Soutenance de thèse

« Optical manipulation of polaritons in semiconductor microstructures »

Félix Marsault

Vendredi 16 décembre 2016, 14 h

Salle Richard Planel, bâtiment D1, C2N Marcoussis

This PhD thesis is dedicated to the experimental study of microcavity polaritons in III-V semiconductor microstructures. It consists in a fundamental part focusing on the coherence and polarization properties of polariton lasers, and in a more applied second part which concerns the proof of principle of new all-optical polariton devices.

In the first part, we use a streak camera in the single shot regime to measure second order photon correlations with a picosecond resolution. This technique allows measuring the emission statistics of polariton lasers and analyzing at the picosecond scale the dynamics of the establishment of the spontaneous coherence and polarization of the mode during the laser initialization. We show a stochastic initialization of the polarization followed by a precession around an effective magnetic field inside the cavity. The influence of the system dimension is discussed as well as a theoretical model reproducing our experimental observations.

The second part of the work is dedicated to the realization of polariton devices with an all-optical control. These devices are constituted of a 0D resonator coupled to 1D input and output waveguides. We demonstrate the operation of a polariton router and a remotely controlled optical bistability. This last effect is the core ingredient of an optical memory and we show preliminary results on the implementation of all-optical AND, OR and XOR logic gates.

Members of the jury :

M. Maxime Richard, Research director, *Institut Néel, Grenoble*, Rapporteur

M. Thierry Guillet, Professor, *Laboratoire Charles Coulomb, Montpellier*, Rapporteur

M. Alberto Bramati, Professor, *LKB, Paris 6*, Examinateur

Mme. Angela Vasanelli, Professor, *MPQ, Paris 7*, Examinateur

M. Michiel Wouters, Professor, *Université d'Anvers, Anvers, Belgique*, Examinateur

M. Alberto Amo, Researcher, *C2N, Marcoussis*, Invité

Mme. Jacqueline Bloch, Research director, *C2N, Marcoussis*, Directrice de thèse