Quantum Physics

Relationship between probabilities of the state transfers and entanglements in spin systems with simple geometrical configurations

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In this paper we derive analytical relations between probabilities of the excited state transfers and entanglements calculated by both the Wootters and positive partial transpose (PPT) criteria for the arbitrary spin system with single excited spin in the external magnetic field and Hamiltonian commuting with I_z. We apply these relations to study the arbitrary state transfers and entanglements in the simple systems of nuclear spins having two- and three-dimensional geometrical configurations with XXZ Hamiltonian. It is shown that High-Probability State Transfers (HPSTs) are possible among all four nodes placed in the corners of the rectangle with the proper ratio of sides as well as among all eight nodes placed in the corners of the parallelepiped with the proper ratio of sides. Entanglements responsible for these HPSTs have been identified.

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