

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

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The experimental program of WASA-at-COSY focuses on symmetries and symmetry breaking patterns in the non-perturbative regime of QCD. One objective is the determination of  $p$ -wave contributions to the charge symmetry breaking amplitude in the reaction  $dd \rightarrow {}^4\text{He} \pi^0$  at 1.2 GeV/c beam momentum (350 MeV kinetic beam energy) [1]. Charge symmetry is a special case of isospin symmetry being broken by the different masses of the up and down quarks as well as electromagnetic interaction [2]. To get access to the quark mass difference it is favorable to look at Charge Symmetry Breaking (CSB) observables as the relative  $\pi$ -mass difference, which is of electromagnetic origin, does not contribute. In addition, the reaction  $dd \rightarrow {}^4\text{He} \pi^0$  is only possible via charge symmetry breaking mechanisms and, thus, the cross section is directly proportional to the square of the CSB amplitude.

While the reaction has been measured close to threshold at IUCF [3] resulting in a cross section compatible with  $s$ -wave, data at higher excess energies sensitive to higher partial waves are missing. Such data are, however, crucial for  $\chi$ PT calculations currently under way. These calculations are a major theoretical effort. Recent developments in this direction are reported in Ref. [4-7].

This presentation will discuss the status of the analysis of data taken with WASA-at-COSY in November 2007 and June 2008.

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