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POLARIZATION OBSERVABLES FOR THE COLLINEAR $dp \to {}^3\mathrm{He}\pi^0$ REACTION

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1. Introduction

Pion production and absorption is one of the most fundamental problems in intermediate energy physics. On one the hand, since the process $\pi N \to N$ is kinematically forbidden on a free nucleon and strongly suppressed in nuclei, the pion absorption requires the participation of at least two nucleons. On the other hand, this process is sensitive to large-momentum components in the relative wave function of the nucleons. Hence, the production and absorption of the pions on nuclei is the unique possibility to study short-range NN-correlations ($r < 1fm$) where non-nucleonic degrees of freedom may become essential.

The pion absorption, however, is dominated by P- wave scattering (Fig.1b) (mainly via an $^5S_2$ intermediate ΔN state), which masks the NN-correlations.

S- wave rescattering (Fig.1a) is not mediated by the Δ resonance, and, therefore, it can be sensitive to short-range NN- correlation. Since S- wave rescattering is much smaller than P- wave rescattering, the cross section is not sensitive to this component. Polarization observables, however, depend on interferences between these diagrams, and so they are particularly sensitive to smaller terms.

The deuteron is the simplest system on which pions can be absorbed. In the last few decades the reaction $\pi^+ d \to pp$ (and the time-reversed reaction $pp \to d\pi^+$) has been extensively investigated, including polarization observables, and several partial-wave amplitudes fits have been published to date.

The next step is a detailed studying of the pion production and absorption on a nucleus heavier than the deuteron.

The number of experiments to be performed for an amplitude analysis and for the reconstruction of partial-wave amplitudes is usually large. But the number of experiments can be sufficiently reduced in special geometries like the collinear one or in the center of mass system (CMS) at 90°.

In this letter the $dp \to {}^3He\pi^0$ reaction is considered in collinear kinematics when ^3He is produced at $\theta_\tau = 0^o$ or at $\theta_\tau = 180^o$ in the CMS. Taking into account spin-parity restrictions under this kinematic condition, one gets only 2 independent complex amplitudes for this process.

The measurements of the differential cross section [1, 2] and both cross section and tensor analyzing power T_{20} [3] for forward and backward π^o production in the CMS makes it possible to extract the moduli of these amplitudes for collinear kinematics. A significant structure in the amplitudes, particularly at $\theta_\tau = 180^o$, can be related with Δ and N^* excitation in this process.

Note that the vector analyzing power $C_{N,0,0,0}$ at large angles in the CMS

also varies strongly with energy and even changes its slope at 180° in the same region [4, 5, 6].

The large negative T_{20} measured at threshold [7] is a direct evidence for the two-body absorption of stopped pions taking place primarily on pairs of nucleons with isospin zero. This measurement allowed one to estimate that the capture of pions on isoscalar nucleon pairs in ^3He is more than an order of magnitude stronger than on isovector pairs [8].

The measurements of differential cross section [9] and the recent measurements of both the cross section and the tensor analyzing power T_{20} [10] near threshold allow one to reconstruct the moduli of 2 independent amplitudes in this region.

But it is impossible to obtain the relative phase of these amplitudes from study of the differential cross section and T_{20}. For this purpose it is necessary to perform the investigation of such polarization observables as deuteron-proton spin correlation between both polarized particles or polarization transfer from polarized deuteron to ^3He. The measurement of such observables near threshold allows one to obtain the relative sign of the coupling constants for absorption on isoscalar (g_0) and isovector (g_1) nucleon pairs.

The investigation of this reaction is essential for a good knowledge of NN interaction above pion production threshold. It can give us information on the short-range NN correlation, on the nature of $N\Delta$ and NN^* interaction, on a possible 3-body mechanism of pion absorption, provide us with the basic input for the microscopic calculation of more complicated processes on multinucleon systems.

The performance of these experiments is possible at Dubna, SATURNE, TRIUMF and PSI using the polarized beams, targets and intense pion beams.

