Incoherent photoproduction of η-mesons from the deuteron near threshold

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The reaction $\gamma d \to \eta np$ close to the meson production threshold offers an opportunity to investigate the final state interactions (FSI) between the outgoing particles, proton, neutron and η-meson. Specifically, provided the FSI between the nucleons is understood, the reaction could allow to draw conclusions about the ηN interaction at low energies.
In Refs. [1,2] we investigated incoherent η photoproduction from the deuteron close to threshold. The elementary $\gamma N - \eta N$ transition amplitude is described within an isobar model, taking into account the S_{11} (1535) resonance [1]. The amplitude for the reaction $\gamma d \to \eta np$ is given by the sum of the first order term, the impulse approximation, and the terms of next higher order due to the final state interactions in the np as well as ηN systems. When comparing our calculations to the data [3] available at that time we found that the few experimental points for the cross section of the reaction $\gamma d \to \eta np$ close to the reaction threshold require for an adequate description the additional contribution from the η-nucleon final state interaction.
Very recently the TAPS Collaboration reported new and more precise data [4] for the incoherent photoproduction of η-mesons from the deuteron near threshold. These new data not only contain the total $\gamma d \to \eta np$ reaction cross section but also angular and momentum spectra of the η-meson. In our contribution we study whether those new data [4] can shed some light on issues raised in our previous work [1,2]. In particular we address the question in how far those new data allow to pin down the magnitude of the ηN scattering length $a_{\eta N}$. Our investigations indicate that values around 0.5 fm for the real part of $a_{\eta N}$ are favoured by the experimental information.

References

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