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Measuring effective temperatures in a Generalized Gibbs ensemble

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In Gibbs equilibrium, fluctuation-dissipation relations can be generically used to
probe the thermal properties of the system and measure its temperature.
When the system under study is integrable, though, the dynamics fails to approach such a Gibbs state, reaching instead a generalized ensemble with a macroscopic number of temperature-like parameters which enforce the value of the underlying conserved quantities.
In this setting we show that generalized fluctuation-dissipation relations for appropriately chosen – yet very physical – observables, can be used to infer such temperatures allowing us to reconstruct the non-thermal state.
These results can be applied to a large variety of models including the one dimensional Bose gas where the relevant correlation function is provided by the structure factor, a quantity that can be experimentally accessed.

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