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Recent results on T, CP and CPT tests with KLOE-2

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KLOE and KLOE-2 full data sample, corresponding to 8 fb−1, has been collected at the Frascati DAΦNE φ−factory of INFN Laboratories and repre- sents the world largest data sample of this kind: about 2.4 × 1010 φ mesons and 8 × 109 K0K¯ 0 entangled pairs. The neutral kaon system has unique properties such as entanglement, flavour oscillations, charge-parity (CP) and time-reversal (T) violation allowing us to test quantum mechanics coherence and fundamental discrete symmetries T, CP, CPT at the utmost sensitivity. KLOE-2 Collabo- ration just published a study on the quantum interference between the decays of entangled neutral kaons in the φ ⟶ KSKL ⟶ π+π−π+π− process by using KLOE data statistics of about 1.7 fb−1 . This channel exhibits the characteris- tic Einstein–Podolsky–Rosen correlations that prevent both kaons to decay into π+π− at the same time. It constitutes a unique tool for testing and constrain, at an unprecedented precision, parameters of various theoretical models, and to search for tiny decoherence and CPT violation effects which may arise, in a quantum gravity picture, due to space-time fluctuations at Planck scale. With the same data sample, KLOE-2 Collaboration is also performing the first di- rect test of the T and CPT symmetries in neutral kaon systems, by comparing neutral meson transition rates between flavour and CP eigenstates. The analysis exploits the φ ⟶ KSKL ⟶ π+π−π∓e±ν and φ ⟶ KSKL ⟶ π∓e±ν 3π0 processes which allow to build discrete symmetry-sensitive observables and per- form model independent tests. Moreover, a new measurement of the KS ⟶ πeν branching fraction, using ~ 1.6fb−1 of KLOE data, has been combined with the previous KLOE result (0.4 fb−1) improving the total precision by almost a factor of two, and allowing a new derivation of f+(0)|Vus|.

Scientific topic

Symmetries

Author: CURCIARELLO, Francesca

Presenter: CURCIARELLO, Francesca

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