Limit shape phenomena in integrable models

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Abstract

Limit shape phenomena arise in a broad class of two-dimensional integrable lattice models, where, under suitable scaling limits, random configurations develop deterministic geometric structures known as arctic curves, separating frozen and liquid regions.

For free-fermionic models, such as dimer models, the fluctuation theory is by now well understood: in the liquid region, height fluctuations are described by a massless free boson, while at the arctic boundary one encounters universal edge statistics described by the Tracy–Widom distribution.

Here, I will discuss this phenomenon beyond the free-fermionic setting. I will focus on integrable interacting vertex models, in particular four- and five-vertex models, as a framework for studying limit shapes and fluctuations in interacting systems. A central question is to understand how interactions modify the fluctuation theory and to what extent the universality classes familiar from free-fermionic models persist.