Spécialité de Master « Optique, Matière, Plasmas »

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

Proposition de stage

Date de la proposition : 28/10/2013

Responsable du stage / *internship supervisor*:

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Nom du Laboratoire / *laboratory name*: Laboratoire Pierre Aigrain de l'Ecole Normale Supérieure

Code d'identification : UMR 8551 Organisme : CNRS

Site Internet / *web site*: *http://www.lpa.ens.fr/spip/spip.php?rubrique66&lang=en*

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*: ***Coherent THz emission from graphene***

Résumé / *summary*

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. This is due to the lack of practical sources and detectors. 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.

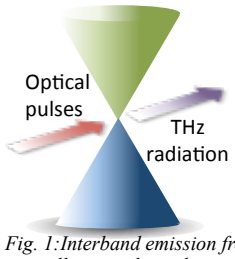

Fig. 1:Interband emission from optically excited graphene.

Our group is currently exploring the potential of graphene to generate coherent THz radiation. Indeed, owing to its unique properties such as a band structure with a zero energy gap and linear energy dispersion, many mechanisms may be responsible for efficient THz emission in graphene. We are particularly interested in radiative interband transitions, photon drag effects and inter-Landau level transitions in graphene that, according to theoretical studies, could lead to efficient coherent THz emission.

The aim of the intership is to study the photonic properties of graphene in the THz frequency range and also the possiblity of graphene to emit coherent THz radiation. Further, a population inversion near the Dirac point in graphene will be investigated by exciting graphene with intense femtosecond optical pulses. The candidate will participate in the development of an advanced TDS system [1] covering frequencies from 0.05 THz to 40 THz using ultra-short (~15fs) optical pulses. The experiment will be coupled to a low temperature cryostat and a magnetic field. Additionaly, the candidate will perform optical-pump/THz-probe experiments in graphene to investigate carrier relaxation dynamics as function of temperature, the position of Fermi level energy and magnetic field. This experimental work will be supported by close exchange with the theory group at LPA.

This topic is major step towards the realization of THz lasers by exploiting stimulated photon emission in graphene. This intership may be pursued by a thesis.

[1] R. Rungsawang *et al.* PRL **110**, 177203 (2013)

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**

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

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