2. The $dp \to {}^3He\pi^o$ in collinear geometry

In the general case there are 6 complex amplitudes depending on total energy $\sqrt{s}$ and scattering angle θ in the CMS to describe the $dp \to {}^3He\pi^o$ process. These amplitudes can be reconstructed in a complete experiment which contains measurements of at least 11 different polarization observables. But the number of necessary experiments to be performed is drastically reduced in special geometry like collinear one.

For collinear geometry there are only 2 independent complex amplitudes for $dp \to {}^3He\pi^o$ which can be written in the following form [8, 11]:

$$\hat{\mathbf{F}} = \chi_\tau^+ \cdot \left(A \cdot (\vec{n}\vec{U}) + iB \cdot \vec{n}\vec{U} \times \vec{\sigma}\right) \chi_p, \tag{1}$$

where the Pauli matrix $\vec{\sigma}$ acts between proton and ${}^3He$ spinors (χ_p and χ_τ), $\vec{U}$ is the deuteron polarization vector and $\vec{n}$ is the unit vector along the relative momentum of initial particles.

The polarized cross section is written in terms of the initial density matrix of the $d-p$ system $\hat{\rho}_\mathrm{i}$ and amplitude $\hat{\mathbf{F}}$ as

$$\frac{d\sigma^{pol}}{d\Omega} = \frac{Tr(\hat{\mathbf{F}}\hat{\rho}_\mathrm{i}\hat{\mathbf{F}}^+)}{Tr(\hat{\rho}_\mathrm{i})} \tag{2}$$

Using expansion of the density matrix $\hat{\rho}_\mathrm{i}$ in terms of Pauli spin matrices σ for initial proton and final ${}^3He$ and a set of spin operators S_λ for initial deuteron, the general spin observable is defined as

$$C_{\alpha,\lambda,\beta,0} = \frac{Tr(\hat{\mathbf{F}}\hat{\sigma}_\alpha^p\hat{S}_\lambda^d\hat{\mathbf{F}}^+\hat{\sigma}_\beta^\tau)}{Tr(\hat{\mathbf{F}}\hat{\mathbf{F}}^+)} \tag{3}$$

where indices $\alpha and \lambda$ refer to the initial proton and deuteron polarization, index β refers to final ${}^3He$ polarization and index 0 refers to final π^o, respectively. (Here we follow the notations used in ref.[12])

The spin-correlation coefficients or second-order spin observables $C_{\alpha,\lambda,0,0}$ are defined as:

$$C_{\alpha,\lambda,0,0} = \frac{Tr(\hat{\mathbf{F}}\hat{\sigma}_\alpha^p\hat{S}_\lambda^d\hat{\mathbf{F}}^+)}{Tr(\hat{\mathbf{F}}\hat{\mathbf{F}}^+)} \tag{4}$$

Using expression (1) for amplitude $\hat{\mathbf{F}}$, one can obtain, for collinear geometry:

$$C_{L,L,0,0} = \frac{-2 \cdot |B|^2}{|A|^2 + 2|B|^2} \tag{5}$$

$$C_{N,N,0,0} = \frac{-2 \cdot ReBA^*}{|A|^2 + 2|B|^2} \tag{6}$$

$$C_{N,SL,0,0} = \frac{-3 \cdot ImBA^*}{|A|^2 + 2|B|^2} \tag{7}$$

$$C_{0,NN,0,0} = \frac{|A|^2 - |B|^2}{|A|^2 + 2|B|^2} \tag{8}$$

where L is longitudinal, N is normal and S is sideways polarization of particles. Notice that the coefficients of polarization transfer from deuteron to ${}^3He$ are related to the spin-correlation coefficients as:

$$\begin{aligned} C_{0,L,L,0} &= -C_{L,L,0,0} \\ C_{0,N,N,0} &= C_{N,N,0,0} \\ C_{0,SL,N,0} &= C_{N,SL,0,0} \end{aligned}$$

