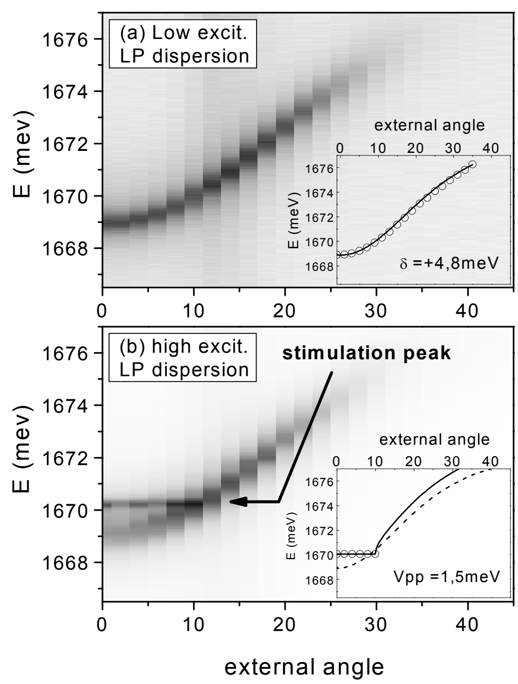
Towards evidence of spontaneous polariton condensation in II-VI microcavities

Maxime Richard , Jacek Kasprzak, Régis André, Robert Romestain, Le Si Dang
CEA-CNRS-UJF joint group Nanophysique et Semiconducteurs
Laboratoire de Spectrométrie Physique (CNRS UMR 5588)
Université Joseph Fourier – Grenoble, BP 87, 38402 Saint Martin d'Hères, France

Exciton-polaritons are bosonic eigenstates of semiconductor microcavities, consisting of a coherent mixing of quantum well excitons and cavity photons. Their density of states is four orders of magnitude smaller than that of excitons, which favors the possibility of reaching high occupancy factor before the breakdown of the exciton bosonic character. Thus polaritons are good candidates for the formation of a Bose condensate, particularly in II-VI microcavities due to the larger binding energy of II-VI excitons. Previous experimental studies of CdTe microcavities have clearly demonstrated that stimulated emission of polaritons can be obtained under non-resonant optical excitation (1). In this work, we present an experimental study of CdTe polaritons in this high excitation regime.

First, an angle resolved setup allows us to probe the polariton population along the dispersion curve. We observe that the population distribution is strongly peaked at $k_{//}=0$ state by stimulated relaxation process, and that the emission dispersion becomes flat (see figure). We show that the latter effect can be well explained in terms of coherent collisions between in-phase polaritons (2). On a second hand, a microphotoluminescence setup allows us to observe shrinkage and a shape modulation of the emission spot in real space in the stimulated regime. The spatial and transverse coherence of the emission will be discussed.



Angle resolved photoluminescence of CdTe microcavity in the low excitation regime (a) and high excitation regime (b). In the latter case, both spontaneous and stimulated emissions are observed since photoluminescence is continuously measured using pulsed laser excitation (80 MHz, subpicosecond pulse duration). Insets show fits to polariton dispersions based on theory of (2).

(1) Le Si Dang et al., Phys. Rev. Lett. **81**, 3920 (1998) ; F. Boeuf et al., Phys. Rev. B **62**, R2279 (2000).
(2) C. Ciuti et al., Phys. Rev. B **63**, 041303 (2001).