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POLARIZATION OBSERVABLES IN DEUTERON BREAKUP AND DEUTERON-PROTON BACKWARD ELASTIC SCATTERING REACTIONS

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Поляризационные наблюдаемые в реакциях фрагментации
и упругого дейтрон-протонного рассеяния назад

Рассмотрены поляризационные эффекты в реакциях фрагментации дейтрона и упругого дейтрон-протонного рассеяния назад. Использование поляризованной протонной мишени дает новые возможности получения важной информации как о дейтронной волновой функции, так и о нуклон-нуклонных амплитудах. Главное внимание уделено наблюдаемым, связанным с поляризацией протонной мишени.

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Polarization Observables in Deuteron Breakup
and Deuteron-Proton Backward Elastic Scattering Reactions

The polarization effects in deuteron breakup and deuteron-proton backward elastic scattering are considered. Using of polarized proton target gives the new opportunities to obtain the reliable information on the deuteron wave function as well as on the nucleon-nucleon amplitudes. The main attention is paid to the observables due to the polarization of the proton target.

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

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1 Introduction

Deuteron breakup and deuteron-proton backward elastic scattering reactions has been the subject of extensive work for the last two decades. This interest is related to the fact that within Impulse Approximation (IA) (Fig.1a-b) the cross sections are directly proportional to the squared deuteron wave function, $\Phi(q)^2$, and to the forth degree of those, $\Phi(q)^4$, for deuteron breakup and dp backward elastic scattering, respectively. The polarization observables, like tensor analyzing power T_{20} and spin transfer coefficient from vectorially polarized deuteron to proton κ_o, are also simply related to the S- and D- waves of the deuteron wave function. Therefore, one can expect, that the studying of these reactions will provide the obtaining of reliable information on the behaviour of the deuteron wave function at short distances between nucleons.

Measurements of the cross section of the inclusive breakup $A(d,p)X$ reaction with the proton emitted at zero angle at different initial energies and for different A values of the target [1]-[4] have shown the consistency with the calculations based on the standard nucleon-nucleon potentials [5, 6, 7] except in the vicinity of momenta of proton in the rest frame of deuteron $q \sim 0.3$ GeV/c, where a relatively broad shoulder is observed. The successful attempt to describe dp-backward elastic data [8] within One-Nucleon Exchange (ONE) using an empirical momentum density extracted from $A(d,p)X$ data made by Kobushkin [9] has supported the idea of validity of IA for both reactions with the using of the additional components in the deuteron wave function [10].

Measurements of the tensor analyzing power T_{20} [3, 4, 11] performed at Saclay and Dubna have demonstrated the strong deviation from the IA predictions at $q \geq 0.2$ GeV/c. Recent measurements of tensor analyzing power up $q \sim 0.55$ GeV/c performed by two Dubna groups on carbon [12] and on proton and carbon [13] have shown weak dependence on A value of the target as well as an approximate energy independence, i.e. the feature of IA, of T_{20}. The behaviour of the spin transfer coefficient from vector polarized deuteron to proton κ_o [14, 15, 16] disagrees with the calculations using standard deuteron wave functions at $q \geq 0.2$ GeV/c, but also exhibits an approximate energy and A independence. Measurements of T_{20} [17, 18] and κ_0 [17] for dp elastic scattering have shown the deviation from the ONE predictions as well as from the behaviour of T_{20} and κ_0 in deuteron breakup at large q, which is not explained yet theoretically. Calculation with the inclusion of the additional components of the deuteron wave function [10, 19, 20, 21, 22, 23] as well as considering of the mechanisms additional to ONE [24, 25, 26] can not explain the observed features of the experimental data. Nevertheless, in spite of the certain difficulties in the describing of these processes, one can say, that obtained information characterizes the internal deuteron structure even at relatively large momenta ($q \geq 0.2$ GeV/c).

Using of polarized proton target allows to extend sufficiently the number of possible experiments with the deuteron. In this paper we consider the spin correlations due to the polarization of both deuteron beam and proton target and spin transfer coefficients from the polarized proton target to proton for deuteron breakup in the strictly collinear kinematics and dp backward elastic scattering. These experiments will provide the new sources of the reliable information on the deuteron structure at short distances.

2 Matrix elements

In this section we construct the matrix elements of two processes : deuteron breakup in the collinear geometry and deuteron-proton backward elastic scattering.

2.1 Deuteron wave function

The deuteron wave function (S- and D- waves only) in the momentum space can be presented in the following form [19]:

$$\Phi_d(\vec{p}) = \frac{i}{\sqrt{2}}\frac{1}{\sqrt{4\pi}}\psi_p^{\alpha+}\left[\left((u(p)(\vec{\sigma}\vec{\xi}) - \frac{w(p)}{\sqrt{2}}(3(\hat{p}\vec{\xi})(\vec{\sigma}\hat{p}) - (\vec{\sigma}\vec{\xi})\right)\sigma_y\right]_{\alpha\beta}\psi_n^{\beta+}, \qquad (1)$$

where ψ_p and ψ_n are the proton and neutron spinors, respectively, $\vec{\xi}$ is the deuteron polarization vector, defined in a standard manner:

$$\vec{\xi}_1 = -\frac{1}{\sqrt{2}}(1,i,0) \qquad \vec{\xi}_{-1} = \frac{1}{\sqrt{2}}(1,-i,0) \qquad \vec{\xi}_0 = (0,0,1), \qquad (2)$$

$\vec{p}$ is the relative proton-neutron momentum inside the deuteron, $\hat{p} = \vec{p}/|\vec{p}|$ is the unit vector in the $\vec{p}$ direction; $u(p)$ and $w(p)$ are S- and D- components of the deuteron wave function (DWF).

2.2 Nucleon-nucleon amplitude in the collinear kinematics

Using parity conservation, time reversal invariance and Pauli principle we can write the matrix of NN elastic scattering in terms of 5 independent complex amplitudes [27] (when isospin invariance is assumed):

$$\begin{aligned} M(\vec{k}',\vec{k}) = \frac{1}{2} \quad & ((a+b)+(a-b)(\vec{\sigma}_1\vec{n})\cdot(\vec{\sigma}_2\vec{n}) + (c+d)(\vec{\sigma}_1\vec{m})\cdot(\vec{\sigma}_2\vec{m}) + \\ & (c-d)(\vec{\sigma}_1\vec{l})\cdot(\vec{\sigma}_2\vec{l}) + e((\vec{\sigma}_1\vec{n}) + (\vec{\sigma}_2\vec{n}))), \qquad (3) \end{aligned}$$

where a, b, c, d and e are the scattering amplitudes, $\vec{\sigma}_1$ and $\vec{\sigma}_2$ are the Pauli 2×2 matrices, $\vec{k}$ and $\vec{k}'$ are the unit vectors in the direction of the incident and scattered particles, respectively, and center-of-mass basis vectors $\vec{n}$, $\vec{m}$, $\vec{l}$ are defined as:

$$\vec{n} = \frac{\vec{k}'\times\vec{k}}{|\vec{k}'\times\vec{k}|}, \qquad \vec{l} = \frac{\vec{k}'+\vec{k}}{|\vec{k}'+\vec{k}|}, \qquad \vec{m} = \frac{\vec{k}'-\vec{k}}{|\vec{k}'-\vec{k}|}, \qquad (4)$$

For pp and np scattering, one can write the scattering matrix element as a combination of two matrices M_0 and M_1, having the same form as (3):

$$M(\vec{k}',\vec{k}) = \frac{1}{4}M_0(1-(\tau_1\tau_2)) + \frac{1}{4}M_1(3+(\tau_1\tau_2)), \qquad (5)$$

where τ_1 and τ_2 are the nucleon isospin matrices, M_0 and M_1 are the isosinglet and isotriplet scattering matrices.

