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Structure and quantum-dynamics relationship in spin networks
LUIS CAJAMARCA, LUIS QUIROGA, Universidad de los Andes — We report on the relationship of the spin dynamics with the quantum network topology. The network consists of N-1 spins-1/2 arranged along a circle, also referred to as a ring, equidistant to a central spin (Heisenberg star or ring topology). Every spin along the ring interacts with its first neighbors by means of a coupling constant J2, as well as with the central spin by means of a constant coupling J1. Both couplings are of antiferromagnetic nature and the competition among these incorporates the well known magnetic frustration behavior, which is characteristic of this type of systems. A full analysis of the quantum system's dynamics is carried out for the two limiting cases of coupling constants. We analyze the ground state transitions of the system as well as correlations between any pair of spins including the temperature dependence. The time evolution of the central spin is also analyzed for a given preparation state of the whole spin network. Finally, an stochastic element is incorporated into the system by disconnecting the central spin with any spin along the ring in a random manner. Such dynamics is referred to as dilution and allows us to describe how quantum quantities, such as spin coherences, entanglement and general quantum correlations, depend on the different path topologies between the considered spins (classical structural quantities). Extensions to more complex network topologies are also addressed.

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