Spécialité de Master « Optique, Matière, Plasmas »

Stage de recherche (4 mois minimum, à partir de début mars)

Proposition de stage (ne pas dépasser 1 page)

Date de la proposition : 18 novembre 2013

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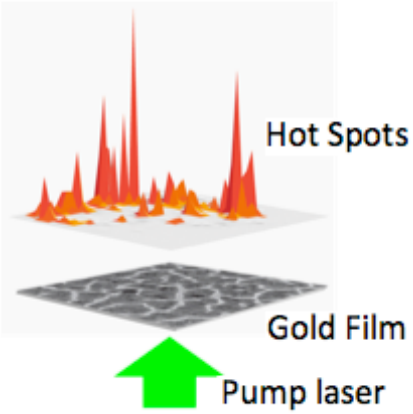
Adresse / *address:* 1, rue Jussieu 75005 Paris			
Lieu du stage / *internship place*: Institut Langevin 1, rue Jussieu 75005 Paris			

Titre du stage / *internship title*: **Development of nanosized plasmonic random lasers based on 2D metallic fractal films**

Résumé / *summary*

Conventional lasers comprise a gain medium sandwiched between the two mirrors of a Fabry-Pérot cavity. The gain medium is pumped to achieve population inversion and the cavity provides the necessary feedback to induce stimulated emission. Nevertheless, lasing can also be achieved with a feedback that does not rely on confinement by an actual cavity. On the one hand, random lasers use multiple scattering of light to increase the lifetime of photons within the gain medium. On the other hand, surface plasmons can provide feedback, as recently demonstrated [R. F. Oulton et al., Nature **461**, 629 (2009)].



At the Institut Langevin, we have recently explored the interaction of fluorescent emitters with two-dimensional (2D) metallic fractal films. We have observed in particular nanosized hot spots at the surface of these films, where the local density of electromagnetic modes (LDOS, local density of states) is dramatically enhanced [V. Krachmalnicoff et al. Physical Review Letters **105**, 183901 (2010)].

In this Master project, we will explore the potential of the 2D plasmonic materials for random lasing. Since these materials provide both multiple scattering and highly confined fields due to surface plasmons, we expect to prove the feasibility of a new class of random lasers that benefit from both aspects and which could achieve nano-sized dimensions. The goal here will be to achieve lasing at highly localized hot spots at the surface of the 2D metallic fractal films, as illustrated in the figure below. The gain medium will be a fluorescent dye circulating inside a microfluidic channel at the surface of the metallic fractal films in order to prevent photobleaching. Alternatively we will use fluorescent beads, semiconducting nanocrystals, or nanosized diamond particles with NV colored centers, and distribute them randomly at the surface of the metallic fractal films. A pulsed pump laser will be focused on the metallic film using a confocal fluorescence microscopy set-up and we will search for signatures of local laser emission by measuring the emission intensity as a function of the pump power (which should exhibit a threshold once laser emission is achieved), or by measuring the evolution of the emission linewidth while increasing the pump power.

Toutes les rubriques ci-dessous doivent obligatoirement être remplies

Ce stage pourra-t-il se prolonger en thèse ? *Possibility of a PhD* **? : oui**

Si oui, financement de thèse envisagé/ *financial support for the PhD***: Ecole Doctorale**

Lasers, Optique, Matière	**x**	Lumière, Matière : Mesures Extrêmes	**x**
Plasmas : de l'espace au laboratoire			

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