Exciton Polariton Lasers in a Magnetic Field

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In contrast to conventional lasers, polariton lasers do not rely on stimulated emission but stimulated bosonic scattering and hence their operation does not require population inversion. Indeed, it has been demonstrated in optically pumped systems, that such bosonic lasers can outperform standard lasers in the weak light-matter coupling regime in terms of their threshold power. The polaritons, which consist of part light and part matter, can undergo a condensation process into a common energy state. The radiated light from such a system shares many similarities with the light emitted from a conventional photon laser, even though the decay of the polaritons is a spontaneous process.

We discuss properties of polariton lasers in GaAs based microcavities. Special emphasis is given to the system's response to an applied magnetic field, which has a tremendous influence on the condensation effect. We introduce the magnetic field interactions as a reliable tool to distinguish a polariton laser from a conventional photon laser device. In particular, we will discuss optically and electrically pumped polariton laser operation, and we reveal non-equilibrium physics in the condensation phenomena.