Higher order tacnodes in a free fermionic model

We investigate a free fermion model with nearest and next-nearest neighbor hopping, evolving in imaginary time from a product state with N consecutive fermions, and conditioned to go back to the same state after a given time. In the case of nearest neighbor hoppings, this model is known to give rise to limit shapes and arctic curves for large time and fermion number, with in particular two fluctuating regions which can be tuned to merge depending on ratio between time and N. Fluctuations near the merger are governed by a so-called tacnode kernel. In this paper we study the analogous picture in the presence of a next nearest interactions. In particular, we discuss the limit shapes, and compute analytically the corresponding density profile. We also study the behavior of correlations close to the merger point, and find a novel higher order tacnode kernel governing them.

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