A direct transition of the matrix element (3) to the case of zero scattering angle is impossible because of the uncertainty in the direction of $\vec{m}$ and $\vec{l}$ when $\vec{k} = \vec{k}\prime$. However, the requirement of uniqueness of the forward scattering matrix $M(\vec{k},\vec{k}\prime)$ leads to the following relations between amplitudes [27]:

$$a(0) - b(0) = c(0) + d(0) \qquad e(0) = 0, \qquad (6)$$

which are used to get

$$M(0) = \frac{1}{2}(A + B(\vec{\sigma}_1\vec{\sigma}_2) + C(\vec{\sigma}_1\vec{k})(\vec{\sigma}_2\vec{k})), \qquad (7)$$

where

$$A = a(0) + b(0), \qquad B = c(0) + d(0), \qquad C = -2d(0) \qquad (8)$$

2.3 Deuteron breakup in the collinear geometry

We consider deuteron breakup reaction in the special kinematics, i.e. with the emission of the spectator proton at zero angle, while the neutron interacts with the proton target and the products of this interaction go along the axis defined by the primary momentum direction.

Using of both (1) and (7) expressions the matrix element of deuteron breakup process in the collinear geometry can be written as:

$$\begin{aligned} \mathcal{M} = & \frac{i}{2\sqrt{2}}\frac{1}{\sqrt{4\pi}}\psi_1^+\psi_2^+\mathcal{F}\psi_1^*\psi_2 \\ = & \frac{i}{2\sqrt{2}}\frac{1}{\sqrt{4\pi}}\psi_1^+\psi_2^+(A + B(\vec{\sigma}_1\vec{\sigma}_2) + C(\vec{\sigma}_1\vec{k})(\vec{\sigma}_2\vec{k})) \qquad (9) \\ & \left[\left((u(q)(\vec{\sigma}_1\vec{\xi}) - \frac{w(q)}{\sqrt{2}}(3(\hat{q}\vec{\xi})(\vec{\sigma}_1\hat{q}) - (\vec{\sigma}_1\vec{\xi})\right)\sigma_y\right]\psi_1^*\psi_2 \end{aligned}$$

where ψ_1 and ψ_2 are spinors corresponding to the initial and final nucleons, respectively, $\vec{\sigma_1}$ and $\vec{\sigma_2}$ are the 2×2 Pauli matrices, acting between nucleons. From (9) one can obtain the following expression for the squared matrix element:

$$Tr(\mathcal{F}\mathcal{F}^+) = 3\cdot(u^2(q)+w^2(q))\cdot(A^2+3B^2+C^2+2\mathcal{R}eBC^*) \tag{10}$$

2.4 Deuteron proton backward elastic scattering

Within framework of ONE one can write the matrix element of dp backward elastic scattering as :

$$\begin{aligned}\mathcal{M} &= \frac{1}{8\pi}\psi_f^+\mathcal{F}\psi_i = \\ &= \frac{1}{8\pi}\psi_f^+\left(u(q)(\vec{\sigma}\vec{\xi}) - \frac{w(q)}{\sqrt{2}}(3(\hat{q}\vec{\xi})(\vec{\sigma}\hat{q}) - (\vec{\sigma}\vec{\xi}))\right) \\ &\quad \left(u(q)(\vec{\sigma}\vec{\xi}) - \frac{w(q)}{\sqrt{2}}(3(\hat{q},\vec{\xi})(\vec{\sigma}\hat{q}) - (\vec{\sigma}\vec{\xi}))\right)\psi_i\end{aligned} \tag{11}$$

This expression leads to the squared matrix element in the following form:

$$Tr(\mathcal{F}\mathcal{F}^+) = 9\cdot(u^2(q)+w^2(q))^2 \tag{12}$$

3 Polarization effects

In this section we give the definition of the general polarization observable and results of our calculations for the number of polarization observables for both reactions.

3.1 General polarization observable

We define the general spin observable of the third order in terms of Pauli 2×2 spin matrices σ for protons and a set of spin operators S_λ for the spin 1 particle for both reactions as:

$$C_{\alpha,\lambda,\beta,0} = \frac{Tr(\mathcal{F}\sigma^p_\alpha S^d_\lambda \mathcal{F}^+\sigma^p_\beta)}{Tr(\mathcal{F}\mathcal{F}^+)}, \tag{13}$$

where indices α and λ refer to the initial proton and deuteron polarization, index β refers to the final proton, respectively.

3.2 Tensor analyzing power $C_{0,LL,0,0}$

This observable, due to the tensor polarization of the deuteron is expressed through the S and D waves for both reactions as:

$$C_{0,LL,0,0} = \frac{2\sqrt{2}u\cdot w - w^2}{u^2+w^2} \tag{14}$$

The expression (14) was derived firstly by Frankfurt and Strikman [28] for deuteron breakup and by Vasan and Karmanov [29, 30] for dp- backward elastic scattering, respectively. In spite the fact, that the tensor analyzing power $T_{20} = 1/\sqrt{2}C_{0,LL,0,0}$ was measured in number of experiments [3, 4, 11, 12, 13], it would be interesting to measure $C_{0,LL,0,0}$ in deuteron breakup in the strictly collinear geometry, as described in the previous section, to compare with the dp backward elastic data [17, 18].

3.3 Spin transfer coefficients from deuteron to proton

The spin transfer coefficients due to the polarizations of the deuteron and outgoing proton, expressions of those also coincide for both reactions, are related with the S- and D- waves as:

$$C_{0,N,N,0} = \frac{2}{3}\cdot\frac{u^2-w^2-uw/\sqrt{2}}{u^2+w^2} \tag{15}$$

for vertically and

$$C_{0,L,L,0} = \frac{2}{3}\cdot\frac{(u+w/\sqrt{2})^2}{u^2+w^2} \tag{16}$$

for longitudinally polarized particles, respectively.

The expressions (15) and (16) were derived in refs.[31, 32] for deuteron breakup and in ref.[33] for dp- backward elastic scattering, respectively.

Spin transfer coefficient $\kappa_0 = \frac{3}{2}C_{0,N,N,0}$ was measured recently at Saclay and Dubna for deuteron breakup [14, 15, 16] and dp- backward elastic scattering [17].

3.4 Spin correlations

Using of polarized proton target allows to extend the number of possible experiments providing the new independent sources of information on the deuteron structure.

The spin correlation parameters in dp backward elastic scattering due to vector polarization of both colliding particles are expressed as [34, 35]:

$$C_{N,N,0,0} = \frac{2}{9}\frac{(u^2-w^2-uw/\sqrt{2})(u-\sqrt{2}w)^2}{(u^2+w^2)^2} \tag{17}$$

$$C_{L,L,0,0} = \frac{2}{9}\frac{(u^2-w^2+4\sqrt{2}uw)(u+w/\sqrt{2})^2}{(u^2+w^2)^2} \tag{18}$$

The expressions (17) and (18) depend only on the deuteron wave function.

