Formation of Fast Spin-Singlet Nucleon Pairs in FSI Region and Short-Range NN-Properties

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A model independent approach [1] for calculation of the contribution of the spin-triplet pn-pair in the final state interaction (FSI) region is applied here to analyze the data on the reaction $pp \to pn\pi^+$ at 800 MeV [2], new data of COSY at 492 MeV [3] and the Wirdginia data on the exclusive reaction $pd \to pnp$ at 585 MeV [4]. A previous conclusions [2,4] about large admixture of the spin-singlet state ($\sim \frac{1}{3}$) were obtained on an ambiguous procedure. We have found [5,6] that the spin-triplet final state dominates in the unpolarized cross section of the all reaction in question whereas the spin-singlet admixture is at most few percent. Good qualitative agreement with the measured proton analysing power in the reaction $\vec{p}p \to pn\pi^+$ is also found within this approach. The smallness of the singlet contribution in the reaction $pd \to pnp$ is compatible with (i) a small admixture of the singlet contribution in the reaction $pp \to pn\pi^+$ and (ii) dominance of the triangle diagram with the subprocess $pp \to d\pi^+$ in large-angle elastic pd scattering. From the theoretical point of view, the singlet channel can give a principal new information about the dynamics of the process in contrast to the triplet one. The reason is the triplet observables correlate strongly with those for the rather known deuteron channel and are determined mainly by the $\Delta-$ isobar formation in the intermediate state. The smallness of the singlet-to-triplet ratio makes too difficult a separation of the singlet state from the mixed singlet-triplet pn state. Direct measurement of the singlet channel can be done by detecting the final pp pair in the $^1S_0$-state. Analysis [7] of the reaction $pd \to (pp)(0^\circ) + n(180^\circ)$ on the basis of the main mechanisms of the elastic backward pd-scattering shows that at energies below the pion production (~ 200 MeV) this process provides a new testing ground for the spin structure of the three-nucleon forces, in addition to recent precision polarization data on the elastic Nd-scattering [8]. At higher energies 0.5-2.5 GeV in this reaction are expected remarkable peculiarities caused by the standard potential picture of the NN-interaction [9]. These properties can be used as a test for the mechanism of the pd backward quasi elastic scattering, in particularly, for possible exotic contributions like N^*-exchange in the u-channel.

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