Physikalisches Institut
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PHYSIKALISCHES KOLLOQUIUM

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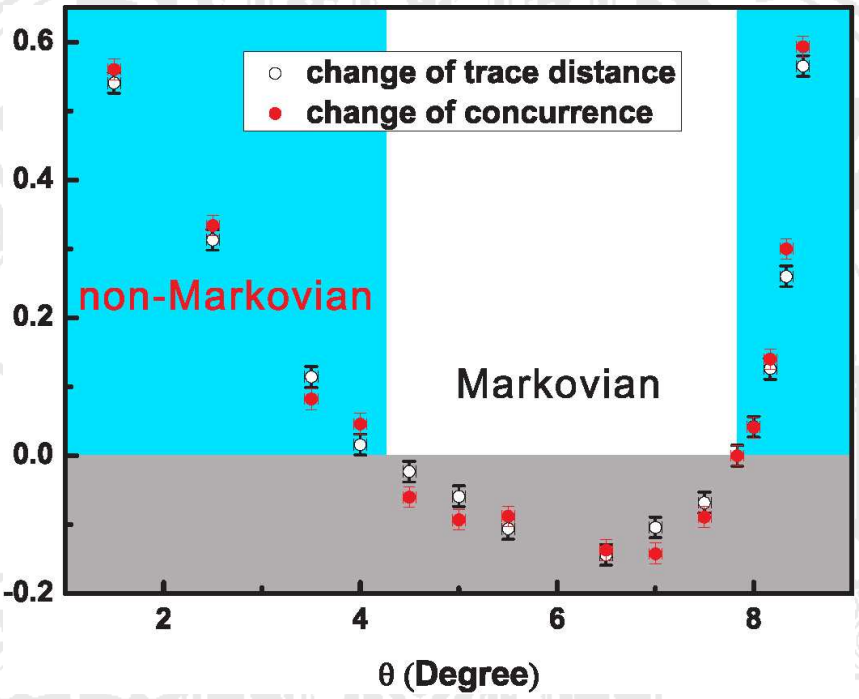
IM GROßEN HÖRSAAL



NONEQUILIBRIUM DYNAMICS OF OPEN SYSTEMS: QUANTUM MEMORY, CORRELATIONS AND NON-LOCALITY

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The dynamics of open quantum systems is usually modeled by means of Markovian processes in which the open system irretrievably loses information to its surroundings. However, open systems in structured environments often show a rich and complex dynamics: In addition to purely classical effects like the dissipation of energy and the relaxation of populations to a thermal equilibrium or nonequilibrium stationary state, the time evolution features genuine quantum effects such as the decay and revival of quantum coherences, correlations, and entanglement. Such a behavior is characterized by a flow of information from the environment back to the open system. This backflow of information implies the presence of memory effects and represents the key feature of non-Markovian quantum dynamics. We will explain the general theoretical characterization and quantification of non-Markovianity in the quantum regime, and discuss recent experiments which allow to control the information flow between system and environment and to monitor the transition from the Markovian to the non-Markovian regime. Moreover, we will develop schemes for the experimental detection of system-environment correlations, and introduce the concept of nonlocal memory effects in composite open systems.