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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<sup>-1</sup> collected at the Frascati e<sup>+</sup>e<sup>-</sup> 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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