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

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The reaction $pp \rightarrow d^+$, 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 $pp \rightarrow \{pp\}_S^{-0}$, the spin-isospin partner of $pp \rightarrow d^+$. 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 $pp \rightarrow d^+$ reaction is caused by three dominant transitions exhibiting resonant behavior in the intermediate two-baryon system: ${}^{1}D_{2}p$, ${}^{3}F_{3}d$ and ${}^{3}P_{2}d$; and for the reaction $pp \rightarrow \{pp\}_{S}{}^{0}$ by two transitions ${}^{3}P_{2}d$ and ${}^{3}P_{0}s$. 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 $pp \rightarrow \{pp\}_S^0$ was additionally investigated at small angles in the beam energy range $T_{beam} = 1.0-2.8$ GeV. For the reaction $pp \rightarrow \{pp\}_S^0$ 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 $pp \rightarrow \{pp\}_S{}^0$ 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.

Authors: BAIMURZINOVA, Bota (Joint Institute for Nuclear Research, Dubna, Russia; L. N. Gumilyov Eurasian National University, Nursultan, Kazakhstan); TSIRKOV, Dmitry (JINR)

Presenter: BAIMURZINOVA, Bota (Joint Institute for Nuclear Research, Dubna, Russia; L. N. Gumilyov Eurasian National University, Nursultan, Kazakhstan)

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