For the coefficients of polarization transfer from proton to ${}^3He$ one can obtain:

$$\begin{aligned} C_{L,0,L,0} &= 2 \cdot C_{L,L,0,0} + 1 \\ C_{N,0,N,0} &= -(C_{L,L,0,0} + 1) \end{aligned} \tag{9}$$

Also, the observables $C_{N,N,0,0}, C_{N,SL,0,0}$ and $C_{0,NN,0,0}$ are related as follows:

$$2 \cdot C_{N,N,0,0}^2 + \frac{8}{9} C_{N,SL,0,0}^2 + \frac{\left(4C_{0,NN,0,0}^2 - 1\right)^2}{9} = 1 \tag{10}$$

Assuming that A and B are in phase what means $ReAB^* = \pm |A||B|$ and $C_{N,SL,0,0} = 0$, the equation (10) can be transformed to:

$$2 \cdot C_{N,N,0,0}^2 + \frac{\left(4C_{0,NN,0,0}^2 - 1\right)^2}{9} = 1 \tag{11}$$

The conditions for realization of eq. (11) will be considered below, but one can mention that even in the case when A and B are in phase, it is necessary to perform the measurement of $C_{N,N,0,0}$ to obtain the relative sign of the moduli of A and B.

It should be noted that the spin correlations $C_{N,SL,0,0}$ and $C_{N,N,0,0}$ are the most informative polarization observables because they are the interference terms of two amplitudes in contrast to the others and can be more sensitive to short range NN-correlations.

3. Behaviour near threshold

From π absorption on ${}^3He$ near threshold, it is known that S-wave pions are absorbed mainly on pairs of nucleons (Fig.1a)

$$\mathbf{f}_0 = -ig_0\vec{n}_{NN} \cdot (\vec{U}_{NN}^+ \times \vec{U}_d) \tag{12}$$

$$\mathbf{f}_1 = g_1\vec{n}_{NN} \cdot \vec{U}_{NN}^+ \tag{13}$$

where $\vec{n}_{NN}$ is the relative momentum of the two final nucleons, $\vec{U}_{NN}$ is their polarization vector, $\vec{U}_d$ is the polarization vector of the isoscalar quasi-deuteron pair and g_0, g_1 are the amplitudes for absorption on nucleon pairs with isospin $T=0$ and $T=1$, respectively. These amplitudes correspond to the $^3P_1$ and $^3P_0$ states of the two final nucleons and can therefore be written up to sign ambiguity as follows:

$$g_0 = |g_0| exp\left[i\delta(^3P_1)\right] \qquad g_1 = |g_1| exp\left[i\delta(^3P_0)\right] \tag{14}$$

Near threshold $A \sim (A_0(Q)\cdot g_0 + A_1(Q)\cdot g_1)$ and $B \sim (B_0(Q)\cdot g_0 + B_1(Q)\cdot g_1)$, where $A_i(Q), B_i(Q)$ depend on the structure functions of deuteron and ^3He [8]. Of especial interest is the case where g_0 and g_1 are in phase, i.e. $\delta^3P_1 \approx \delta^3P_0 \equiv \delta$, then $A \sim (A_0(Q)\cdot \bar{g_0} + A_1(Q)\cdot \bar{g_1})\cdot exp(i\delta)$, $B \sim (B_0(Q)\cdot \bar{g_0} + B_1(Q)\cdot \bar{g_1})\cdot exp(i\delta)$, where $\bar{g_0}$ and $\bar{g_1}$ are real.

The two P-wave phase shifts are small at threshold, and it is permissible to assume that the coupling constants g_0 and g_1 are real if P-wave interactions (Fig.1b) are neglected in the analysis. In order to get an agreement with the $n-d$ branching ratio, g_0 and g_1 were assumed have the same sign [13]. But sign uncertainty can only be removed by the measurement of such observable as $C_{N,N,0,0}$ in the $dp \to {}^3He\pi^o$ (or $C_{N,0,N,0}$ in the $\pi^- {}^3He \to nd$).