Using formulas (9) and (13) one can derive the expressions for spin correlations for deuteron breakup:

$$C_{N,N,0,0} = \frac{2}{3}\frac{(u^2 - w^2 - uw/\sqrt{2})}{u^2 + w^2} \cdot \frac{(-B^2 + \mathcal{R}eAB^* - \mathcal{R}eBC^*)}{(A^2 + 3B^2 + C^2 + 2\mathcal{R}eBC^*)} \quad (19)$$

$$C_{L,L,0,0} = \frac{2}{3}\frac{(u + w/\sqrt{2})^2}{u^2 + w^2} \cdot \frac{(-B^2 + \mathcal{R}eAB^* - \mathcal{R}eAC^*)}{(A^2 + 3B^2 + C^2 + 2\mathcal{R}eBC^*)} \quad (20)$$

Note, that there is the factorization of the $d-pn$ and NN vertices for $C_{N,N,0,0}$ and $C_{L,L,0,0}$ and the expressions (19) and (20) can be easy transformed to the following form:

$$C_{N,N,0,0} = \frac{2}{3}\frac{(u^2 - w^2 - uw/\sqrt{2})}{u^2 + w^2} \cdot A_{oonn}(0) \quad (21)$$

$$C_{L,L,0,0} = \frac{2}{3}\frac{(u + w/\sqrt{2})^2}{u^2 + w^2} \cdot A_{ookk}(0), \quad (22)$$

where $A_{oonn}(0)$ and $A_{ookk}(0)$ are the spin correlations of np elastic scattering at zero angle in the notations of ref.[27].

Therefore, one can see that the spin correlations for deuteron breakup in the strictly collinear geometry are defined by both the deuteron wave function and the spin correlation parameters of neutron-proton elastic scattering, in comparison with the dp elastic scattering observables or tensor analyzing power (14) and $C_{0,N,N,0}$ (15)-(16) for breakup defined by the DWF only. Since spin correlations $A_{oonn}(0)$ and $A_{ookk}(0)$ depend on energy, the behaviour of the dp spin correlations (19) and (20) will be also strongly energy dependent. In Fig.2 we compare $C_{N,N,0,0}$ for dp backward elastic scattering and deuteron breakup at 1.25 and 2.1 GeV of incident deuteron energy calculated using Paris deuteron wave function [6]. The np amplitudes are taken from VPI phase-shift analysis [36]. Spin correlation $C_{N,N,0,0}$ calculated with different NN potentials [6, 7] at 1.25 and 2.1 GeV [1] is presented in Figs.3 and 4, respectively. Spin correlation due to longitudinal polarization of colliding particles, $C_{L,L,0,0}$, for dp backward scattering and breakup reactions is shown in Fig.4. The dependence on the used NN potential is demonstrated in Figs.5 and 6 for initial kinetic energy 1.25 and 2.1 GeV, respectively.

One can see, that spin correlations for breakup process exhibit a rather smooth behaviour in comparison with those for the dp elastic scattering. These observables for breakup process are sensitive to the different DWFs at $q \sim 0.2$ GeV/c. It should be noted also that at $q \sim 0$, when D wave is small, $C_{N,N,0,0}$ and $C_{L,L,0,0}$ for dp backward elastic scattering equal 2/9, whereas for deuteron breakup $C_{N,N,0,0} =$

[1]Since the np amplitudes are defined only up to 1600 MeV of the kinetic energy of nucleon [36], at higher energies we took the values of amplitudes as at 1600 MeV.

$2/3 \cdot A_{oonn}(0)$ and $C_{L,L,0,0} = 2/3 \cdot A_{ookk}(0)$. On the other hand, if the kinetic energy of the deuteron is small and the np amplitude is a pure isosinglet, the spin correlations $A_{oonn}(0)$ and A_{ookk} are approximately 1/3 [36]. In this case the values of the spin correlations for breakup and dp elastic scattering are the same and equal 2/9.

3.5 Spin transfer coefficients from proton to proton

Availability of high efficiency proton polarimeters and polarized proton target allows to study the spin transfer coefficients $C_{N,0,N,0}$ and $C_{L,0,L,0}$.

For dp backward elastic scattering we have the following expressions depending on the deuteron wave function only [35]:

$$C_{N,0,N,0} = \frac{1}{9}\frac{(u - \sqrt{2}w)^4}{(u^2 + w^2)^2} \quad (23)$$

$$C_{L,0,L,0} = \frac{1}{9}\frac{(u^2 - w^2 + 4\sqrt{2}uw)^2}{(u^2 + w^2)^2} \quad (24)$$

Using expressions (9) and (13) one can calculate the observables $C_{N,0,N,0}$ and $C_{L,0,L,0}$ for deuteron breakup:

$$C_{N,0,N,0} = \frac{2}{3}\frac{(u - \sqrt{2}w)^2}{u^2 + w^2} \cdot \frac{(-B^2 + \mathcal{R}eAB^* - \mathcal{R}eBC^*)}{(A^2 + 3B^2 + C^2 + 2\mathcal{R}eBC^*)} \quad (25)$$

$$C_{L,0,L,0} = \frac{2}{3}\frac{(u^2 - w^2 + 4\sqrt{2}uw)}{u^2 + w^2} \cdot \frac{(-B^2 + \mathcal{R}eAB^* - \mathcal{R}eAC^*)}{(A^2 + 3B^2 + C^2 + 2\mathcal{R}eBC^*)} \quad (26)$$

The expressions (25) and (26) can be easy transformed to the following form:

$$C_{N,0,N,0} = \frac{1}{3}\frac{(u - \sqrt{2}w)^2}{u^2 + w^2} \cdot A_{oonn}(0) \quad (27)$$

$$C_{L,0,L,0} = \frac{1}{3}\frac{(u^2 - w^2 + 4\sqrt{2}uw)}{(u^2 + w^2)} \cdot A_{ookk}(0) \quad (28)$$

One can see that again due to the factorization of the $d-pn$ and NN vertices the spin transfer coefficients are expressed through the spin correlations of np elastic scattering and $S-$ and D waves of the deuteron. In Fig.8 we show $C_{N,0,N,0}$ for dp backward elastic scattering [35] and deuteron breakup at 1.25 and 2.1 GeV plotted using Paris wave function [6]. Spin transfer coefficient $C_{N,0,N,0}$ calculated with both Paris and Bonn NN potentials [6, 7] at 1.25 and 2.1 GeV are presented in Figs.9 and 10, respectively. Spin transfer coefficient $C_{L,0,L,0}$ due to longitudinal polarization of protons for dp backward scattering and breakup reactions is demonstrated in Fig.11. In Figs.12 and 13 it is shown the dependence of $C_{L,0,L,0}$ on the used NN potential for initial kinetic energy 1.25 and 2.1 GeV, respectively.

