

Macroscopic fluctuations of random lozenge tilings via discrete beta ensembles

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We study uniformly random lozenge tilings of polygonal domains as a model of random stepped surfaces, encoded by their height functions. Our analysis relies on an exact correspondence between vertical sections of the tiling and discrete beta-ensembles with repulsive interactions, providing a powerful probabilistic framework for the problem.

Focusing on a broad class of domains obtained by gluing trapezoids, we uncover the macroscopic structure of height fluctuations. Depending on the geometry and constraints of the domain, these fluctuations display a rich behavior, ranging from discrete Gaussian laws to Gaussian Free Field. Our results extend to domains with nontrivial topology, including non-orientable cases, where new fluctuation phenomena emerge and the classical Gaussian Free Field picture must be modified.

The talk is based on joint work with G. Borot and A. Guionnet.