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T and CPT symmetries in entangled meson systems

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Genuine tests of an asymmetry under T and/or CPT transformations imply the interchange between in-states and out-states. I explain a methodology to perform model-independent separate measurements of the three CP, T and CPT symmetry violations for transitions involving the decay of the neutral meson systems and in B- and factories. It makes use of the quantum-mechanical entanglement only, for which the individual state of each neutral meson is not defined before the decay of its orthogonal partner. The final proof of the independence of the three asymmetries is that no other theoretical ingredient is involved and that the event sample corresponding to each case is different from the other two.
The experimental analysis for the measurements of these three asymmetries as function of the time interval $\Delta t > 0$ between the first and second decays is discussed, as well as the significance of the expected results. In particular, one may advance a first observation of true, direct, evidence of Time-Reserval-Violation by many standard deviations from zero, without any reference to, and independent of, CP-Violation.
In some quantum gravity framework the CPT-transformation is ill-defined, so that there is a resulting loss of particle-antiparticle identity. This mechanism induces a breaking of the EPR correlation in the entanglement imposed by Bose statistics to the neutral meson system, the so-called ω-effect. I present: i) results and prospects for the ω-parameter; ii) the effect of this modified entanglement for the analysis of the three CP, T and CPT asymmetries discussed before.

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