Polariton lasing of semimagnetic exciton-polaritons in magnetic field.

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The past decade has encountered a fast development in the studies on quantum phenomena in a semiconductor microcavities. The works devoted to the interaction between light and matter show that as a result of the strong coupling between a photonic mode and an excitonic state, two new states arise: upper and lower exciton-polaritons. Recent studies include the area of nonlinear interactions as Bose-Einstein condensation [1], polariton lasing [2] or superfluidity [3].

In our work we investigate the magnetic field dependence of polariton lasing in a special structures in which the non-magnetic semiconductor microcavity contain semimagnetic quantum wells. This results in a particular system of cavity polaritons with enhanced magnetic properties.

Our microcavity sample consist of two Bragg mirrors of alternating (Cd,Zn,Mg)Te layers with various magnesium concentration embedding a cavity with four quantum wells containing 0.5% of manganese [4, 5]. We detect angle resolved photoluminescence spectra in a confocal optical microscopy setup. The sample is pumped non-resonantly by a ps pulsed laser.

We observe different effects depending on the excitation power (Figure 1). Starting from low power we observe an accumulation of polaritons at the bottleneck of the lower polariton branch. For a higher excitation power, the population at the bottleneck decreases and the polaritons accumulate at the bottom of lower polariton branch, where the intensity starts to dominate over the intensity at the bottleneck. Above threshold we observe polariton lasing, what turns on to the nonlinear interaction regime. The energy shift due to polariton-polariton interactions is clearly visible. A similar behavior is observed under constant excitation power but with increasing magnetic field. We observe that polariton lasing is induced by an external magnetic field. In this work we demonstrate a study of the semimagnetic polariton lasing threshold dependence on the excitation power and magnetic field.

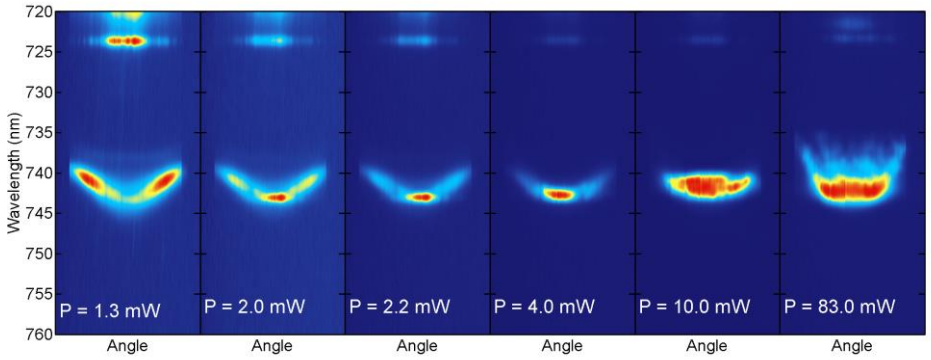

Figure 1. Angularly resolved photoluminescence maps of semimagnetic exciton-polariton lasing as a function of the excitation power in a homogenous photonic potential distribution.

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[4] J.-G. Rousset et al., J. Cryst. Growth 378, 266 (2013). [5] J.-G. Rousset et al., Appl. Phys. Lett. 107, 201109 (2015).