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DETERMINATION OF DIFFERENTIAL CROSS SECTION OF THE REACTION $pp\to\{pp\}_S{}^0$

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The reaction $pp\to d^+$, which is a classical method of studying NN interactions, has two peaks in the energy dependence of the differential cross section at zero angle $d(0)/d$. The first one is located in the region of the sum of the $N(1232)$ masses, $\sqrt{s}$ 2.15 GeV. When analyzing the ANKE-COSY data, a similar peak was found in the reaction $pp\to\{pp\}_S{}^0$, the spin-isospin partner of $pp\to d^+$. Here $\{pp\}_S$ denotes a diproton, i.e. an unrelated interacting proton pair in the ${}^1S_0$ state. The previously published ANKE-COSY data also indicate the possibility of the existence of a similar second peak.

Partial wave analysis shows that the first peak for the $pp\to d^+$ reaction is caused by three dominant transitions exhibiting resonant behavior in the intermediate two-baryon system: ${}^1D_2p$, ${}^3F_3d$ and ${}^3P_2d$; and for the reaction $pp\to\{pp\}_S{}^0$ by two transitions ${}^3P_2d$ and ${}^3P_0s$. The transitions responsible for the second peak remain much less clear.

In order to study the second peak on the ANKE-COSY facility, the reaction $pp\to\{pp\}_S{}^0$ was additionally investigated at small angles in the beam energy range $T_{beam} = 1.0-2.8$ GeV. For the reaction $pp\to\{pp\}_S{}^0$ we obtained the angular dependences of the differential cross section d/d at forward angles for several energies, the energy dependences of the cross section at zero angle $d(0)/d$ and of the forward cross section angular slope k.

The obtained results confirm the existence of a second peak in the $d(0)/d$ energy dependence for the reaction $pp\to\{pp\}_S{}^0$ and allow us to estimate its maximum, mass and width. The change in the sign of the slope k in comparison with the region of the first peak indicates a change in the reaction dynamics at the energies $\sqrt{s}$ 2.3—2.6 GeV.

The obtained results can contribute to the development of a theoretical understanding of the hadron interaction mechanisms in this energy range.

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