Spécialité de Master « Optique, Matière, Plasmas »

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

Proposition de stage

Date de la proposition :

Responsable du stage */ internship supervisor*:

Nom / *name*: SEBBAH Prénom/ *first name* : Patrick

Tél : 01 80 96 30 42 Fax : 01 80 96 33 55

Courriel */ mail*: patrick.sebbah@espci.fr

Nom du Laboratoire / *laboratory name*: Institut Langevin

Code d'identification :UMR 7587 Organisme : CNRS – ESPCI Paris-Tech

Site Internet / *web site*: http://www.institut-langevin.espci.fr/Patrick-Sebbah,436

Adresse / *address:*

Lieu du stage / *internship place*: 1, rue de Jussieu, 75005 Paris

Titre du stage / *internship title*: Random lasers

Résumé / *summary*

A laser is not necessarily a sophisticated device: Pumping energy into an amplifying medium randomly filled with scatterers, a powder for instance, makes a perfect "random laser." In such an unconventional laser, the absence of mirrors greatly simplifies laser design, but control over emission directionality or frequency tunability is lost, seriously hindering any prospect for this otherwise simple laser. We proved recently that control over the random laser emission can be regained by active shaping of the spatial pump profile. The novel approach we propose to harness random lasers is inspired by spatial shaping methods lately employed for coherent light control in opaque media. (a) As a proof-of-concept, we want to show experimentally how to select any desired wavelength and shape lasing modes of an actual random laser by adaptively modulating the spatial profile of the pump without prior knowledge of the lasing modes' spatial distribution. (b) With the ability to freely tune the emission wavelength of the random laser, we will explore the paradigm of pump-induced exceptional points (EP) at which the lasing frequencies and the corresponding lasing modes coalesce. We will use this approach to explore bistable lasing behavior in the vicinity of such an EP and its potential for switching applications. (c) We will go beyond frequency tuning and apply active pump control to manipulate other fundamental characteristics of the random laser, e.g., directionality and the temporal width of the emitted laser pulse, with the goal to achieve a true mode-locking operation. Our conceptually new approach will turn wayward and exotic random lasers into tunable and controlled light sources. Ultimately, active control will initiate a paradigm shift in conventional laser physics, offering cheap mirrorless laser sources as an alternative to conventional cavity lasers, with strong potential and flexibility to address fundamental questions as well as challenging applications.

The candidate will be involved in one or several aspects of this project. The work will focus on experiments, as well as on numerical modeling and simulations, fundamental aspects as well as possible applications.

Good expertise in optics experiments or/and programming is preferred for this position. But most important are curiosity and creativity.

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

Si oui, financement de thèse envisagé/ *financial support for the PhD***: Academic or Army (DGA)**

Lasers et matière	**X**	Lumière, Matière : Mesures Extrêmes	
Optique de la science à la technologie	**X**	Plasmas : de l'espace au laboratoire	

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