Open Quantum Dynamics and Entanglement

The fact that, only under particular circumstances, quantum systems can be thought as closed and behaving reversibly is of primary importance when one deals with large quantum systems of mesoscopic or macroscopic size as in the case of spin chains or of many-body models.
In such cases, one cannot neglect the presence of the environment within which such systems are embedded and must instead take into account the noise and the memory effects it gives rise to. Usually, these latter induce dissipation and decoherence and spoil entanglement and other quantum correlations that are useful to quantum technological and informational tasks.
However, it is also possible that, by controlling the environment, one might gain in entanglement instead of depleting it.
Purpose of the project is to study the entanglement dynamics of the fluctuations of observables in quantum many-body systems under the action of irreversible open quantum dynamics with and without memory and feed-back effects.
These fluctuations turn out to be the proper tools for studying quantum correlations at the mesoscopic level, i.e. at the interface between the purely quantum microscopic level and the classical macroscopic one.
The consequences of such investigations are relevant for quantum thermodynamics, quantum control and quantum sensing.

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References:

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