

On the Nonlocality of the Quantum Channel in the Standard Teleportation Protocol

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Abstract

By exhibiting a violation of a novel form of the Bell-CHSH inequality, Żukowski has recently established that the quantum correlations exploited in the standard perfect teleportation protocol cannot be recovered by any local hidden variables model. Allowing the quantum channel state in the protocol to be given by any density operator of two spin-1/2 particles, we show that a violation of a generalized form of Żukowski's teleportation inequality can only occur if the channel state, considered by itself, violates a Bell-CHSH inequality. On the other hand, although it is sufficient for a teleportation process to have a nonclassical fidelity---defined as a fidelity exceeding $2/3$ ---that the channel state employed violate a Bell-CHSH inequality, we show that such a violation does *not* imply a violation of Żukowski's teleportation inequality or any of its generalizations. The implication does hold, however, if the fidelity of the teleportation exceeds $2/3(1+1/2\sqrt{2})\approx .90$, suggesting the existence of a regime of nonclassical values of the fidelity, less than $.90$, for which the standard teleportation protocol can be modelled by local hidden variables.

Keywords: quantum teleportation, locality, hidden-variables, explanation

[General Issues: Causation](#)

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