

# Testing discrete symmetries with neutral kaons at KLOE-2

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The KLOE-2 experiment is finalizing data taking at the upgraded e+e- DAΦNE collider of the INFN Laboratori Nazionali di Frascati, collecting more than  $5 \text{ fb}^{-1}$  at the center of mass energy of the  $\phi$  meson. Together with the data sample collected by its predecessor KLOE, the total of almost  $8 \text{ fb}^{-1}$  integrated luminosity represents the largest existing data sample in the world collected at an e+e- collider at the  $\phi$  meson peak, corresponding to  $\sim 2.4 \times 10^{10}$   $\phi$  mesons produced.

KLOE-2 physics program is mainly focused on  $K_S$ ,  $\eta$  and  $\eta'$  meson rare decays as well as on kaon interferometry, fundamental symmetry tests and physics beyond the Standard Model, including searches for new exotic particles that could constitute the dark matter. The entanglement in the neutral kaon pairs produced at the DAΦNE  $\phi$ -factory is a unique tool to test discrete symmetries and quantum coherence at the utmost sensitivity, in particular strongly motivating the experimental searches of possible CPT violating effects, which would unambiguously signal New Physics.

The lepton charge asymmetry measured in  $K_S$  semileptonic decays with  $1.7 \text{ fb}^{-1}$  of KLOE data, improving the statistical uncertainty of present result by about a factor two, will be presented together with the test of Time reversal and CPT in transitions in  $\phi \rightarrow K_S K_L \rightarrow \pi e \nu$ ,  $3\pi^0$  and  $\pi e \nu$ ,  $2\pi$  decays and the search for the CP violating  $K_S \rightarrow 3\pi^0$  decay with newly acquired KLOE-2 data.

**Primary authors:** Dr CZERWIŃSKI, Eryk (Jagiellonian University); DI DOMENICO, Antonio (Sapienza Università e INFN, Roma I (IT))

**Presenter:** DI DOMENICO, Antonio (Sapienza Università e INFN, Roma I (IT))

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