TWO PION PRODUCTION IN THE REACTION $pd \to pd\pi\pi$

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The recent WASA-at-CELSIUS data [1] on the $pn \to d\pi^0\pi^0$ reaction demonstrate a remarkable narrow peak in the total cross section at $\sqrt{s} = 2.35$ GeV in the region of the ABC effect. It is assumed [1] that the peak reflects a bound state of two $\Delta(1232)$'s, presumably, a dibaryon state. A similar peak was observed at ANKE COSY in the reaction $pd \to pd\pi\pi$ [2], but the kinematics of the reaction studied in Ref. [2] differs considerably from that in Ref. [1]. Here we present the results of calculations of the cross section of the reaction $pd \to pd\pi\pi$ at beam energies 1-1.5 GeV within a model, which includes the box diagram with excitation of the Roper $N^*(1440)$ resonance in the intermediate state. We demonstrate that the absolute value of the cross section and the width of the peak strongly depend on the parameters of the Roper resonance (couplings constants, cut-off's), which are taken from current literature [3, 4]. In the kinemtics of the ANKE experiment [2] the calculated cross section at beam energies $T_p = 0.8$, 1.1, 1.4 and 2 GeV are by two-orders of magnitude smaller than the preliminary data [2] and the predicted peaks are shifted to lower masses of the $d\pi\pi$ system. The mechanism of the $\Delta\Delta$ excitation via the pion exchange in the t-channel is estimated within the impulse approximation and its contribution is also found to be insufficient to explain the data. The small contributions of these mechanisms are caused mainly by large transferred momentum $Q \sim 1$ GeV/c to the deuteron. We show that there is another kinematics of this reaction $pd \to pd\pi\pi$ at the same beam energies, in which the transferred momentum to the final deuteron is much lower $Q \sim 0.3$ GeV/c and, as a result, the contribution of the considered Roper- and $\Delta\Delta$ mechanisms increases by two order of magnitude.
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References

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