

Search for exotic effects in eta meson leptonic decays

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In this talk the preliminary analysis dedicated to a search for very rare $\eta \rightarrow e^+e^-$ decay will be presented. This analysis was performed with WASA detector working at COSY storage ring. The data were collected during a 2 week experimental run in Sept-Nov 2008.

The experiment WASA-at-COSY taking place in Forschungszentrum Jülich focuses on investigation of production and decays of various light mesons like π^0 , η and ω . In those decays we are especially interested in searching for symmetry breaking mechanisms and looking for the processes that could indicate the presence of new physics.

The COloer SYnchrotron COSY accelerates protons and deuterons with momenta up to 3.7 GeV/c. The WASA target constructed with the aim to minimize the photon conversion in the target uses unique system of droplets of frozen hydrogen or deuterium injected to cross the COSY beam. The decays are measured in the WASA detector which covers nearly 4π of decay space. Energies and angles of the scattered particles emitted with small polar angles are precisely measured in forward detector. Decay products of mesons are studied with central detector consisting of drift chamber in magnetic field, plastic barrel of scintillators and electromagnetic calorimeter.

The analysis of various leptonic decay channels of roughly 10^7 eta mesons produced with the reaction $pp \rightarrow pp\eta$ at energy of 1.4 GeV will be presented. The rarest among them - $\eta \rightarrow e^+e^-$ decay has an expected branching ratio of about 10^{-9} in the Standard Model. In this model the electron-positron pair is produced in fourth order electromagnetic process with two intermediate photons. This makes this decay very sensitive to non conventional interaction which could lead to significant increase of the branching ratio (BR). The observation of a higher signal would indicate the possible interaction from beyond the Standard Model. Also the analysis of more frequent leptonic decays of eta meson, like single and double Dalitz decays, will be shown and discussed. The experimental method is similar to that used by the CELSIUS/WASA collaboration in 2008 [1] where no $\eta \rightarrow e^+e^-$ decay candidates were identified and an upper limit of $\text{BR}(\eta \rightarrow e^+e^-) < 2.7 \cdot 10^{-5}$ (90% CL) was obtained. Since the number of the collected eta meson decays by the WASA-at-COSY collaboration is forty times larger than previously obtained we hope to get the better limit. We also expect to extract a statistically significant data sample of some other leptonic decays.

[1] M. Berłowski *et al.*, "Measurement of eta meson decays into lepton-antilepton pairs"
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