

Spécialité de Master « Optique, Matière, Paris »

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

Proposition de stage

Date de la proposition : 14/10/15

Responsable du stage / internship supervisor: DHILLON,

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Nom du Laboratoire / laboratory name:

Code d'identification : UMR 8551

Organisme : Laboratoire Pierre Aigrain

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

Adresse / address: Ecole Normale Supérieure, 24 rue Lhomond, 75005 Paris

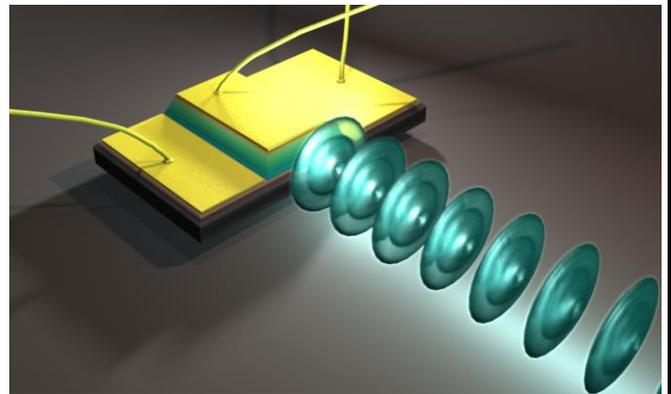
Lieu du stage / internship place: Ecole Normale Supérieure, 24 rue Lhomond, 75005 Paris

Titre du stage / internship title: Ultra-short Pulse Generation in Quantum Cascade Lasers

Résumé / summary

Context: Modelocking is the paradigm for the generation of ultra-short laser pulses and frequency combs. It has revolutionized technology in the visible and near-infrared, and touches a range of applications from spectroscopy to cold atoms. Nonetheless modelocking in other spectral ranges such as the terahertz (THz) has proven to be challenging, despite potential applications in coherent control to metrology. This proposition consists in the study of ultrashort pulse generation in Quantum Cascade Lasers (QCLs). QCLs are promising semiconductor based sources that operate in the mid-infrared (MIR) and THz regions. In these devices laser action is based on electronic intersubband transitions within a series of quantum wells and a "cascade" where the electrons undergo multiple transitions through many periods of the quantum system. These two concepts have permitted powerful and compact sources in previously inaccessible electromagnetic regions.

Internship Subject: Our group has demonstrated recently that pulses can be generated from QCLs but are limited to pulse widths of ~10ps. The internship will consist in the demonstration of the coupling of passive and active pulse generation techniques. This will potentially allow the pulse width to be reduced to a few picoseconds and provide the first steps for the generation of a THz frequency comb. The internship will provide a strong base in ultrafast techniques (optical, electronic and simulations) applied to a semiconductor system. This will be based around femtosecond lasers, ultrafast microwave modulation and simulation of the dynamics of intersubband transitions.



Thesis: Through a recent European wide project ('ULTRAQCL'), coordinated by the LPA, and an extensive European network with partners from Germany, Italy and the UK, our group wishes to use new concepts in modelocking to realise a reduction in pulse widths by an order of magnitude. As well as short pulse generation this will permit the generation of a frequency comb in the THz range from a compact and powerful source.

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: Bourse d'Ecole Doctorale

Lumière, Matière, Interactions

YES

Lasers, Optique, Matière

YES

Fiche à transmettre (fichier pdf **obligatoirement**) sur le site <http://stages.master-omp.fr>