

Speaker: Leonie Mahlert, University of Freiburg
Title: Non-Markovian Dynamics of a Central Ising Spin bath
Date: Wednesday, March 5, 14:00 pm
Place: Seminar room 915

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Abstract:

The dynamics of an exactly solvable spin-star model, exhibiting both dephasing and dissipation, are analysed. The analytical solution is presented with and without initial system-environment correlations, and it is demonstrated that at low temperatures and strong coupling, these initial correlations significantly influence the dynamics. Furthermore, it is shown that this model is non-Markovian and thus cannot be treated using the Born-Markov approximation. Instead, the time-convolutionless master equation is derived up to second order in the coupling strength and its performance is evaluated by comparing it to the exact solution.

This analysis reveals that, for weak coupling between the system and the environment, the master equation provides an accurate description of the spin system's dynamics, with improved performance at higher temperatures. However, at strong coupling, it breaks down after a short time interval, even at higher temperatures.

By defining a measure of non-Markovianity, it is further demonstrated that the model exhibits small periodic information backflow at weak coupling and more pronounced recurrences at strong coupling. While the time-convolutionless master equation captures the small information backflow in the weak-coupling regime, it fails to reproduce the non-Markovian behaviour at strong coupling.