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CHSH Violation for All Two-Qubit Measurement Settings

DANIEL DILLEY, ERIC CHITAMBAR, Southern IL Univ-Carbondale — It is well-known that certain two-qubit quantum states demonstrate nonlocal correlations when Alice and Bob measure the spin of their systems in particular directions. This is shown by a violation of the so-called CHSH Inequality. Necessary and sufficient conditions have previously been established for when measurement directions exist that violate the CHSH Inequality for a given two-qubit state. In this talk we turn the question around and ask whether or not an entangled quantum state exists that demonstrates nonlocal correlations for a given choice of local measurement directions. We show that the CHSH Inequality can be violated by some quantum state for any choice of distinct local measurement directions, and we explicitly describe the state that violates the inequality. Furthermore, we show that a maximally entangled state generates the greatest violation of the CHSH Inequality for any choice of measurements. This provides a stronger type of equivalence between maximal entanglement and maximal nonlocality in CHSH experiments.

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