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A Boltzmann-distribution-equivalent for Levy noise and how it leads to thermodynamically consistent epicatalysis

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Nonequilibrium systems commonly exhibit Levy noise. This means that the distribution for the size of the Brownian fluctuations has a "fat" power tail. Large Brownian kicks are then more common as compared to the ordinary Gaussian distribution that is associated with equilibria.

We consider a two-state system, i.e. two wells and in between a barrier that is sufficiently high for a barrier crossing to be a rare event. When the noise is Levy, we do *not* get a Boltzmann distribution between the two wells. Instead we get a situation where the distribution between the two wells also depends on the height of the barrier that is in between.

A catalyst, by lowering the barrier between two states, can speed up the establishment of an equilibrium. It will, however, not change the equilibrium distribution. In an environment with Levy noise, on the other hand, we have the possibility of epicatalysis, i.e. a catalyst effectively altering the steady state distribution between two states by changing the barrier height. We discuss how this idea may possibly apply to nuclear reactions and to biochemical reality in a living cell.

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