

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 : 26/10/2012

Responsable du stage / internship supervisor:			
Nom / name:	Goldfarb	Prénom/ first name :	Fabienne
Tél :	01 69 35 21 03	Fax :	01.69.41.01.56
Courriel / mail:	Fabienne.goldfarb@u-psud.fr		
Nom du Laboratoire / laboratory name: Laboratoire Aimé Cotton			
Code d'identification :	UPR3321	Organisme :	CNRS
Site Internet / web site:	http://www.lac.u-psud.fr		
Adresse / address:	bât 505, campus d'Orsay / 91405 Orsay cedex		
Lieu du stage / internship place:	laboratoire Aimé Cotton		

Titre du stage / internship title: Coherent processes in metastable helium
Résumé / summary
<p>Simple two level systems can model many light-matter interaction phenomena. But three level systems are necessary to study some effects when the existence of two optical transitions give rise to coherent processes, that makes it possible to transfer states from light to atoms (and vice-versa). In the so-called Λ-system (when two optical transitions share the same excited state), a initially opaque medium for a weak probe, which couples one of the transitions becomes transparent when the other transition is excited with a stronger coupling laser beam : this is the electromagnetically induced transparency (EIT) phenomenon, which can also be interpreted as an optical pumping of the atoms in a « dark state ». The dispersive properties associated with EIT allow a control of the light group velocity, and to go from a slow light regime to a fast light regime and even to negative group velocities [1].</p> <p>Metastable helium has the advantage to make it possible to isolate both a pure three level « Λ-system », and a « tripod system » where 3 levels are optically coupled to the same excited state. The first system was recently used to study the behavior of a cavity in which such a dispersive medium was inserted in the case of a slow light regime [2], and in the case of negative group velocities [3]. Preliminary studies are now performed about light storage experiments. Other results showed that « Λ-system » can exhibit very narrow resonances due to coherent population oscillations [4], and experiments about 4 wave mixing, phase sensitive amplification and non-classical state of light generation (squeezed states or single photons) are considered.</p> <p>Preliminary experiments were also performed with the tripod system, which has the advantage to have two dark states. Different theoretical articles were published on such systems and the consequences of the existence of transitions between these dark states, but very few experiments were performed. We have already published an article that shows that these dark states can interfere destructively [5].</p> <p>The trainee will be included in our current research work about light pulse storage or tripod.</p> <p>This research work is part of a strong collaboration with the group of Pr. R. Ghosh (Jawaharlal Nehru University, Delhi, India)</p> <p>Our research group has different collaborations in France, Europe and India.</p> <p>[1] F. Goldfarb, T. Lauprêtre, J. Ruggiero, F. Bretenaker, J. Ghosh, and R. Ghosh, C. R. Physique, 10, 919 (2009) [2] T. Lauprêtre, C. Proux, R. Ghosh, S. Schwartz, F. Goldfarb, and F. Bretenaker, Opt. Lett. 36, 1551 (2011) [3] T. Laupretre, S. Schwartz, I. Carusoto, R. Ghosh, F. Goldfarb and F. Bretenaker, N. J. Phys 14, 043012 (2012) [4] T. Laupretre, S. Kumar, P. Berger, R. Faoro, R. Ghosh, F. Bretenaker and F. Goldfarb, Phys ; Rev. A 85, 051805 (2012) [5] S. Kumar, T. Lauprêtre, R. Ghosh, F. Bretenaker, and F. Goldfarb, Phys. Rev. A 84, 023811 (2011)</p>
Toutes les rubriques ci-dessous doivent obligatoirement être remplies

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

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