To thermalize or not to thermalize, that is the question

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Classical systems usually tend to thermalize in isolation (micro-canonical ensemble) or in contact with environment (canonical and generalized Gibbs ensembles). But, already in classical physics there are examples of breakdown of ergodicity and thermalization: spin glasses being the most celebrated, but not the only example. Quantum closed systems, when perturbed or quenched, tend to "thermalize" in an ergodic way: the reduced density matrix of a block of the system in 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 deconfined ones.