Spécialité de Master « Optique, Matière, Paris »

Stage de recherche

Proposition de stage

Date de la proposition : 10/11/2018

Responsable du stage */ internship supervisor*:

Nom / *name*:	MANGENEY	Prénom/ *first name* :	Juliette
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Nom du Laboratoire / *laboratory name*: Laboratoire Pierre Aigrain

Code d'identification : UMR 8551 Organisme : CNRS

Site Internet / *web site*: www.lpa.ens.fr

Adresse / *address:* 24 rue Lhomond, 75005 Paris cedex

Lieu du stage / *internship place*: Laboratoire Pierre Aigrain de l'Ecole Normale Supérieure

Titre du stage / *internship title*: **Graphene Nanostructures for Coherent THz Light Emission**

The terahertz (THz) frequency domain (typically 0.1 to 10 THz) is a very specific region within the electromagnetic spectrum, which lies between the microwave and mid-infrared ranges. THz radiation has many promising applications in various areas of science and technology such as astronomy, chemistry, bio-security and high bandwidth communications. However, even if THz rays are being widely studied, their consumer applications are almost inexistent due to the lack of compact powerful sources. Thus, the development of a coherent, miniature and powerful source of THz radiation that can operate at room temperature is one of the main challenges of modern THz technology.

Our group is currently exploring the potential of graphene to generate coherent THz radiation [1]. Indeed, owing to its unique properties such as a band structure with a zero-energy gap, THz photons can instigate interband transitions at THz frequencies, suggesting that THz lasing may be possible[2].

The aim of this internship is to investigate the potential of graphene nanostructures for the realization of novel THz lasers. The candidate will characterize the optical properties of graphene nanostructures at THz frequencies using time-domain spectroscopy experiment. The candidate will study the influence of the morphology of these graphene nanostructures (size, shape,..) on the optical transitions and their selection rules. The candidate will then perform optical pump-THz probe experiments to investigate the carrier relaxation dynamics in these graphene nanostructures. Microscopic models will be developed to interpret the experimental results. The objective is to design graphene nanostructures with long lifetime optical gain at THz frequencies by reducing non-radiative recombination channels. This work will provide a strong support for the realization of graphene-based THz sources. This internship may be pursued by a thesis.

[1] J. Maysonnave, et al. Nano Lett. 14, 5797 (2014)

[2] S. Massabeau et al., Phys. Rev. B 95, 085311 (2017)

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***: Ministerial Funding**

Lumière, Matière, Interactions		Lasers, Optique, Matière	**X**