When polariton condensates have dissipations or have no excitons

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Abstract: Microcavity exciton-polaritons are formed in a semiconductor with strong exciton-photon coupling and low carrier density. They have been widely studied as a weakly interacting boson gas that can form a Bose-Einstein condensation (BEC) like many-body state in a solid. However, the cavity dissipation and fermionic nature of the electrons can lead to phenomena outside the well established framework for polariton condensation. We first examine a phenomenon unique to a dissipative, non-equilibrium condensate. We show the formation of limit cycles with two coupled condensates, as a result of dissipative coupling and polariton nonlinearity.

We then look "inside" the polaritons and reveal an electron-hole-photon condensate that share similar spectral properties as a polariton BEC but with a microscopic origin similar to a BCS-state.