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Phase diagram of a 1d exciton-polaritons condensate.

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Exciton-polaritons are short-lived hybrid bosonic quasiparticles generated by the coupling of the electronic excitations of a semiconductor and light in an optical cavity. A steady state can be obtained by driving the system with an external laser compensating the photon loss [1]. If tuned above some threshold power, the laser driving triggers the Bose-Einstein condensation of exciton-polaritons [2].
We propose a phase diagram of a one-dimensional condensate of exciton-polaritons, obtained by investigating its driven-dissipative dynamics through the stochastic generalized Gross-Pitaevskii equation [1]. We benchmark and expand the ideas proposed in [3], choosing realistic values for the parameters of the model, based on the experimental platform of [4], on which the universal non-equilibrium properties of the coherence (Kardar-Parisi-Zhang universality class) were observed and supported by the theory. Here, we illustrate and characterize the rich dynamics emerging by spanning the space of parameters around the conditions of [4]. In particular, we focus on the role of the two-body interactions, the amplitude of the stochastic noise modeling the fluctuations of the open quantum system in the mean-field description, and the power of the laser driving.
We identify two distinct regimes: (i) a disordered vortex regime, at high noise, dominated by point-like phase defects in space-time; (ii) a soliton-patterned regime, at low noise, populated by localized structures analogue to dark solitons of Bose-Einstein condensates at equilibrium.

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