In order to get an agreement with the measured tensor analyzing power T_{20} at threshold of the $dp \to^3 He\pi^o$ reaction [7] using realistic wave functions of deuteron and ^3He with D- waves and the S-wave $\pi^- \ {}^3He \to nd$ branching ratio [14], the authors [8] could extract numerical values of g_0 and g_1:

$$|g_0| = (6.5 \pm 0.6)10^{-2} fm^{-2} \qquad |g_1| = (1.4 \pm 0.4)10^{-2} fm^{-2} \tag{15}$$

Using these values, one can predict the values of other polarization observables, defined above. Using completely symmetric ^3He and deuteron wavefunctions and also realistic wavefunctions from [8], the predicted values for $C_{N,N,0,0}$, $C_{L,L,0,0}$, $C_{L,0,L,0}$ and $C_{N,0,N,0}$ at threshold are presented in Table 1.

Table 1. Predictions for $C_{N,N,0,0}$, $C_{L,L,0,0}$, $C_{L,0,L,0}$ and $C_{N,0,N,0}$ at threshold in the $dp \to {}^3He\pi^0$ using completely symmetric ^3He and deuteron wavefunctions and realistic wavefunctions with D- waves. The values are calculated with the parameters $g_0 = (6.5 \pm 0.6)10^{-2} fm^{-2}$ and $g_1 = (1.4 \pm 0.4)10^{-2} fm^{-2}$ from ref.[8].

	$C_{N,N,0,0}$	$C_{L,L,0,0}$	$C_{L,0,L,0}$	$C_{N,0,N,0}$
Without D waves	± (0.333± 0.026)	-0.059± 0.013	0.882 ± 0.026	-0.941± 0.013
With D waves	± (0.289± 0.023)	-0.044± 0.007	0.912 ± 0.014	-0.956± 0.007

The value of $C_{N,N,0,0}$ can be predicted up to sign ambiguity, but a negative value of $C_{N,N,0,0}$ at threshold is more favourable when g_0 and g_1 are assumed to have the same sign to avoid a strong suppression of the $n-d$ branching ratio [13]. One can also see that $C_{N,N,0,0}$ is very sensitive to short-range NN- correlations.

The value of $C_{L,L,0,0}$ at threshold is small what is easy to understand. Since the projection m of deuteron polarization vector is along the direction of proton momentum in the case of longitudinal polarization, the amplitude (12) vanishes and the small amplitude (13) defines the value of $C_{L,L,0,0}$ at threshold.

We would like to note that amplitudes A and B are real at threshold in the S-wave pion absorption approach, and from the measured cross section and T_{20} [7, 9, 10] one can predict the values of other polarization observables. Carring out $C_{N,N,0,0}$ measurements at threshold could provide removing sign ambiguity between the A and B amplitudes (and between the g_0 and g_1 coupling constants).

4. Spin-correlations at high energies

For complete description of this process at higher energies, it is necessary to include in calculations the $N\Delta$ and NN^* intermediate state production, three-body mechanisms [15] and so on. But from simple relations between polarization observables it is possible to predict the behaviour or to set a limit to changing some of them using information extracted from the observables measured to date.

The unpolarized differential cross section and tensor analyzing power of the $dp \to {}^3He\pi^o$ determine the moduli of A and B through [8]:

$$\frac{d\sigma^o}{d\Omega} = \frac{1}{6}\cdot\frac{p^*_\pi}{p^*_d}\cdot\left[|A|^2 + 2|B|^2\right] \tag{16}$$

$$T_{20} = \sqrt{2}\cdot\frac{|B|^2 - |A|^2}{|A|^2 + 2|B|^2} \tag{17}$$

where p^*_π and p^*_d are the pion and deuteron CM momenta, and the tensor analyzing power T_{20} is relate to $C_{0,NN,0,0}$ as

$$T_{20} = -\sqrt{2}C_{0,NN,0,0} \tag{18}$$

The values of $|B|^2$ and $|A|^2$ extracted from the experimental data at $\theta_\tau = 0^o$ and at $\theta_\tau = 180^o$ [3] are presented in Fig.2 . One can see that the A amplitude is always dominant at $\theta_\tau = 0^o$. However, at $\theta_\tau = 180^o$ there is a rich structure in both amplitudes which can be connected with excitations of resonances in the intermediate state.

