

Investigations of the charge symmetry breaking reaction $dd \rightarrow \alpha\pi^0$ with WASA-at-COSY experiment

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Investigations of charge symmetry breaking is one of the most important topics for the WASA-at-COSY experiment. The study concentrates on the charge symmetry forbidden $dd \rightarrow \alpha\pi^0$ reaction. The aim is to compare the experimental results with Chiral Perturbation Theory (χ PT) predictions gaining information on the up and down quarks mass difference. First steps toward a theoretical understanding of the $dd \rightarrow \alpha\pi^0$ reaction have been taken [1,2]. It was found that the existing data are not sufficient for a precise determination of the parameters of the χ PT and new data are required. These new data should comprise the measurement of the charge symmetry forbidden $dd \rightarrow \alpha\pi^0$ reaction and the charge symmetry conserving $dd \rightarrow {}^3\text{He}n\pi^0$ reaction at sufficiently high energy where p-wave contribution becomes important.

Preliminary experimental results of the investigation of the $dd \rightarrow \alpha\pi^0$ reaction with the WASA-at-COSY detector setup at a beam momentum of 1.2 GeV/c will be presented. Preliminary total cross section and the differential distributions of this reaction were obtained. Results and data analysis will be discussed.

For the next step of the $dd \rightarrow \alpha\pi^0$ reaction measurements with higher statistics and different beam energy the modification of the detection setup is planned. Possible scenarios will be discussed.

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[1] A. Gårdestig et al. Phys. Rev. C 69, 044606 (2004).

[2] A. C. Fonseca, R. Machleidt and G. A. Miller, Phys. Rev. C 80, 027001 (2009).