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Kardar-Parisi-Zhang universality in a one-dimensional polariton condensate

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Cavity polaritons are hybrid exciton-photon quasi-particles emerging from the strong coupling regime between photons confined in an optical cavity and excitons confined in quantum wells. They present physical properties reflecting their mixed nature. From the photon part, they inherit a small effective mass and can be confined in lattices with typical dimensions of the order of a few microns. Their excitonic part endows them with inter-particle interactions resulting in a giant Kerr non linearity. Cavity polaritons exhibit fascinating properties such as Bose Einstein condensation at elevated temperature, superfluidity, multistability... Importantly, the system is driven-dissipative in nature: the driving field maintains an out-of-equilibrium steady-state by compensating the constant leakage of photons.
Recent theoretical works have shown that the phase dynamics of out-of-equilibrium condensates obeys the celebrated Kardar Parisi Zhang (KPZ) equation [1-3]. In this talk, I will present our recent experimental observation of universal KPZ scaling laws in the first order coherence of a 1D polariton condensate [4]. I will first explain how we generated highly elongated polariton condensates in a 1D polariton lattice. I will then describe our measurements of the condensate coherence. Finally, I will show that data points lying within a well-defined spatio-temporal window collapse onto a single scaling function, characteristic of the KPZ universality class.

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