Long-term protection of thermal quantum correlations and their role in enhancing the quantum teleportation protocol

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This contribution presents a scheme for the quantum teleportation process. The proposed scheme involves transmitting information encoded in an unknown state from the sender, conventionally referred to as Alice, to the receiver named Bob, using a quantum channel in a thermal equilibrium model. To implement this process, we assess the quantum correlations using local quantum uncertainty, as well as the quantum coherence and entanglement measured by the concurrence of the final teleported state. Additionally, we examine the fidelity to demonstrate the reliability of transmitting the unknown state. Our findings reveal that within a specific range of assumed exchange anisotropy, the average fidelity is significantly enhanced. However, as the anisotropy further increases, the average fidelity tends to converge to a limiting value of 2/3. The average fidelity also exhibits distinct behaviors, such as line accumulation and sharp drops near the critical points.