Using the extracted moduli of A and B and relation (5), one can predict the behaviour of $C_{L,L,0,0}$ (Fig.3). This observable is more sensitive to the small amplitude B than T_{20}. The observables $C_{L,0,L,0}$ and $C_{N,0,N,0}$ can also be obtained from simple relations (9). However, these polarization observables do not contain principal new information about this process in addition to the measured cross section and T_{20}.

Relation (11) between $C_{N,N,0,0}$ and $C_{0,NN,0,0}$ is valid at threshold. At high energies relation (11) is destroyed and only (10) remains right.

The energy dependence of a more favourable solution [13] of equation (11) for $C_{N,N,0,0}$ at $\theta_\tau = 0°$ is presented in Fig.4. The point in the graph is the predicted value of this observable at threshold. The real value of $C_{N,N,0,0}$ from experiment must lie above this prediction.

In principle, there are only 3 totally independent observables for the $dp \to {}^3He\pi^o$ reaction in collinear geometry, i.e. cross section, $C_{0,NN,0,0}$ and $C_{N,N,0,0}$. The value of $C_{N,SL,0,0}$ can be obtained from eq.(10) (up to sign uncertainty). Therefore, from measuring $C_{N,N,0,0}$ (in addition to the cross section and T_{20}) it is possible to perform an amplitude analysis and reconstruction of the partial-wave amplitudes up to a constant phase shift.

Concluding this section, we would like to note that the $dp \to {}^3He\eta^o$ reaction having the same spin structure is also defined by two amplitudes in collinear kinematics. This process at threshold is dominated via an intermediate $S_{11}(1535)$ resonance. Thus, in contrast to the π case, the low energy η-${}^3He$ interaction is very strong.

In the two-body absorption approach [16] the η- meson at threshold can also be absorbed on pairs of nucleons with isospin $T = 0$ and $T = 1$:

$$\begin{aligned} \mathbf{f}_0 &= g_0 \vec{n}_{NN} \cdot \vec{U}_d^+ \\ \mathbf{f}_1 &= g_1 \vec{n}_{NN} \cdot \vec{U}_{NN}^+ \end{aligned} \qquad (19)$$

where g_0, g_1 are the amplitudes for absorption on nucleon pairs with isospin $T = 0$ and $T = 1$, respectively; $\vec{n}_{NN}$ is the relative momentum of two final nucleons, $\vec{U}_{NN}$ is their polarization and $\vec{U}_d$ is the polarization of the isoscalar quasi-deuteron pair. From measurements of the cross section at threshold for $np \to d\eta^0$ [17] and $pp \to pp\eta^0$ [18], one could estimate that the absorption of η- meson on isoscalar nucleon pairs is an order of magnitude stronger than on isovector pairs.

One of the main features of these processes is the dominance of ρ- exchange, but in principle the relative sign between the π and ρ contributions is not determined. If we neglect D- waves in the deuteron and ${}^3He$, the difference between S^* and S waves in the ${}^3He$ and ω, η exchange diagrams, the A and B amplitudes of the $dp \to {}^3He\eta^0$ process correspond to pure π- and ρ- contributions, respectively. The relative phase between the A and B amplitudes corresponds to the mixing parameter between the π- and ρ- exchange graphs. The spin correlation $C_{N,N,0,0}$ takes the following form:

$$C_{N,N,0,0} = |C_{N,N,0,0}| \cdot cos\delta, \qquad (20)$$

where the $cos\delta$ is the mixing parameter between the π- and ρ- contributions.

