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Talk Invited Invited Talk

Quantum Information Devices and the problem of Decoherence. Some results from toy models

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Quantum Information is the manifestation of quantum coherence as this is involved in the creation of entangled quantum states. Entanglement is a resource that can be stored and manipulated with special arrangements of quantum systems, the quantum information devices. But the original quantum property of coherence is very fragile under the influence of environmental perturbations. Thus the loss of coherence in a very short time makes these quantum devices useless. As it is impossible to completely isolate a quantum system from its local or global environment, there is a great effort either to algorithmicly correct random errors, or to engineer the local environment for increasing the decoherence time. Since the problems become graver with the increase of the quantum system (problem of scalability) and the possibility to simulate a big quantum system is fundamentally impossible (Feynman's Thesis), it is necessary to investigate these difficulties with specific toy models that capture the essential problems. In this talk we present some results from few simple models which can represent a quantum device in interaction with local and global environments. These environments are taken as classical or semi-classical. In addition, in some cases we investigate the influence of classical noise which has a surprising and unexpected signature on the behavior of the systems.