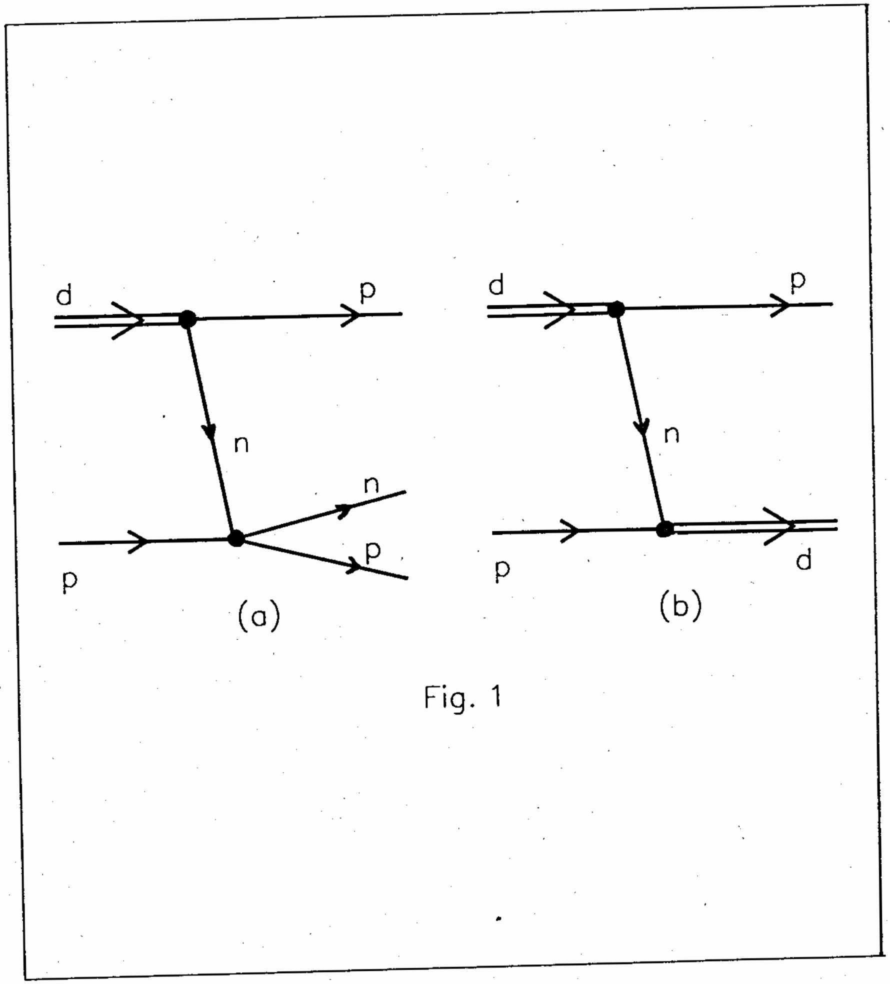

Fig.1. Diagrams of IA for (a) deuteron breakup and (b) *dp* backward elastic scattering.

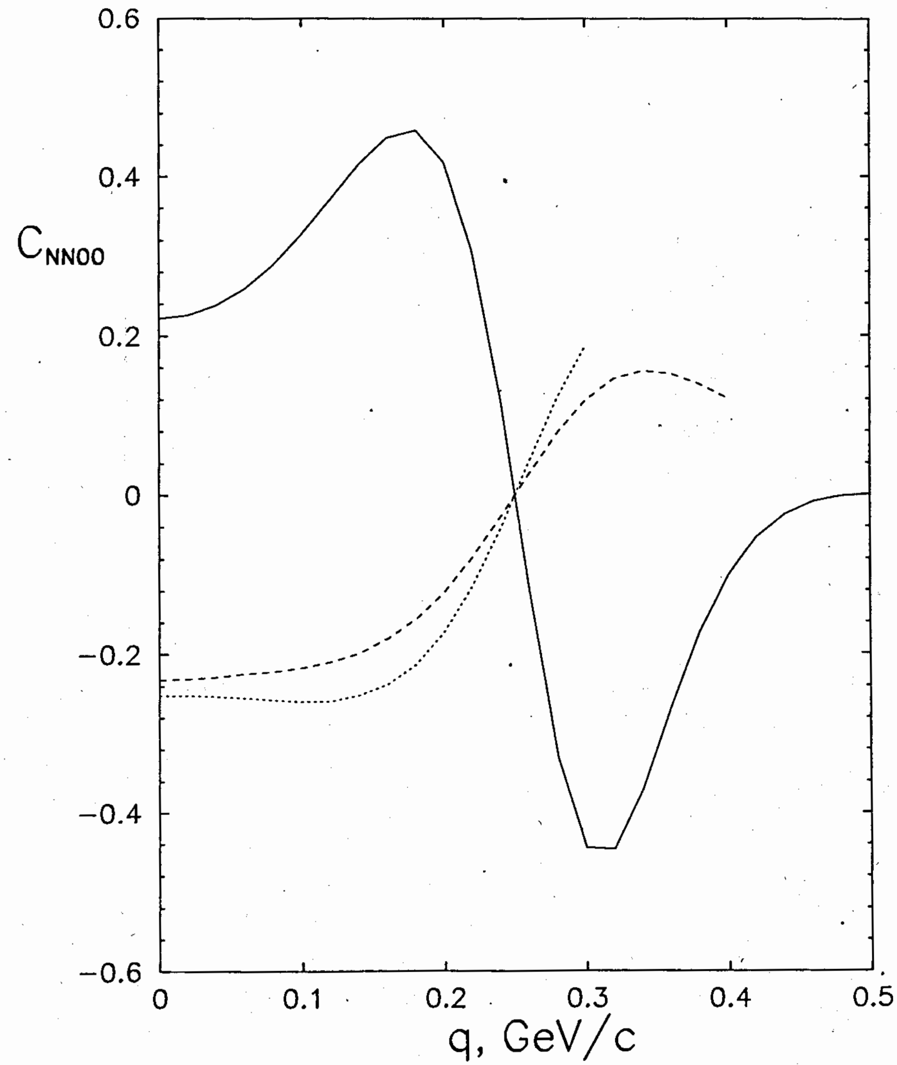

Fig.2. Spin correlation $C_{N,N,0,0}$ due to normal polarizations of colliding particles. Solid line is the predictions for *dp* backward elastic scattering, dashed and dotted lines are for deuteron breakup at 2.1 and 1.25 GeV, respectively, using Paris *NN*-potential [6].

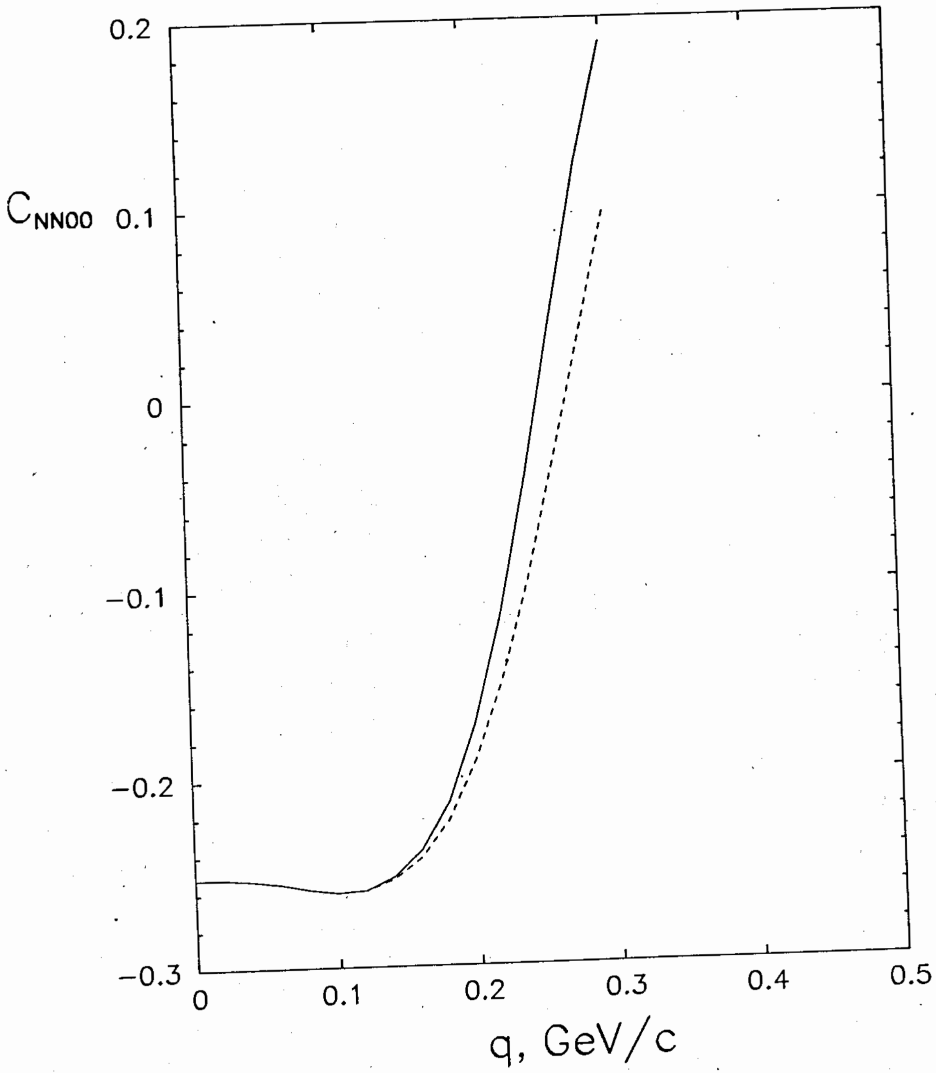

Fig.3. Spin correlation $C_{N,N,0,0}$ for deuteron breakup at 1.25 GeV of deuteron kinetic energy. Solid and dashed lines are the IA predictions using Paris [6] and Bonn [7] potentials, respectively.

