Interaction induced Anderson transition in a kicked one dimensional Bose gas

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The quantum kicked rotor is a Floquet system known to exhibit dynamical localisation, the analogue of Anderson localisation in driven systems. We study the Lieb-Liniger model of one-dimensional bosons subjected to periodic kicks in the finite-interacting regime. In both the non-interacting and strongly interacting (Tonks-Girardeau) limits, dynamical localisation is the rule, leading to energy saturation at long times. However, for finite interactions with three or more particles, we identify a transition from an insulating to a metallic phase at a critical kicking strength (Fig. 1). We establish a formal correspondence between the dynamical evolution of an N-particle Lieb-Liniger gas and an Anderson model in N spatial dimensions using the Bethe Ansatz solution. Numerical simulations and finite-time scaling analysis confirm the presence of a transition to delocalisation in the orthogonal Anderson universality class [1]. We also investigate the interplay of interactions and quasiperiodic driving in the Lieb–Liniger model subjected to a sequence of delta kicks [2].

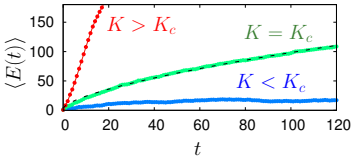

FIG. 1. Time evolution of the total energy for three particles at interaction strength $c = 10$ for different stochasticity parameters K. Near the critical point $K_c/\hbar_e \simeq 2.1$ (green), anomalous diffusion with exponent 2/3 is observed (black dashed line). For $K = 1.5\hbar_e < K_c$ (blue) the energy saturates as expected in the localised regime, while for $K = 3.2\hbar_e > K_c$ (red) the dynamics is diffusive [1].

[1] H. Olsen *et al.*, *Phys. Rev. Lett.* **135**, 173403 (2025).
[2] H. Olsen *et al.*, *New J. Phys.* (2026).

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