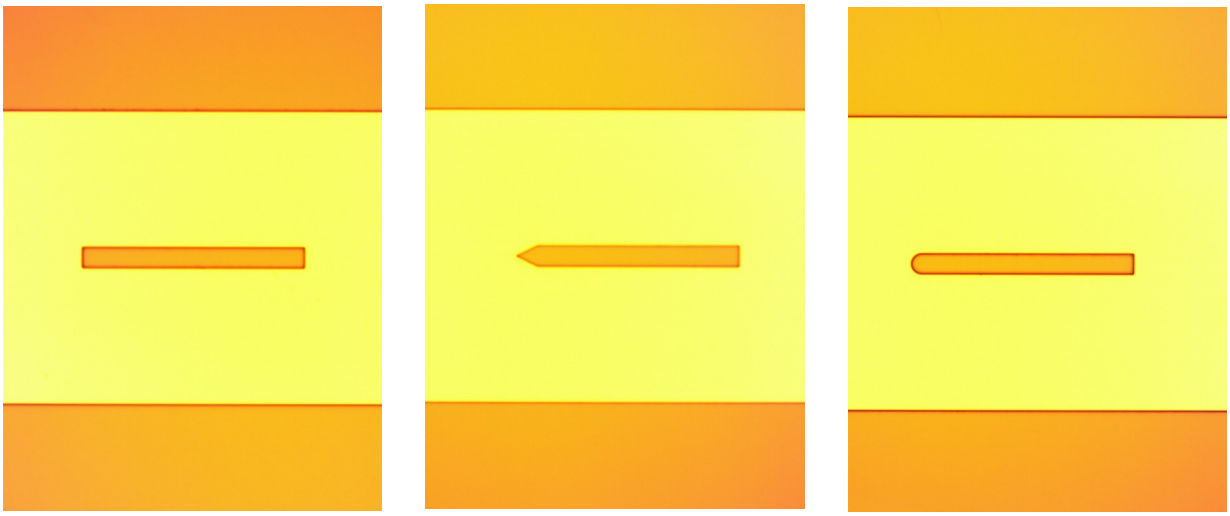

Fig. 1 Example of micro-object geometries under investigation.

Work schedule:
- synthesis of thermal nanoprobes with the supervision of the FENNEC ILM team
- learn how to run and control the confocal microscope
- perform thermal calibrations in empty channels with thermal nanoprobes
- perform measurements of temperature and gas fraction for different geometries
- perform analysis of results regarding the literature state of art

Expected skills: A knowledge in micro-fluidics and/or laser induced fluorescence measurements and/or Labview and/or nanoparticles synthesis will be some positive points.

Contrat details:
- 18 month CDD contract from January 2019 for PostDoctoral research
- As the PostDoc is funded by a DGA grant, only european citizens may apply to that offer
- Organization: This experimental work will be performed at ILM (Lyon) under the supervision of Gilles Ledoux and in collaboration with Damien Colombet, Frédéric Ayela from LEGI and Eric Goncalves from Pprime insitut. Microfluidics devices will be microfabricated by the LEGI partner

Contact:

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References:

[1] Ayela, F., Medrano-Munoz, M., Amans, D., Dujardin, C., Brichart, T., Martini, M., et al. (2013). Experimental evidence of temperature gradients in cavitating microflows seeded with thermosensitive nanoprobes. Physical Review E
[2] Podbevšek, D., 2019. PhD Thesis at Claude Bernard University. Optical probing of thermodynamic parameters and radical production in cavitating micro-flows
[3] Qiu, X., Cherief, W., Colombet, D., & Ayela, F. (2017). A simple process to achieve microchannels geometries able to produce hydrodynamic cavitation. Journal of Micromechanics and Microengineering, 27(4).