Of course, for correct description of this process it is necessary to add to this simplified model 3-body mechanisms [19], strong FSI due to large complex $\eta{}^3He$ scattering length [20, 21] and so on.

Using simple relations between the polarization observables and the measured cross section [2] and the value of tensor analyzing power T_{20} [22] at threshold, one can estimate the values of spin correlations and polarization transfer coefficients. The results are presented in the Table 2.

Table 2. Predictions for $|C_{N,N,0,0}|$, $C_{L,L,0,0}$, $C_{L,0,L,0}$ and $C_{N,0,N,0}$ at threshold in the $dp \to^3 He\eta^0$.

$\lvert C_{N,N,0,0}\rvert$	$C_{L,L,0,0}$	$C_{L,0,L,0}$	$C_{N,0,N,0}$
0.694 ± 0.052	-0.596 ± 0.024	0.192 ± 0.048	-0.404 ± 0.024

The values of $|B|^2$ and $|A|^2$ for the $dp \to {}^3He\eta^o$ reaction at $\theta_\tau = 180°$ extracted from the experimental data [2, 22] are presented in Fig.5. Note that the ratio of the $|A|/|B|$ equals 1.16 ± 0.05 over the range of $p^*_\eta = 0 \div 80MeV/c$. This means that the observables presented in the Table 2 , except $C_{N,N,0,0}$ and $C_{N,SL,0,0}$, will be constant in this region and equal to the values at threshold. The spin correlations $C_{N,N,0,0}$ and $C_{N,SL,0,0}$ will have the following expression in this region:

$$\begin{aligned} C_{N,N,0,0} &= (0.694 \pm 0.052) \cdot cos\delta \\ C_{N,SL,0,0} &= (1.041 \pm 0.078) \cdot sin\delta \end{aligned} \qquad (21)$$

Arguments for measuring $C_{N,N,0,0}$ (in addition to the measured cross section and T_{20}) to perform an amplitude and partial-wave analysis are the same as for $dp \to {}^3He\pi^0$.

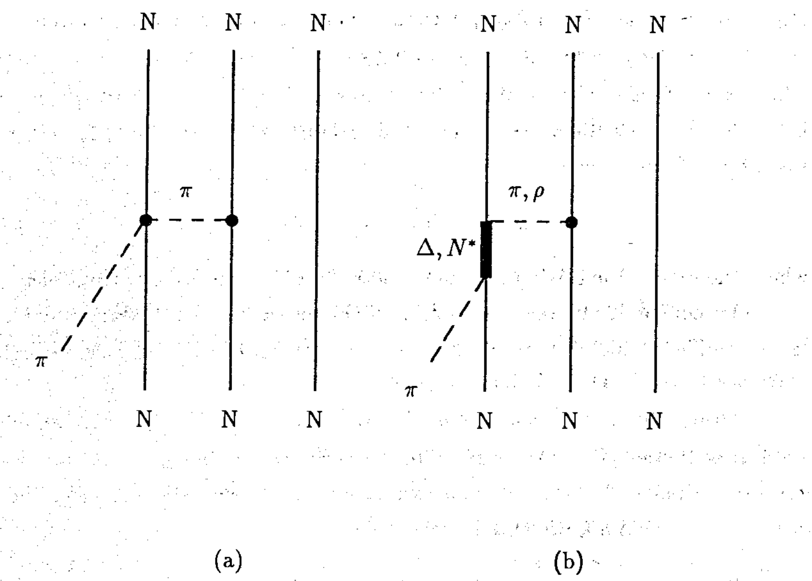

Fig.1 Diagrams for 2N- absorption mechanisms:(a) S-waves pion rescattering; (b) via an intermediate Δ and N^* state excitation.

