Non-equilibrium 1D many-body problems and asymptotic properties of Toeplitz determinants

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http://iopscience.iop.org/1751-8121/44/16/165003 [2]

Non-equilibrium bosonization technique facilitates the solution of a number of important many-body problems out of equilibrium, including the Fermi-edge singularity, the tunneling spectroscopy and full counting statistics of interacting fermions forming a Luttinger liquid. We generalize the method to non-equilibrium hard-core bosons (Tonks–Girardeau gas) and establish interrelations between all these problems. The results can be expressed in terms of Fredholm determinants of the Toeplitz type. We analyze the long time asymptotics of such determinants, using Szegő and Fisher–Hartwig theorems. Our analysis yields dephasing rates as well as power-law scaling behavior, with exponents depending not only on the interaction strength but also on the non-equilibrium state of the system.

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