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Search for the X_{17} QCD Axion in the $\eta \rightarrow \pi^+\pi^-e^+e^-$ decay with the HADES Detector

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The High-Acceptance Di-Electron Spectrometer (HADES) operates at the GSI Helmholtzzentrum für Schwerionenforschung in Darmstadt with pion, proton and heavy-ion beams provided by the synchrotron SIS-18 [1]. In February 2022, the HADES Collaboration measured proton-proton collisions at 4.5 GeV momenta using the upgraded setup within the FAIR-Phase0 programme. One of the goals of the physics program of HADES is to test validity of Standard Model predictions and search for hints of new phenomena escaping known schemes. In particular using η meson decays into channels with dileptons (e^+e^- pairs) we are investigating the possible existence of X_{17} boson which is a candidate to be an axion-like particle (ALP) [2,3]. In this scenario an intermediate state of η decay could involve an existence of QCD axion through the sequence $\eta \rightarrow \pi^+\pi^-X_{17}(\rightarrow e^+e^-)$. The X_{17} particle is suspected to be an axial-vector gauge boson, which may mediate a fifth force with some coupling to SM particles. The conducted studies are moreover stimulated by recently observed anomalies in the invariant mass distribution of e^+e^- in the isoscalar magnetic nuclear transitions of ^8Be and ^4He nuclei [4-6], which have been interpreted as the creation and decay of an intermediate particle X_{17} with mass of about 17 MeV/ c^2 which have suppressed mixing with the neutral pion.

In this talk, we introduce general motivations for studies of a X_{17} , present analysis methodology and preliminary results from the data collected with high-resolution HADES spectrometer.

Bibliography:

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