

RESEARCH TOPIC FOR THE PARISTECH/CSC PHD PROGRAM

Field: Physics, Optics

Subfield: Applied Physics

Title: Highly sensitive sensors for detection of pollutants based on optical nanofibers

ParisTech School: Institut d'Optique Graduate School

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Research group/Lab: Laboratoire Charles Fabry

Lab location: Palaiseau

(Lab/Advisor website): <https://www.lcf.institutoptique.fr/>

Short description of possible research topics for a PhD: Our research group is working since more than 10 years on non linear effects in optical nanofibers. We have developed a pulling machine with performances at the state of the art that enabled us to realize several first ever experimental demonstrations. As shown on the fig., the nanofiber is linked to the two unstretched parts of a standard fiber through two tapers. At these small diameters the optical mode shows a high evanescent field around the nanofiber which is very sensitive to the external environment. In this thesis we propose to study a new type of sensor using Raman scattering in the evanescent field of nanofibers immersed in liquids or gas to detect pollutants. This sensor will be highly compact, low cost and sensitive compared to other techniques.

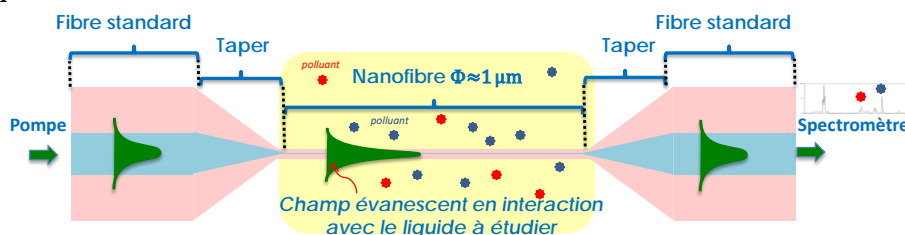


Figure 1. Scheme of the pollutant sensor based on a silica nanofiber.

Required background of the student: Master in physics with a pronounced interest in optics and experimental work. Knowledge in non linear optics and/or guided optics and/or sensors are welcome.

A list of 5 (max.) representative publications of the group:

1. L. Shan, G. Pauliat, G. Vienne, L. Tong, and S. Lebrun, Appl. Phys. Letters, 102, (2013).
2. M. Bouhadida, J. C. Beugnot, P. Delaye, K. Phan Huy and S. Lebrun, Appl. Phys. B 125,228 (2019).
3. J.-C. Beugnot, S. Lebrun, G. Pauliat, H. Maillotte, V. Laude, and T. Sylvestre. Nature Communications, 5:5242, October 2014.