Assessing the various measurements of the polariton-polariton interaction strength in GaAs microcavities

D. W. Snoke,[1] Y. Yoon,[2] D. M. Myers,[1*] S. Mukherjee,[1] J. Beaumariage,[1] V. Hartwell,[3] M. Steger,[4] and K.A. Nelson[2]

[1]University of Pittsburgh, 3941 O'Hara St., Pittsburgh, PA 15260, USA
[2]Massachusetts Institute of Technology, 77 Massachusetts Ave., Cambridge, MA 02139, USA
[3]L3 Harris Insight, 615 Epsilon Dr, Pittsburgh, PA 15238
[4]National Renewable Energy Lab, 15013 Denver Parkway, Golden, CO 80401, USA

Various experiments have measured the value of the polariton-polariton interaction constant in GaAs/AlGaAs microcavity structures, and the numbers have ranged over orders of magnitude, from the theoretically predicted[1] value of around 1 μeV-μm^2 for the pure exciton-exciton limit, to three orders of magnitude larger than that. Recalibration of the data of Ref. 2 has reduced the results of that experiment by one order of magnitude, but the implied value of those experiments is still two orders of magnitude larger than the theoretical value, even when the effects of quantum confinement due to trapping are taken into account.

In this talk we will review the various experiments on this value and present new results from numerical models of the thermalization of the polariton gas in these structures, following the same method as Ref. 3 but including the effect of dark excitons and the known calibrations for polariton and exciton density in typical experiments. As seen in Figure 1, using the theoretical value for the interaction does not allow enough thermalization of the polaritons and gives energy distributions greatly in disagreement with the experiments, while using a higher value gives agreement. We will also discuss the theory of line broadening of the polariton emission, which is another constraint on the interaction strength.

References

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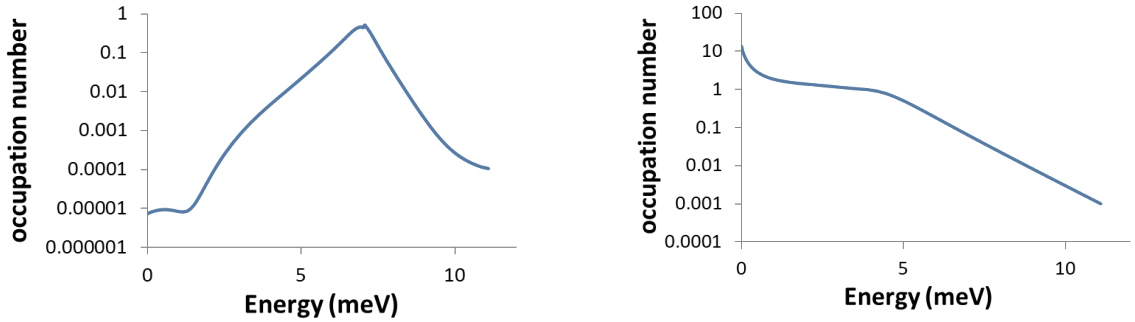

Figure 1. a) Numerically predicted polariton and exciton distribution for a cavity lifetime of 1.3 ps, with non-resonant pumping, using the theoretically predicted value for the exciton-exciton interaction constant, for total polariton density 7.4×10^9 cm^{-2}. b) The same simulation but with density 3.4×10^9 cm^{-2} and interaction constant 100 times larger.

*Current address: Department of Engineering Physics, Polytechnique Montréal, Montréal, QC H3C 3A7.