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Precision Kaon Physics with KLOE

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 pairs and the detection of a K_S (K_L) tags the presence of a K_L (K_S), the same holds for charged kaons. This allows to perform precise measurement of kaon properties. The KLOE experiment has measured most decay branching ratios of K_S , K_L and K^{*+} mesons. It has also measured the K_L and the K^{*+} lifetime and determined the shape of the form factors involved in kaon semileptonic decays. These data provide the basis for the determination of the CKM parameter V_{us} and the most precise test of the unitarity of the quark flavor mixing matrix. We are presently finalizing new determinations of the K_L and K_S lifetimes using the whole KLOE data set, consisting of more than 109 $\phi \rightarrow K_S K_L$ decays. The K_L lifetime, which has been already measured by KLOE with 0.6% accuracy using 20% of the total data sample (PLB 626, 2005, 15), will be extracted from the proper time distribution of $K_L \rightarrow 3\pi^0$ decays, tagged by a $K_S \rightarrow \pi^+\pi^-$ decay on the opposite hemisphere of the apparatus. A competitive measurement of the K_S lifetime is obtained from the proper time distribution of $K_S \rightarrow \pi^+\pi^-$ decays. Bounds on new physics extensions of the standard model with lepton flavor violation can be set using the KLOE result on $R_K = \Gamma(K \rightarrow e \nu) / \Gamma(K \rightarrow \mu \nu)$ based on the complete data set of 2.2 fb⁻¹ collected at the Frascati e⁺e⁻ collider DAFNE. The final 1.3% accuracy on the ratio R_K has been achieved measuring the differential width $d\Gamma(K \rightarrow e \nu) / dE_\gamma$ for photon energies $10 < E_\gamma < 250$ MeV. KLOE recent results will be presented together with an outlook for further improvements in the near future.

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