Energy conservation and fluctuation relations for open quantum systems

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Abstract: We study the counting statistics of a projective measurement of the energy transfer in a open quantum system.

We focus on the energy correlator that controls the large deviations of the respective quantum statistics probability measure in the large time limit. If the open quantum system is time-reversal invariant this correlator satisfy the celebrated quantum Evans-Searls fluctuation relations and the corresponding symmetry.

We show that under very general hypothesis, the correlator satisfies an additional symmetry (first observed by in [AGMT]) and we explore its consequences on energy conservation, leading to a strengthening of the first law of thermodynamics for open quantum system. We also show that liner response theory can be derived as consequence of the symmetries.

This is joint work with T. Benoist, V. Jakšić, Y. Pautrat and C.-A. Pillet.

[AGMT] Andrieux, D., Gaspard, P., Monnai, T., and Tasaki, S.: Fluctuation theorems for currents in open quantum systems. New J. Phys., **11**(4), 043014 (2009)