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Generalized Gibbs states in Quantum Markov Processes.

One of the basic postulates of statistical physics declares that an equilibrium state of a macroscopic system is characterized by the maximum of its entropy under given constrains (usually integrals of motion). The description of such states requires only a small number of parameters and these states take the form of a Gibbs state. Recently it has been found that Gibbs states play an important role in the description of equilibrium quantum states also on smaller scales. However, in which situations and why the maximum entropy principle could be the proper paradigm for constructing the quantum equilibrium state remains rather unclear yet. In our work we study equilibrium states in the context of quantum Markov processes (including both discrete and continues). For a broad class of quantum Markov processes we identify their asymptotic states as well as their integrals of motion and show that equilibration within quantum Markov processes follows a rule which only for a certain subset of quantum Markov processes coincides with the maximum entropy principle. Surprisingly, taking into account mutual relationships between equilibrium states and integrals of motion, one can show that all resulting equilibrium states can be still cast into a generalized Gibbs state form. (Received September 16, 2015)