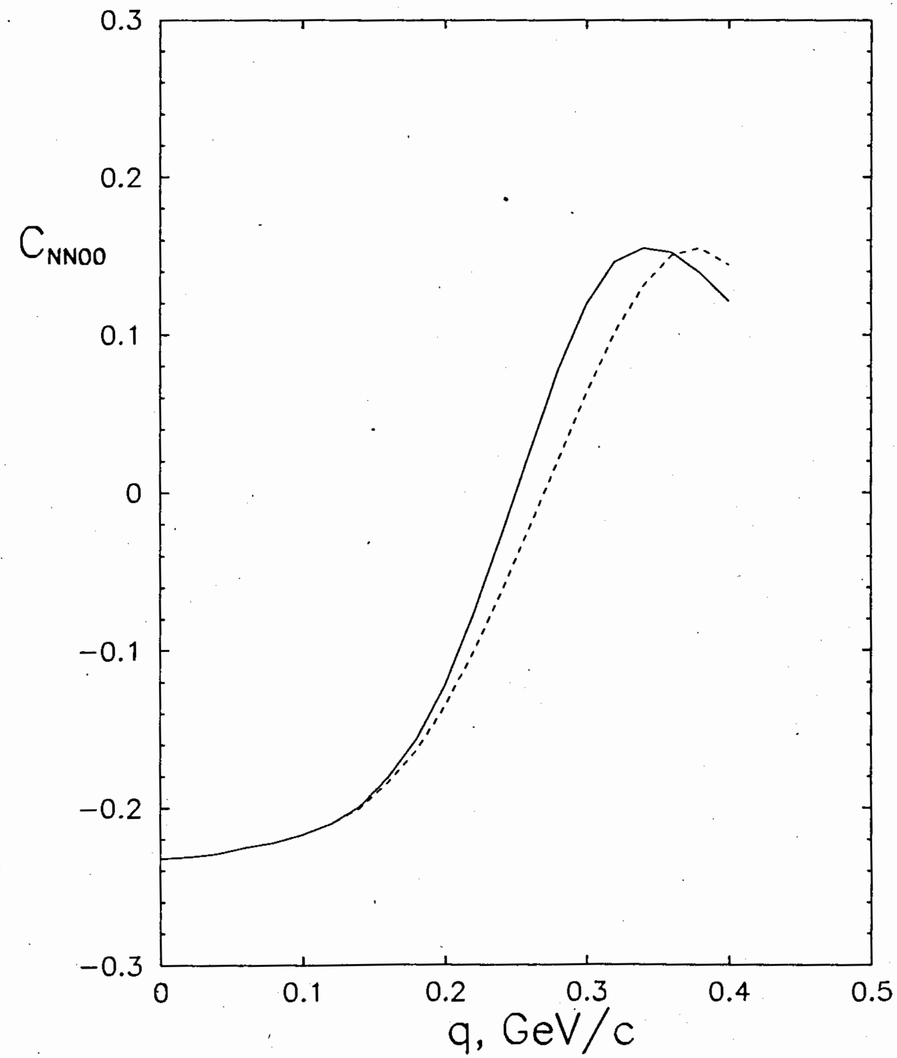

Fig.4. Spin correlation $C_{N,N,0,0}$ for deuteron breakup at 2.1 GeV of deuteron kinetic energy. Lines are as in Fig.3.

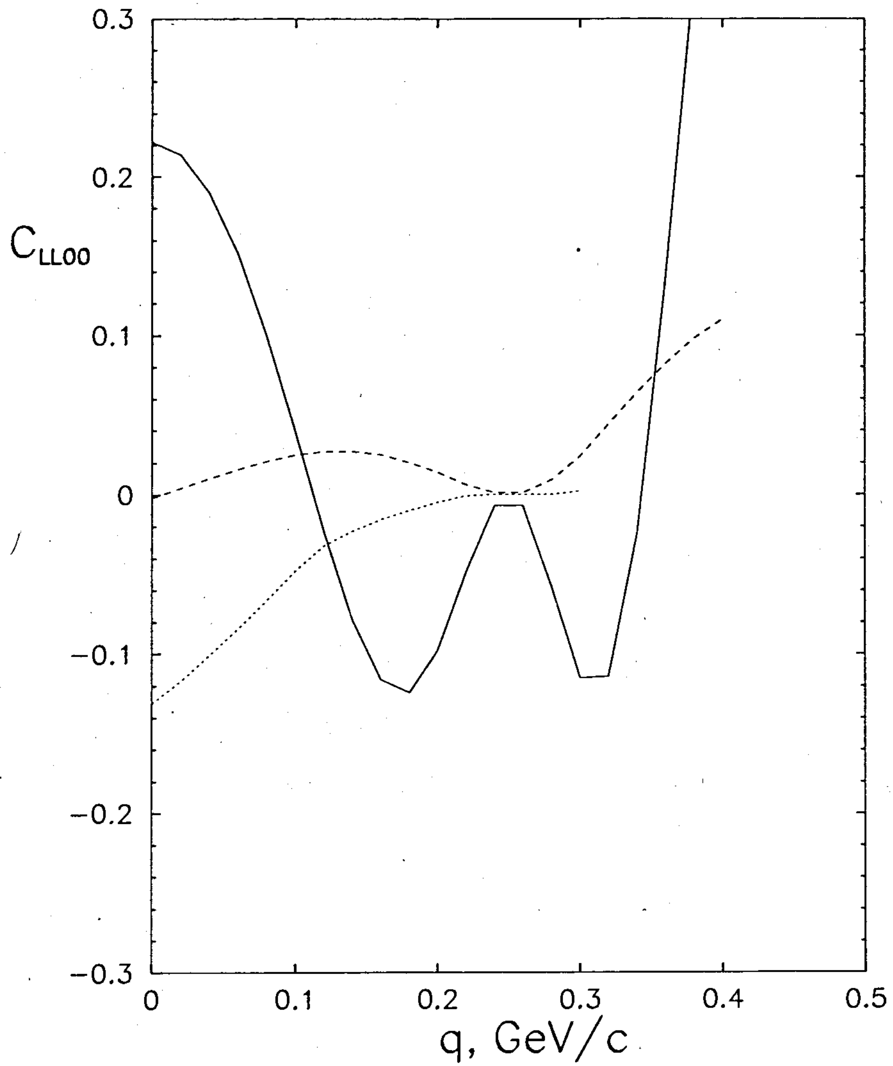

Fig.5. Spin correlation $C_{L,L,0,0}$ due to longitudinal polarizations of colliding particles. Lines are as in Fig.2.

