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The quest for new data on the Space Star Anomaly in pd breakup

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Even though the development of the theories providing a precise description of few-nucleon interactions is well advanced, certain inconsistencies between experimental data and theoretical predictions are still to be resolved. One of the most intriguing discrepancies observed in the proton-deuteron breakup reaction is known as the Space Star Anomaly [1]. It concerns a very special geometrical configuration, where the momentum vectors of the reaction products are of the same length. What is interesting, the experimental evidence shows that the effect marks its presence at low energies (7.5-13 MeV/nucleon) [2], to
the contrary to the inconsistencies attributed to the so-called three-nucleon force.

Unfortunately, the highest energies ever analysed with this respect were 19 MeV [3] and 65 MeV [4]. Therefore due to a poor coverage of the energy range over 19 MeV it was not possible to draw clear conclusions about the source of the effect. The measurement and the calculations at 65 MeV show lack of the Space Star Anomaly at this energy and, on the other hand, enhanced sensitivity to relativistic effects [5]. The systematic studies in the domain of energy and for various orientations of the star relatively to the beam direction are important for better understanding of the process dynamics. The Big Instrument for Nuclear-polarization Analysis (BINA) [6,7] is one of the detectors well suited for such measurements. The research programme of the experiment aims i.a. at providing additional data on the Space Star cross-sections.

In this contribution, a thorough description of the Space Star
Anomaly effect will be presented. The latest theoretical predictions based upon Refs. [8,9] will be compared with each other and with the preliminary data points for the star configuration obtained with the BINA experimental setup for beam energies >=50 MeV/nucleon, as the next step in the research programme started recently.

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Selected session

Few body systems

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