

# OpenQMBP2023: New perspectives in the out-of-equilibrium dynamics of open many-body quantum systems



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## Elusive phase transition in the replica limit of monitored systems

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We study an exactly solvable model of monitored dynamics in a system of  $N$  spin  $1/2$  particles with pairwise all-to-all noisy interactions, where each spin is constantly perturbed by weak measurements of the spin component in a random direction. We make use of the replica trick to account for the Born's rule weighting of the measurement outcomes in the study of purification and other observables, with an exact description in the large- $N$  limit. We find that the nature of the phase transition strongly depends on the number  $n$  of replicas used in the calculation, with the appearance of non-perturbative logarithmic corrections that destroy the disentangled/purifying phase in the relevant  $n \rightarrow 1$  replica limit. Specifically, we observe that the purification time of a mixed state in the weak measurement phase is always exponentially long in the system size for arbitrary strong measurement rates.

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