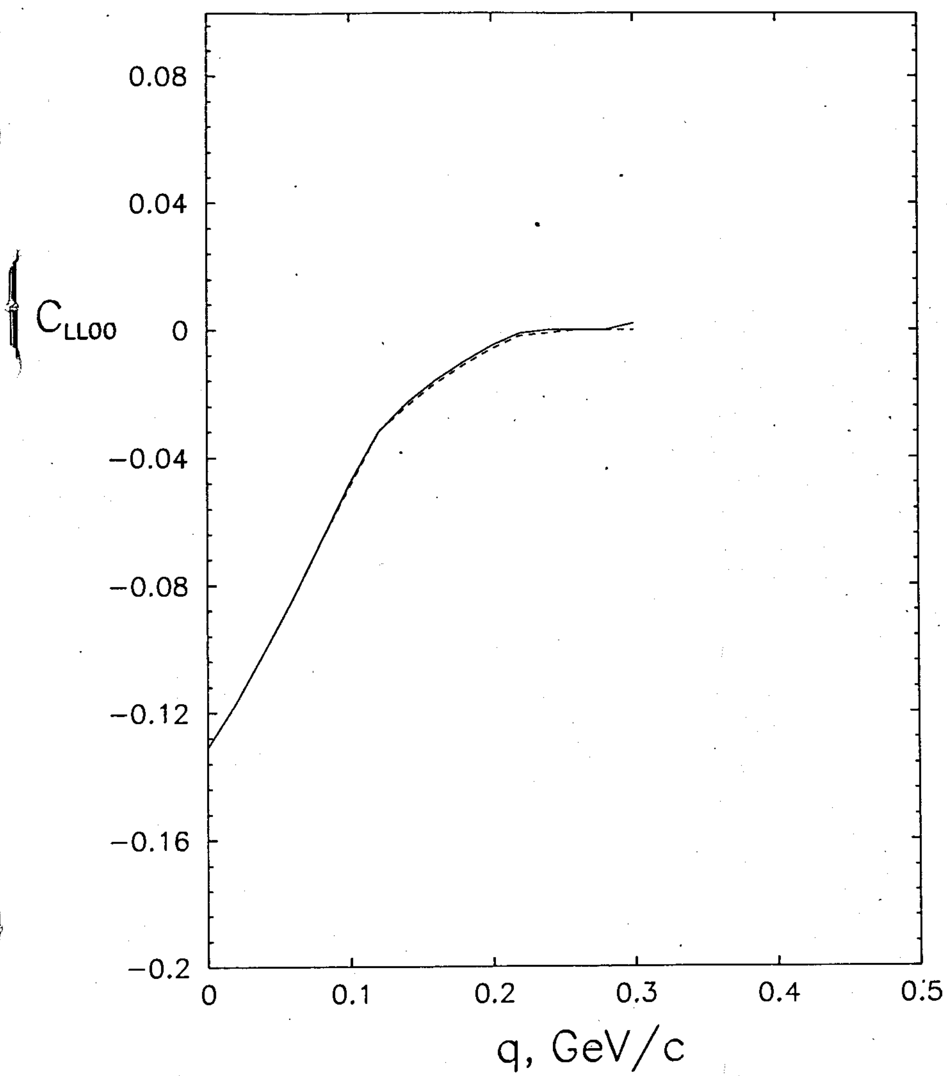

Fig.6. Spin correlation $C_{L,L,0,0}$ for deuteron breakup at 1.25 GeV of deuteron kinetic energy. Lines are as in Fig.3.

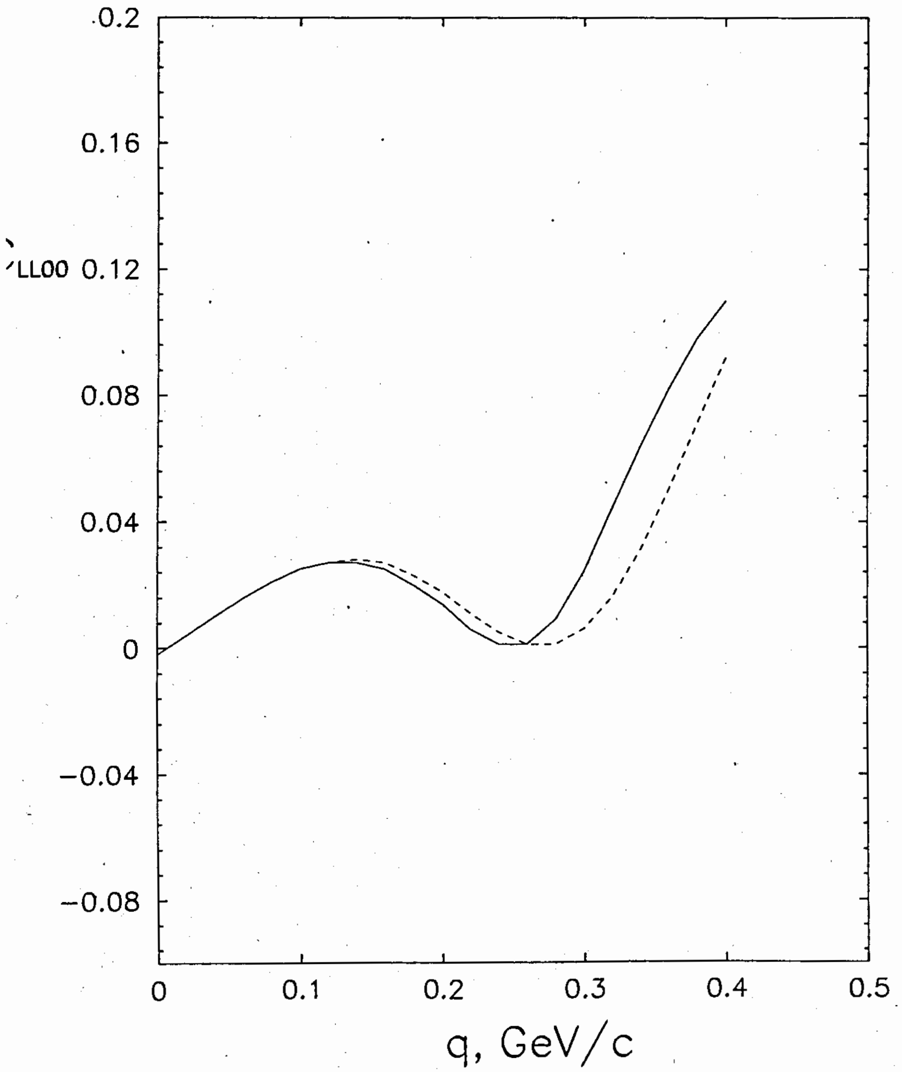

Fig.7. Spin correlation $C_{L,L,0,0}$ for deuteron breakup at 2.1 GeV of deuteron kinetic energy. Lines are as in Fig.3.

