

Charge Symmetry Breaking in the Reaction $dd \rightarrow 4\text{He}\pi^0$ with WASA-at-COSY

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Probing elementary symmetries and symmetry breaking tests our understanding of the theory of strong forces, Quantum Chromodynamics. Investigations of charge symmetry breaking is one of the primary goals for the WASA-at-COSY experiment. The presented study concentrates on the charge symmetry forbidden reaction $dd \rightarrow 4\text{He}\pi^0$.

The aim is to provide experimental results for comparison with predictions from Chiral Perturbation Theory (χ_{PT}) to study effects induced by quark masses on the hadronic level, e.g., the proton-neutron mass difference. In addition, data are needed to determine certain parameters of χ_{PT} and to describe the initial and final state interactions. First steps towards a theoretical understanding of the $dd \rightarrow 4\text{He}\pi^0$ reaction have already been taken, however, it was found that the existing data are not sufficient. New data should comprise the measurement of the charge symmetry forbidden $dd \rightarrow 4\text{He}\pi^0$ reaction and the charge symmetry conserving $dd \rightarrow 3\text{He}n\pi^0$ reaction at sufficiently high energy where the contribution of higher partial waves becomes important. Results from a first $dd \rightarrow 4\text{He}\pi^0$ measurement with the WASA detector setup at a beam momentum of 1.2 GeV/c had been already published, but the limited statistics did not allow a decisive interpretation.

A second measurement using an improved detector setup aiming at higher statistics has been performed in spring 2014. For the first time, the differential cross section has been determined, showing the importance of the contribution of higher partial waves. The results from the new measurement will be presented.

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