Quantum Stochastic dynamics for many-body systems

Wojciech De Roeck

Abstract: The theory of quantum stochastic dynamics (aka 'Lindblad dynamics') is well-developed in the following sense: There is a a good mathematical classification of possible Lindblad generators (at least for finite-dimensional systems) and there is a also a sound physical understanding of Lindbladians for typical quantum optics situations, where the quantum system is typically a few-level system. Recently, in particular in the quantum information community, one has also studied mathematical properties of Lindbladians for many body systems (eg spin chains).

I am interested in the question what is the physical status of such Lindblad operators. Can they be thought of as arising from physics? (even disregarding the question of whether we can 'derive' them). This leads me to questions as: Can we define a fairly general quantum equivalent of 'Glauber dynamics', and also of 'Kawasaki dynamics ' (admitting a local conservation law). Can we model a chain coupled to different temperature reservoirs?

I will try to discuss and motivate these questions and perhaps even give some answers.