Experimental evidence for universal fluctuation properties of growing interfaces

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I will present recent developments on growing interfaces showing universality beyond the scaling exponents, along an experimental realization found in chaotic regimes of electrically-driven liquid crystal convection. Measuring interface fluctuations of growing domains (photos below), we found not only the scaling exponents of the Kardar-Parisi-Zhang (KPZ) universality class, but also particular distribution and correlation functions that were previously derived for solvable models in the KPZ class (figure). Interestingly, these statistical properties have direct yet non-trivial link to random matrix theory, depend on the global geometry of the interfaces (whether the interfaces are curved or not), but are nevertheless universal in each case (see figure). In other words, the KPZ class splits into a few universality subclasses. These results constitute direct evidence for powerful universality of the KPZ class, ruling detailed statistical properties like distribution and correlation functions.

References:

K. A. Takeuchi and M. Sano, Phys. Rev. Lett. 104, 230601 (2010); J. Stat. Phys. 147, 853 (2012).

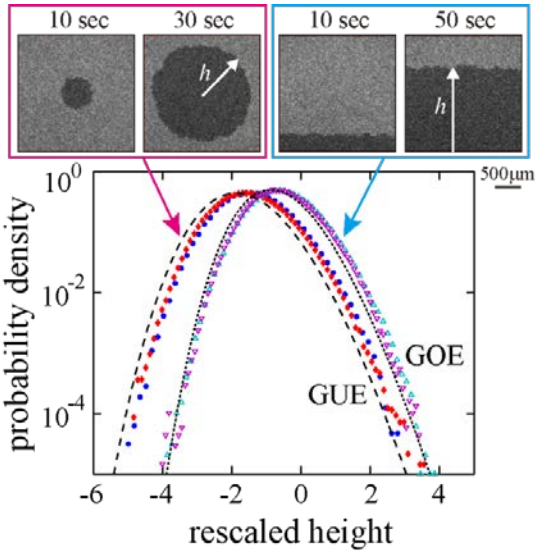

Figure: Growing domains of chaotic liquid-crystal convection. Fluctuations of the height h (as defined in the top figures) for the circular and flat interfaces obey the largest-eigenvalue distributions of the GUE and GOE random matrices, respectively, in the appropriately rescaled units.