Optical Trapping and Propagation of Nonresonantly Driven One-Dimensional Exciton-Polariton Condensate

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Exciton-polariton condensates have been proven as a universal and unique platform to explore a plethora of interesting physics, caused by the interplay of bosonic stimulated scattering and loss in a strongly coupled semiconductor microcavity. The polariton condensate under nonresonant above band-gap excitation is created always with accompanying incoherent excitonic reservoir, which shapes the condensate spatially and spectrally [1]. This reservoir can be employed to intentionally generate optically induced repulsive potentials felt by polaritons to engineer the condensate properties on purpose.

We theoretically investigate the properties of nonresonantly pumped exciton polariton condensate created in a quasi-one-dimensional microwire, which can be understood as a one-dimensional confinement potential for polaritons. We employ the mean field approach, solving numerically Gross-Pitaevskii equation coupled to kinetic rate equations for reservoir dynamics [2]. The ballistic flow of coherent polariton waves can be obtained, when the excitation laser is focused to a small area, creating a localized repulsive potential. We propose a pump-probe type of experiment with two excitation sources, which create two separate reservoirs and condensates in different positions of the microwire. One of the sources (pump) provides the steady state local excitation and the second one (probe) creates a dynamical pulse, which creates a second condensate. Adjustment of the system parameters and the properties of pump and probe sources lead to different dynamical behaviors like self-interference of wave packets, or creation of propagating topological excitations. We explore the parameter space of the system and describe different dynamical behaviors, which seem feasible in current state-of-the-art experimental techniques and samples.

[1] M. Wouters et al., *Phys. Rev. B* **77**, 115340 (2008).
[2] N. Bobrovska et al., *Phys. Rev. B* 90, 205304 (2014).