

# Experimental search for $\eta'$ -mesic nuclei by missing-mass spectroscopy in $^{12}\text{C}(p,dp)$ reaction with the WASA detector at GSI-FRS (invited talk)

Thursday, April 3, 2025 4:50 PM (30 minutes)

The  $\eta'$  meson has an extraordinary large mass among the light pseudo-scalar meson nonet. The large mass is considered to originate from the non-trivial vacuum structure associated with chiral symmetry breaking and the axial U(1) anomaly in the QCD.

In a nuclear medium, where the chiral symmetry is partially restored, the mass reduction of the  $\eta'$  meson is predicted by  $37\text{--}150\text{ MeV}/c^2$  depending on theoretical models.

Since such a mass reduction leads to an attractive potential of  $\eta'$  meson to the nucleus, bound state of  $\eta'$  mesons and nuclei ( $=\eta'$ -mesic nuclei) is expected to exist.

We performed an experimental search for  $\eta'$ -mesic nuclei by missing-mass spectroscopy in  $^{12}\text{C}(p, dp)$  reaction using the WASA detector at the FRS in 2022 February, which was a coincidence measurement of forward deuterons and protons from decay of  $\eta'$ -mesic nuclei ( $\eta'NN \rightarrow NN$ ).

We employed 2.5-GeV proton beams with an intensity of  $\sim 3 \times 10^8/s$  and placed a  $^{12}\text{C}$  target at FRS-F2 focal plane.

The decay products of  $\eta'$ -mesic nuclei were measured with the WASA detector installed at the FRS-F2 focal plane and the forward deuteron momenta were analyzed by the FRS.

In this presentation, we will present details of the experiment and the current status of the analysis.

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**Session Classification:** Plenary Session