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Resonance behaviours of the reactions $pp \to \{pp\}_s\pi^0$ and $pd \to pd\pi\pi$ in the GeV region

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Collaboration

Abstract content

Recently differential cross section and vector analyzing power A_y of the one pion production reaction $pp \to pp_s\pi^0$, where pp_s denotes the pp-pair in the $^1S_0$ state, were measured by ANKE@COSY [1] at proton beam energies 0.3-0.8 GeV. A resonance behavior of the differential cross section was observed at 0.5-0.8 GeV. This behavior and measured A_y were described using fit by two isovector Breit-Wigner resonances in the $^3P_0$ and $^3P_2$ states. The contribution of the Δ-isobar mechanism in this reaction was studied in [2]. The parameters for the coupling constants and vertex form factors which were used to explain the COSY data on the reaction $dp \to pp_s\pi N$ [3] are applied here. The calculated energy dependence of the differential cross section of the reaction $pp \to pp_s\pi$ at zero angle of the pion is in qualitative agreement in shape with the data at energy 0.35-0.8 MeV. It is shown that main contribution is made by three partial waves of the pp-channel: $^3P_0$, $^3P_2$, $^3F_2$. The model explains the position of the peak observed at 0.6 GeV and zero diproton scattering angle but underestimates its absolute value. Furthermore, the Δ-mechanism fails to describe the analyzing power A_y.

Resonance structure was observed by ANKE@COSY also in the behavior of the differential cross section of the two-pion production reaction $pd \to pdX$ at beam energies 0.8-2.0 GeV with high transferred momentum to the deuteron at small scattering angles of the final proton and deuteron (see a talk by D.Tsirkov at this conference). The $d\pi\pi$ invariant masses of the observed peaks are close to 2.380 GeV that is the mass of isoscalar two-baryon resonance $D_{IJ} = D_{03}$ observed by WASA@COSY in the reaction $pn \to d\pi^0\pi^0$ [4], while the width is by a factor of ~ 1.5 larger than for the D_{03}. One possible mechanism of the reaction $pn \to d\pi^0\pi^0$ suggested in the paper [5] involves two dibaryon resonances, D_{03} and D_{12}. We modify this model by inclusion of the σ-meson exchange between the proton and deuteron and apply it to the process $pd \to pdX$.

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