The measurement of $C_{N,N,0,0}$ in the $dp \rightarrow {}^3He\eta^o$ could allow one to obtain an additional information about the excitation of the highest nucleonic resonances, in particular $S_{11}(1535)$, $P_{11}(1710)$ and $D_{13}(1700)$, including their polarization properties in nuclear matter, features of three-body mechanisms in coherent meson production [19], a possible existence of quasi-bound η^3He state [20, 21], a role of $s\bar{s}$ quark- antiquark pair in the η^0 wave function.

5. Conclusions

In the case of collinear geometry when only two amplitudes characterize the process $dp \rightarrow {}^3He\pi^o$, the measurements of the second-order observables $C_{N,N,0,0}$ and $C_{N,SL,0,0}$ (in addition to T_{20} and differential cross section) realize entirely the program of full experiment and one can reconstruct these amplitudes in this case and perform the partial-wave analysis.

At threshold where the two-body absorption of pions dominates, it is possible to remove sign uncertainty between the g_0 and g_1 coupling constants from measurement of $C_{N,N,0,0}$.

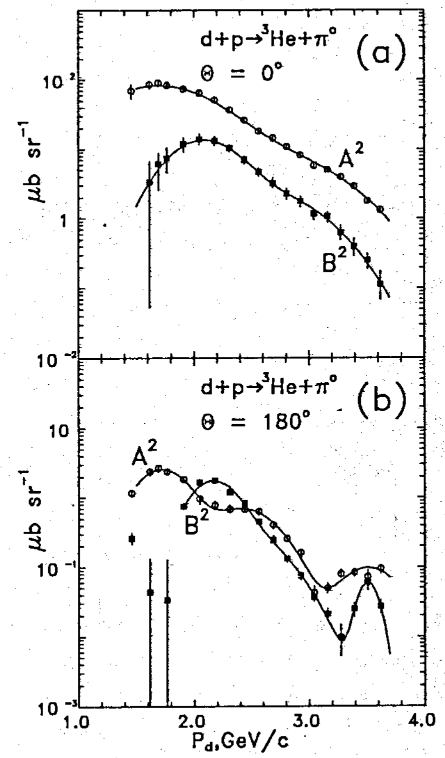

Fig.2 Extracted values of $|A|^2$ and $|B|^2$ from the experimental data for the $dp \rightarrow^3 He\pi^0$: (a) at $\theta = 0^o$; (b) at $\theta = 180^o$ (ref.[3]).Lines are the fitting of the data by a set of gaussians.

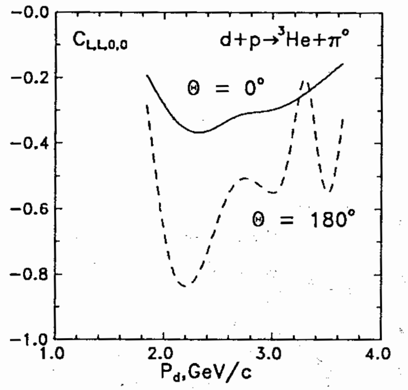

Fig.3 Spin correlation $C_{L,L,0,0}$ in the $dp \rightarrow^3 He\pi^0$ reaction at $\theta = 0^o$ -solid line and at $\theta = 180^o$ - dashed line.

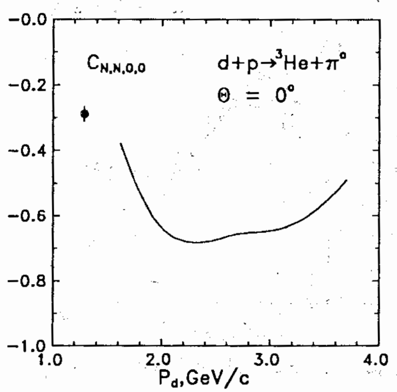

Fig.4 Prediction for a more favourable solution of (11) for $C_{N,N,0,0}$ at $\theta = 0^o$. The point is the value of $C_{N,N,0,0}$ at threshold.

