

Test of quantum nonlocality via vector meson decays to $K_S K_S$

In the system of a pair of quantum-entangled neutral kaons from meson decays, when one kaon collapses into the K_S state, the other will collapse instantaneously into the K_L state, due to entanglement and nonlocality. However, if the alternative hypothesis is correct and there's a time window during which one kaon is unaware that the other has decayed, some quantum mechanically prohibited $K_S K_S$ (CP-violation state) decays may occur. We calculate the branching ratios of $K_S K_S$ in vector meson decays under locality hypothesis and compare them with experimental results. We show that the branching ratio of $J/\psi \rightarrow K_S K_S$ under locality assumption is already excluded by the BESIII experimental upper limit. Additional experimental results are proposed to perform this test in the future.

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