

Recent KLOE-2 results on entangled neutral kaons

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The entanglement of $K^0\bar{K}^0$ pairs produced in ϕ -meson decays, in combination with the unique properties of the neutral kaon system –such as flavour oscillations, charge-parity (CP) and time-reversal (T) violation –allows testing the basic principles of quantum mechanics and its fundamental discrete symmetries T, CP, CPT.

The KLOE and KLOE-2 experiments at the Frascati Laboratories of INFN collected at the DAΦNE collider an integrated luminosity of about 8 fb^{-1} , corresponding to $\simeq 8 \times 10^9$ $K_S K_L$ entangled pairs produced. This is the world largest available data sample of this kind and represents a unique tool to improve the precision on these studies.

The most recent KLOE-2 results will be presented:

- (i) an improved search for decoherence and CPT violation effects that exploits EPR correlations in the process $\phi \rightarrow K_S K_L \rightarrow \pi^+ \pi^- \pi^+ \pi^-$, and constraints the parameters of various phenomenological models with a precision that reaches - for some of them - the interesting level at which -in the most optimistic scenarios - quantum gravity effects might show up.
- (ii) the first direct test of the T and CPT symmetries in neutral kaon transitions between flavor and CP eigenstates, by studying the processes $\phi \rightarrow K_S K_L \rightarrow \pi^+ \pi^- \pi e \nu$, $\phi \rightarrow K_S K_L \rightarrow \pi e \nu 3\pi^0$;
- (iii) a new measurement of the $K_S \rightarrow \pi e \nu$ branching fraction, that in combination with the previous KLOE result improves the total precision by almost a factor of two, and allows a new derivation of $f_+(0)|V_{us}|$.

Category

talk

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