Kardar-Parisi-Zhang universality in the phase distributions of one-dimensional exciton-polaritons

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Exciton-polaritons under driven-dissipative conditions exhibit a condensation transition [1] which belongs to a different universality class than equilibrium Bose-Einstein condensates. Recently it was shown that the long-distance physics of the phase-dynamics is ruled by the Kardar-Parisi-Zhang equation and a numerical verification was given in (1+1)dimensions [2, 3]; however, the experimental accessibility of the KPZ mapping is still under debate. In this talk we present some recent results we get by numerically solving the generalized Gross-Pitaevskii equation with realistic experimental parameters. We show that one-dimensional exciton-polaritons display fine features of KPZ dynamics beyond the scaling exponents, i.e. their phase distribution follows the Tracy-Widom form predicted for KPZ growing interfaces. We moreover evidence a crossover to the stationary Baik-Rains statistics, recently observed also in turbulent liquid-crystals experiments [4]. We finally show that these features are unaffected on a certain timescale by the presence of a smooth disorder often present in experimental setups, in agreement with theoretical predictions [5]. This analysis suggests new experimental protocols for the observation of KPZ properties in exciton-polaritons.

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