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Invited talk: Search for η' -mesic nuclei in (p,d) reaction at GSI/FAIR

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Possible existence of η' meson nucleus bound states (η' -mesic nuclei) has been attracting both theoretical and experimental interests due to their relation to axial U(1) anomaly and chiral symmetry breaking in QCD. Experiments to search for η' -mesic nuclei were recently performed by using the (p,d) reaction at GSI and by the (γ , p) reaction at SPring-8. However, no significant peak structure of the bound mesic states was so far observed, which lead to upper limits of the formation cross sections as well as constraints on the η' -nucleus potential. In order to further investigate η' -mesic nuclei, new experiments with an increased experimental sensitivity are necessary.

At GSI/FAIR, we have performed a new experiment in 2022 by combining the large-acceptance detector system WASA with the forward high-resolution spectrometer FRS to search for η' -mesic nuclei with an improved sensitivity. We employed a 2.5 GeV proton beam from the SIS-18 synchrotron and used the FRS for high-resolution missing-mass spectroscopy of the $^{12}\text{C}(p,d)$ reaction near the η' -meson production threshold. Simultaneously, possible decay particles from the produced η' -mesic nuclei, particularly high-energy protons, were detected and identified by the WASA detector system surrounding the reaction target to enhance the signal-to-background ratio of the missing-mass spectrum.

In this contribution, we will report on this recent experiment including the status of the data analysis.

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