# Measurement-induced phase transition in periodically driven free-fermionic systems

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## Abstract:

It is well known that unitary evolution tends to increase entanglement, whereas continuous monitoring counteracts this growth by pinning the wavefunction trajectories to the eigenstates of the measurement operators. In this work, we investigate the fate of the measurement-induced phase transition in a periodically driven free-fermionic quantum system, where the hopping amplitude is modulated periodically in time using a square pulse. In the high-frequency limit, a renormalization group analysis of the non-Hermitian quantum sine-Gordon model [as proposed in Phys. Rev. X 11, 041004 (2021)] reveals that if the hopping amplitude is varied symmetrically around zero, the system always favors the area-law phase, where the steady-state entanglement entropy is independent of subsystem size. In contrast, asymmetry in the drive amplitudes tends to promote entanglement growth, in excellent agreement with our numerical findings. Furthermore, numerical evidence for the system sizes accessible to us suggests that decreasing the drive frequency typically favors entanglement growth. As a function of the measurement strength, we observe a phase transition between a gapless critical phase—characterized by logarithmic growth of entanglement entropy with subsystem size—and a gapped area-law phase. These two phases are separated by a Berezinskii-Kosterlitz-Thouless (BKT) transition. The fluctuations in the steady-state entanglement entropy also tend to grow as the frequency decreases. However, in the case of a symmetric drive, the system consistently exhibits an area-law phase, regardless of the driving frequency.

# References

Measurement-induced phase transition in periodically driven free-fermionic systems; Pallabi Chatterjee, Ranjan Modak; arXiv:2412.01917 (2024).