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Hadron physics results at KLOE/KLOE2

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KLOE and KLOE-2 experiment, operated at the DAΦNE facility of Frascati, acquired almost 8 fb^{-1} of data at the ϕ peak resonance.
The two samples together represent the largest statistics ever collected at an e^+e^- collider at 1.02 GeV center-of-mass energy.
With about 2.4 $\times 10^{10}$ ϕ and 3.1 $\times$ 10^8 η meson events available for data analysis, KLOE-2 can give an important contribution to hadron spectroscopy and Dark Force research fields. Moreover, thanks to the installation in both DAΦNE arms of two tagger station, KLOE-2 can also investigate the $\gamma\gamma$ fusion.

The $\eta \to \pi^0\gamma\gamma$ decay is considered a ChPT golden mode because of its sensitivity to the p^6 term on both the branching ratio (BR) and the M($\gamma\gamma$) spectrum. There is a 4.5 σ discrepancy between the KLOE preliminary BR measurement, obtained with 450 pb^{-1}, and the most accurate one from Crystal Ball.
By increasing sample statistics KLOE-2 can confirm or solve this discrepancy.

We are also active in the dark force field by testing an alternative model where the Dark Force mediator is an hypothetical leptophobic B boson that can couple only to barions with same quantum numbers of the ω meson. For masses less than 600 MeV the expected dominant decay channel is into $\pi^0\gamma$, thus we are investigated this possibility in the $\phi \to \eta B \to \eta\pi^0\gamma$ channel with $\eta \to \gamma\gamma$.

KLOE-2 aims to precisely measure the π^0 decay width into $\gamma\gamma$ by profiting of the π^0 production through $\gamma\gamma$ fusion. The status of the $\gamma^*\gamma^* \to \pi^0$ analysis will be reported.

We want also to precisely measure the ω cross section in the $e^+e^- \to \pi^+\pi^-\pi^0\gamma_{\rm ISR}$ channel using the Initial State Radiation (ISR) method. Promising results on this item will be also presented.

KLOE-2 searched for the P and CP violating decay $\eta \to \pi^+\pi^-$ by exploiting the radiative $\phi \to \eta\gamma$ process with 1.6~fb^{-1} of KLOE data.
No signal is observed in the $\pi^+\pi^-$ invariant mass spectrum and a limit on the branching ratio at 90\% CL has been extracted.
The limit results to be B($\eta \to \pi^+\pi^-$)$< 4.9 \times 10^{-6}$, three times lower than previous KLOE one,
the combination of the two KLOE limits gives a B($\eta \to \pi^+\pi^-$)$< 4.4 \times 10^{-6}$.

Moreover, KLOE-2 perform the search for the double suppressed $\phi \to \eta\,\pi^+\pi^-$ and the conversion $\phi \to \eta\,\mu^+\mu^-$ decays with both $\eta \to \gamma\gamma$ and $\eta \to 3\pi^0$. Clear signal are observed for the first time.

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