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Thermalization by Rapid Bombardment (G)*

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Imagine a quantum system placed within a thermal gas, which is itself composed of many quantum systems e.g. atoms/molecules. As the constituents of the environment scatter off of the system, it is natural to expect that the system will reach a thermal equilibrium with its environment. Moreover one may expect that the ultimate thermalization of the system is largely independent of the coupling between the system and its environment, H_{SE}, and of the time scale of the scattering.

We show that if the scattering time scale is sufficiently small, then the final temperature of the system is generically not the temperature of its environment, $\beta_S(\infty) \neq \beta_E$. Instead we find equilibrium of the form $E_S\beta_S(\infty) = f(H_{SE}, E_E\beta_E)$ where E_S and E_E are the energy scales of the free system and environment respectively.

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