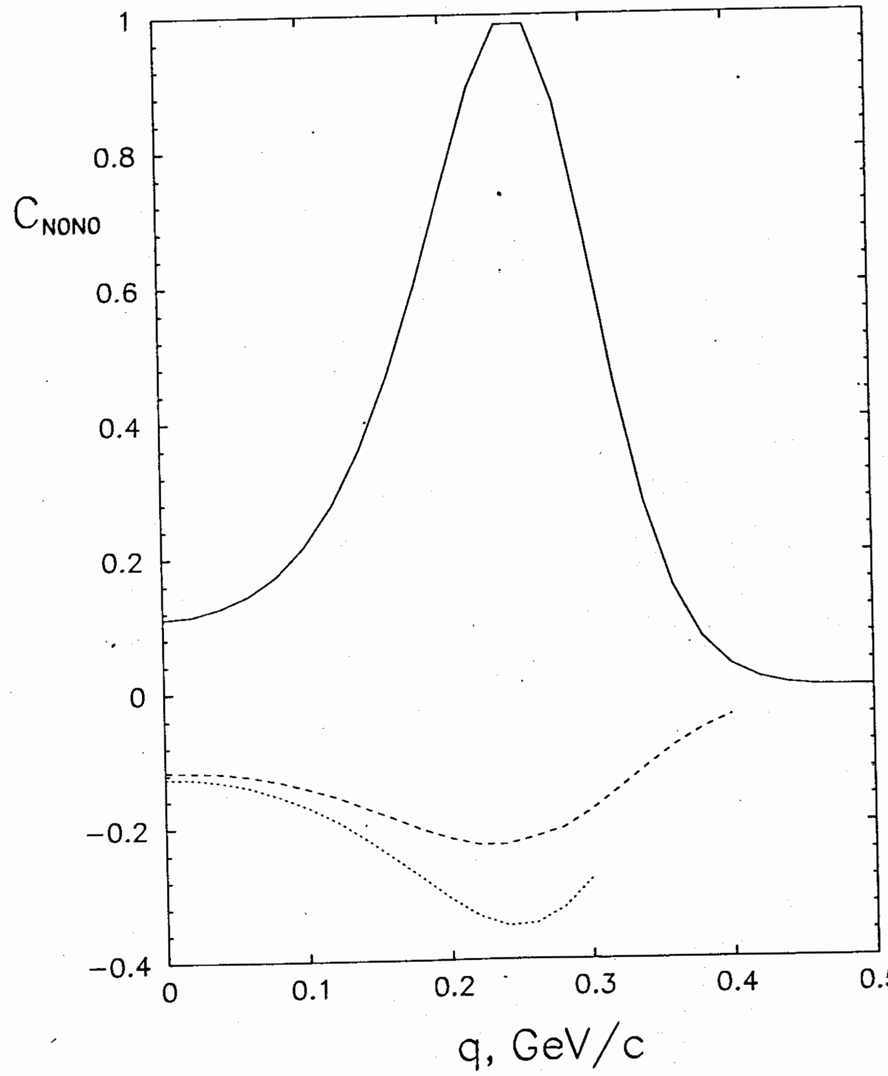

Fig.8. Spin transfer coefficient $C_{N,0,N,0}$ due to normal polarizations of particles. Lines are as in Fig.2.

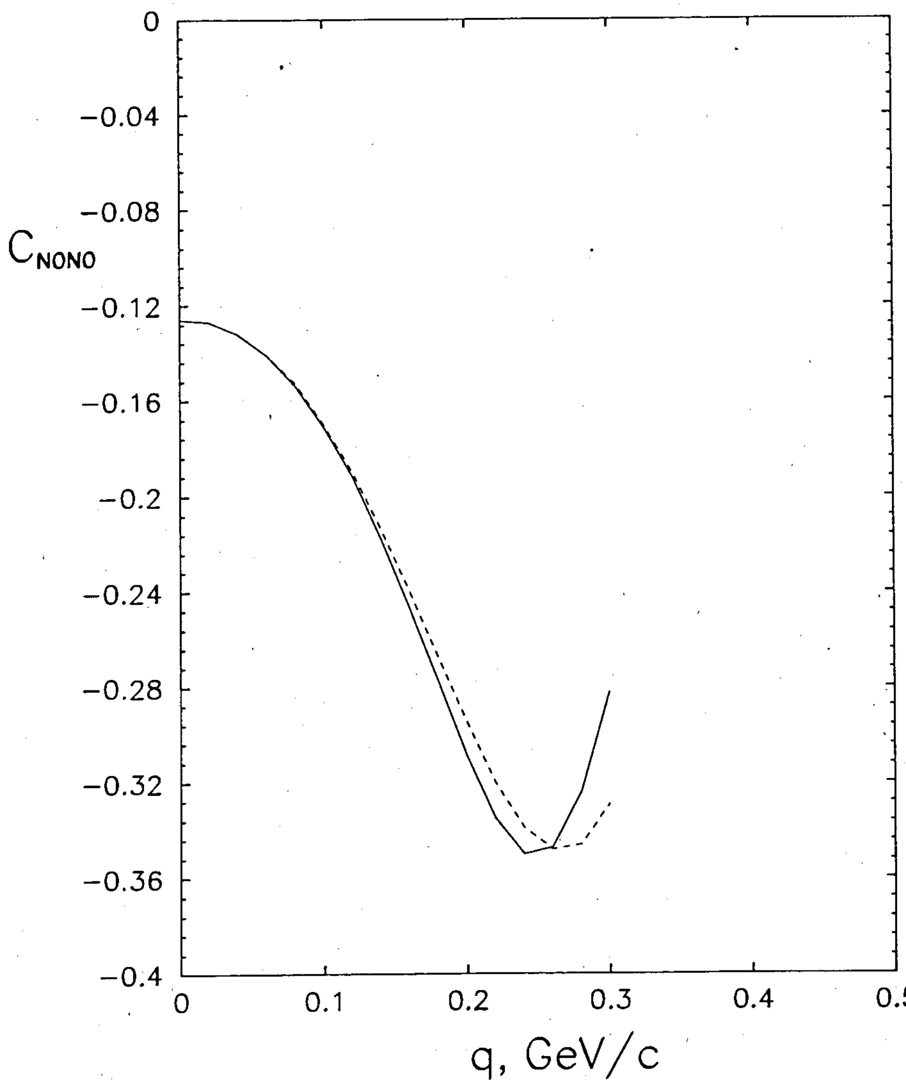

Fig.9. Spin transfer coefficient $C_{N,0,N,0}$ for deuteron breakup at 1.25 GeV of deuteron kinetic energy. Lines are as in Fig.3.

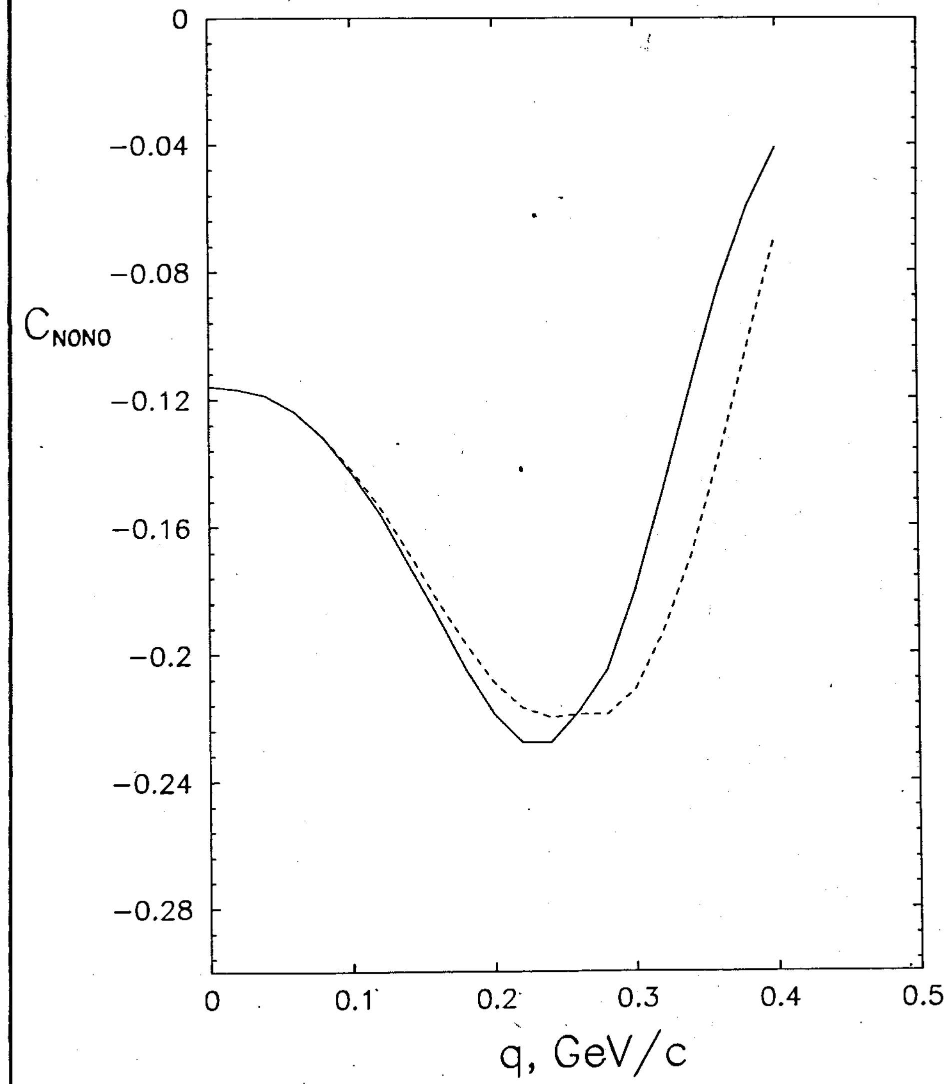

Fig.10. Spin transfer coefficient $C_{N,0,N,0}$ for deuteron breakup at 2.1 GeV of deuteron kinetic energy. Lines are as in Fig.3.

