

Amplification of polariton incoherent emission

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Semiconductor microcavities in the strong coupling regime present a steep in-plane dispersion which allows one to observe bosonic stimulation induced by a large occupancy of the polariton states [1]. However, under non resonant weak excitation, it has been shown that polaritons remain in large k -states and $k=0$ state occupancy remain below unity [2-3]. Here we report on a two beam experiment where the weak incoherent emission due to a non resonant excitation is strongly amplified in the presence of a cw resonant excitation.

Our sample consists of a λ $\text{Cd}_{0.4}\text{Mg}_{0.6}\text{Te}$ cavity containing four 8 nm CdTe Quantum wells. A continuous laser beam resonantly injects polaritons at k_p , inflexion point of the lower polariton dispersion whereas a pulsed laser provides a transient non resonant excitation.

Fig. 1 shows the lower polariton time-resolved emission close to $k=0$ measured with the non-resonant excitation (1mW) or the cw laser (30 mW) only, and with both excitations. With the non-resonant excitation alone, the emission is weak and presents slow rise and decay times. With both excitations, a strong and fast emission is observed following the non-resonant excitation pulse. When increasing the cw power, this amplification is even stronger as shown in fig. 2a where gains larger than 100 are reported. Fig. 2b shows that the gain has a linear dependence above threshold with $I_{\text{cw}}(k=0)$ (the signal measured at $k=0$ with the cw resonant laser only). This suggests that the cw $k=0$ population is the key parameter controlling the gain.

These measurements evidence an incoherent amplification process where the resonant cw excitation accelerates the polariton relaxation and seeds a strong population in $k=0$ state.

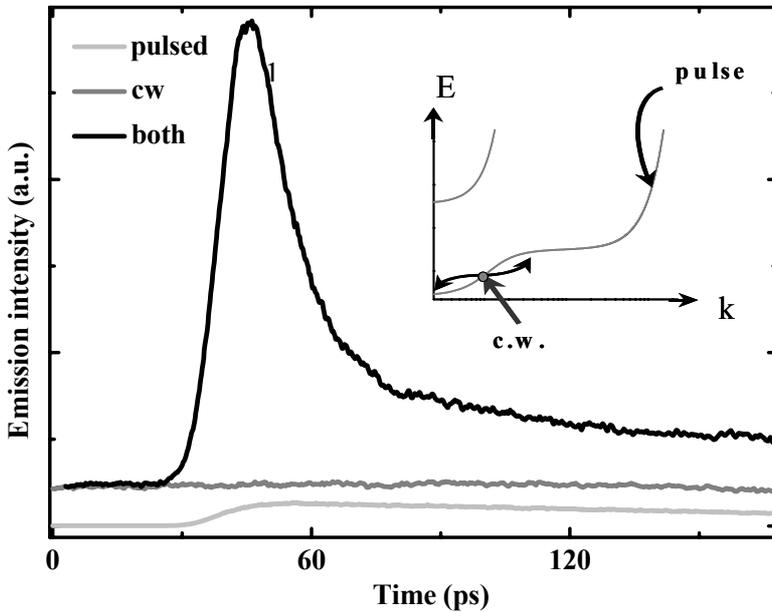


Figure 1.

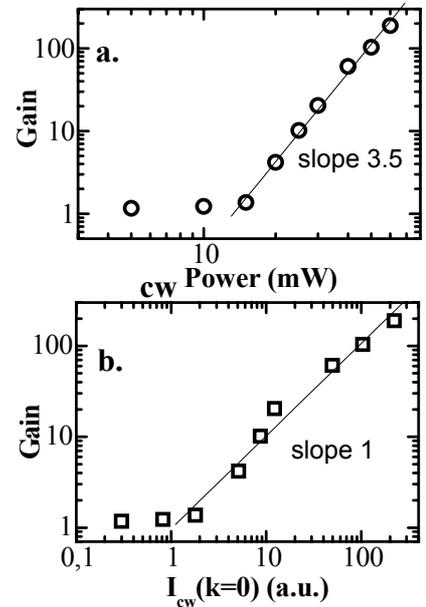


Figure 2.

- [1] P.G. Savvidis et al, Phys. Rev. Lett. **84**, 1547 (2000)
- [2] M. Müller et al, Phys. Rev. B **62**, 16886 (2000)
- [3] P. Senellart et al., Phys. Rev. B **62**, R 16263 (2000)