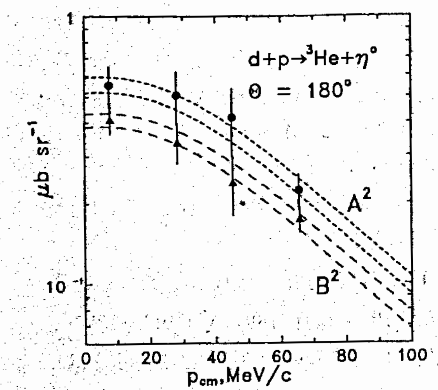

Fig.5 Extracted values of $|A|^2$ and $|B|^2$ from the experimental data (ref.[2, 22]) for the $dp \rightarrow^3 He\eta^o$ at $\theta = 180^o$.Lines are the predictions for $|A|^2$ and $|B|^2$ using the value of $T_{20} = -0.15 \pm 0.05$.

Since $C_{N,N,0,0}$ is an interference term between the amplitudes, it can be sensitive to short-range NN- correlations, in particular at threshold and above the Δ- excitation region.

The comparison of the behaviours of $C_{N,N,0,0}$ for the $dp \rightarrow {}^3He\pi^o$ and $dp \rightarrow {}^3He\eta^o$ reactions near threshold could provide a possible separation of the two- and three-body mechanisms in coherent meson production.

Note that the measurement of $C_{N,N,0,0}$ in the $dp \rightarrow {}^3He\pi^o$ is a most realizable polarization experiment for this reaction to date. The measurement of $C_{N,SL,0,0}$ could be made as the second step to remove π- uncertainty in the relative phase of the A and B amplitudes. This investigation could be performed at Dubna, SATURNE, TRIUMF. The measurement of the $C_{0,N,N,0}$, spin transfer coefficient from polarized ${}^3He$ target to deuteron, which is also an interference term of the two amplitudes, could be carried out for the $\pi^{-3}He \rightarrow dn$ at meson factories, TRIUMF or PSI.

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Поляризационные наблюдаемые для реакции $dp \to {}^3\mathrm{He}\pi^0$ в коллинеарной геометрии

В терминах двух независимых амплитуд, которые в общем случае определяют спиновую структуру амплитуды реакции $dp \to {}^3\mathrm{He}\pi^0$ в коллинеарной геометрии рассмотрены эффекты, связанные с поляризацией сталкивающихся частиц. Предсказывается энергетическая зависимость спиновой корреляции $C_{L,L,0,0}$, связанной с поляризацией сталкивающихся частиц вдоль направления относительного импульса, используя значения модулей амплитуд, извлеченных из экспериментальных данных. Для спиновой корреляции $C_{N,N,0,0}$, связанной с поперечной поляризацией частиц, получен предел возможных изменений. Предсказываются величины этих поляризационных наблюдаемых на пороге. Обсуждается поведение этих поляризационных наблюдаемых для реакции $dp \to {}^3\mathrm{He}\eta^0$, имеющей такую же спиновую структуру.

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Polarization Observables for the Collinear $dp \to {}^3\mathrm{He}\pi^0$ Reaction

Effects due to polarizations of both colliding particles have been analyzed in terms of two independent amplitudes which in the general case define the spin structure of the amplitude of the $dp \to {}^3\mathrm{He}\pi^0$ reaction in collinear geometry. The energy dependence of spin-correlation $C_{L,L,0,0}$ due to longitudinal polarization of colliding particles is predicted using the moduli of amplitudes extracted from experimental data. The limit of possible deviations is obtained for spin-correlation $C_{N,N,0,0}$ due to transverse polarization of both particles. The value of these polarization observables at threshold are predicted. The behaviour of these polarization observables for the $dp \to {}^3\mathrm{He}\eta^0$ reaction, having the same spin structure, is discussed.

The investigation has been performed at the Laboratory of High Energies, JINR.

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