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Probing Large Deviations in Accelerated TASEP: Bethe Ansatz, Cassini Ovals, and Spectral Gaps

In this talk, I will discuss how to study the probabilities of observing unusually large or small particle currents in the context of the totally asymmetric simple exclusion process (TASEP) on a ring. To do this, we will revisit the large deviation function derived in a seminal paper by Derrida and Lebowitz (Phys.Rev.Lett.80,209(1998). We adapt their approach for the TASEP with accelerated rates.

In this scenario, we discover that the matrix operator governing the evolution of a particle current can also be diagonalized by Bethe ansatz techniques. We find the fascinating structure of Bethe solutions, lying on Cassini ovals, and use it to determine the largest eigenvalue, the spectral gap of the evolution matrix and, therefore characterise convergence properties at large times.

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