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η meson physics with WASA-at-COSY

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Collaboration

WASA-at-COSY

Abstract content

The study of η mesons has been one of the main objectives of the WASA experiment, ever since its relocation to the accelerator complex COSY at the Research Center Jülich. As the interaction of η mesons with nucleons is attractive in s-wave, with the $S_{11}(1535)$ resonance situated close to the ηN threshold, studying the properties of ηN and ηA interactions has long been an active research topic. With the η meson being uncharged and short-lived, such studies are best performed in nucleon-nucleon and nucleon-nucleus collisions containing an η meson in the final state. With both COSY and an internal pellet target being able to provide protons as well as deuterons, η meson production can be studied in various reactions, most notably the proton-deuteron fusion. Here, experimental evidence for a strong final state interaction in the $\eta\,^3$He system has lead to an ongoing discussion of a potential η-nucleus bound state.

Another major part of the η physics program with WASA-at-COSY is the search for rare or forbidden decays. The η meson, possessing no allowed strong decays, provides ideal surroundings to search for both rare standard model processes and symmetry violating decays potentially involving beyond standard model physics. Two dedicated datasets, containing 30×10^6 η mesons in $pd \rightarrow {}^3\mathrm{He}\eta$ and 500×10^6 η mesons in $pp\eta$, allow precision studies of standard model decays and stringent limits on symmetry violating processes. Recent results on η meson physics with the WASA-at-COSY experiment will be discussed.

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