Giant Zeeman effect in semi-magnetic exciton-polaritons

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Recent achievements in the exciton-polariton physics, especially the observation of coherent polariton state (BEC [1] and polariton lasing [2]) with the prediction of prominent Meisner effect [3] motivated our work to implement the magnetic ions into semiconductor structure to significantly enhance the Zeeman splitting. The Meissner effect in the coherent polariton state predicts the full quenching of the Zeeman splitting up to a critical magnetic field (of the order of few Tesla). The exciton-polaritons in GaAs-based cavities exhibit the Zeeman splitting below 100 μeV at 5 T, therefore the observed Meissner effect was smaller than the linewidth [4-6]. In our work we demonstrate the giant Zeeman effect in the semimagnetic exciton-polaritons. The energy splitting is of 3 meV at 5 T and the two Zeeman split branches are well resolved (Figure).

Our sample consists of four semi-magnetic (Cd,Zn,Mn)Te QWs placed between Mn-free DBRs [7]. In this structure, the strong coupling of cavity photons with excitons in the semimagnetic QW results in semimagnetic polaritons. The sample is investigated by angle resolved photoluminescence and reflectivity in magnetic field up to 5 T.

We observe that the magnetic field has a significant influence on magnetic-polaritons: the energy blue-shift change the detuning and the exciton-photon coupling strength increases. The polariton dispersion is also affected as the magnetic field is acting only on the excitonic component which changes along the dispersion. The value of the giant Zeeman splitting of polaritons depends therefore not only on the detuning but also on the polariton wavevector (Figure).

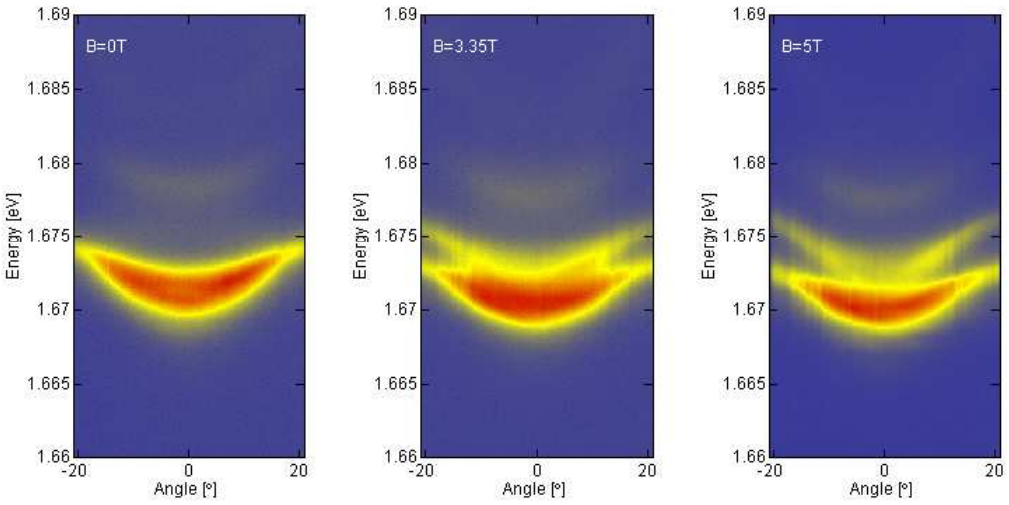

Figure: Angularly resolved photoluminescence maps of exciton polaritons in magnetic field (T = 5 K). The giant Zeeman effect is visible in the energy splitting of lower polariton branch.

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