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## To thermalize or not to thermalize, that is the question

*Sunday, 18 September 2022 15:00 (45 minutes)*

In the first part of my lecture, I will discuss thermalization, ergodicity, and lack of them in classical systems. I will focus on paradigmatic example of spin glasses, and normal and anomalous diffusion processes. I will turn then to quantum closed systems, which, when perturbed or quenched, tend to “thermalize” in an ergodic way: the reduced density matrix of a block of the system is well approximated by the Gibbs-Boltzmann canonical ensemble, at least for averages of local observables and their-not-too-high-moments. There are several exceptions from this situation: i) Systems with multiple constants of motion are described by generalized Gibbs-Boltzmann ensembles; ii) Many-body localization (MBL) occurs in certain disordered systems; iii) MBL may occur also in non-disordered systems; iv) Local conservation laws, like the Gauss law, may prevent thermalization, for instance in Lattice Gauge Theory (LGT) models; v) Systems may exhibit quantum many-body scars, i.e. low entropy states that cause “weak” ergodicity breaking; vi) The latter occur frequently in confined LGT, but also in deconfined ones.

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