

# Measurement of the KS lifetimes and CPT symmetry tests in the neutral kaon system with quantum interferometry at KLOE

*Friday, July 17, 2009 3:30 PM (15 minutes)*

A phi-factory offers the possibility to select pure kaon beams: neutral kaons from  $\phi \rightarrow K_S K_L$  are in fact produced in a well defined state ( $J^{PC}=1^-$ ) and the detection of a kaon at large (small) times tags a  $K_S$  ( $K_L$ ). This allow to perform precise measurement of kaon properties, as for example lifetime, and to study time evolution of neutral kaon system. In particular, studying the distribution of  $\Delta t$ , the difference between the two neutral kaon decay times, where both kaons decay into  $\pi^+\pi^-$  pair, provides unique opportunities for testing quantum mechanics and CPT symmetry.

Using the full 2004-2005 data sample ( $L=1.5 \text{ fb}^{-1}$ ) collected with the KLOE detector at the Frascati-DAΦNE  $e^+e^-$  collider,

we discuss very recent update of the results testing the validity of quantum mechanics and CPT invariance.

Then, we are presently finalizing the determination  $K_S$  lifetimes using  $\sim 1/3$  the whole KLOE data set, where the proper time distribution of  $K_S \rightarrow \pi^+\pi^-$  provides a competitive measurement of lifetime.

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**Session Classification:** II. Flavour Physics

**Track Classification:** Flavour Physics