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Thermalization with a multibath: an investigation in simple models

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We study analytically and numerically a couple of paradigmatic spin models, each described in terms of two sets of variables attached to two different thermal baths with characteristic timescales T and τ and inverse temperatures B and β.

In the limit in which one bath becomes extremely slow ($\tau \rightarrow \infty$), such models amount to a paramagnet and to a one-dimensional ferromagnet, in contact with a single bath. We show that these systems reach a stationary state in a finite time for any choice of B and β. We determine the non-equilibrium fluctuation-dissipation relation between the autocorrelation and the response function in such state and, from that, we discuss if and how thermalization with the two baths occurs and the emergence of a non-trivial fluctuation-dissipation ratio.

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