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Heat fluctuations in the two-time measurement framework and ultraviolet regularity

Since Kurchan's seminal work (2000), two-time measurement statistics (also known as full counting statistics) has been shown to have an important theoretical role in the context of quantum statistical mechanics, as they allow for an extension of the celebrated fluctuation relation to the quantum setting. In this contribution, we consider two-time measurement statistics of heat for a locally perturbed system, and we show that the description of heat fluctuation differs considerably from its classical counterpart, in particular a crucial role is played by ultraviolet regularity conditions. For bounded perturbations, we give sufficient ultraviolet regularity conditions on the perturbation for the moments of the heat variation to be uniformly bounded in time, and for the Fourier transform of the heat variation distribution to be analytic and uniformly bounded in time in a complex neighborhood of 0. On a set of canonical examples, with bounded and unbounded perturbations, we show that our ultraviolet conditions are essentially necessary. If the form factor of the perturbation does not meet our assumptions, the heat variation distribution exhibits heavy tails. The tails can be as heavy as preventing the existence of a fourth moment of the heat variation. This phenomenon has no classical analogue.

(Based on joint work with T.Benoist, R. Raquépas, https://arxiv.org/abs/1802.02073)