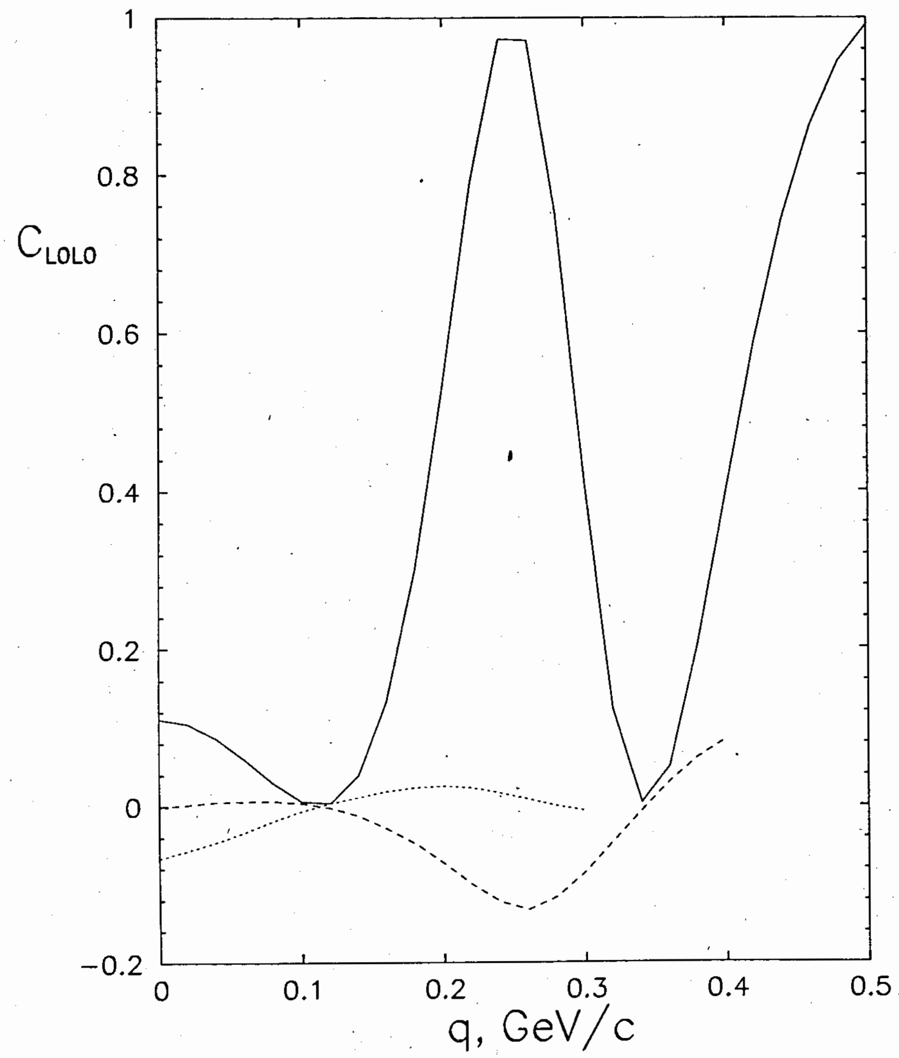

Fig.11. Spin transfer coefficient $C_{L,0,L,0}$ due to longitudinal polarizations of particles. Lines are as in Fig.2.

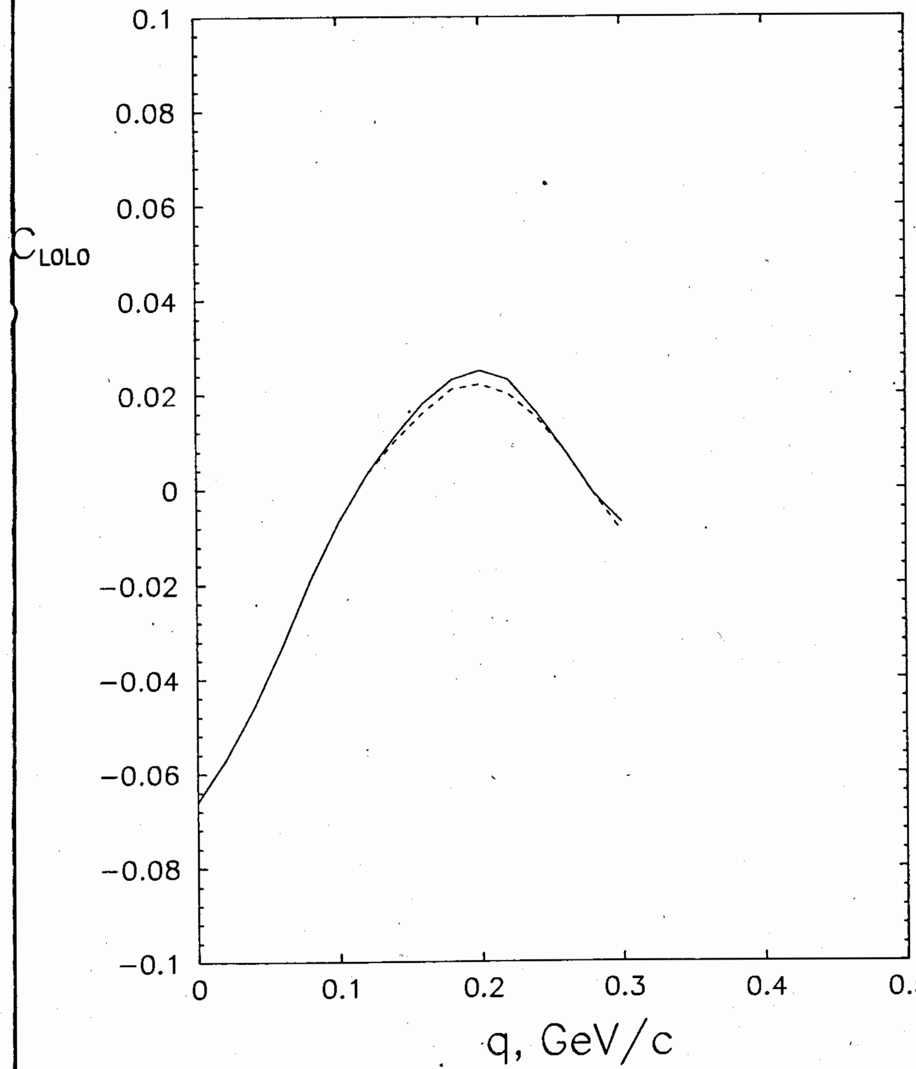

Fig.12. Spin transfer coefficient $C_{L,0,L,0}$ for deuteron breakup at 1.25 GeV of deuteron kinetic energy. Lines are as in Fig.3.

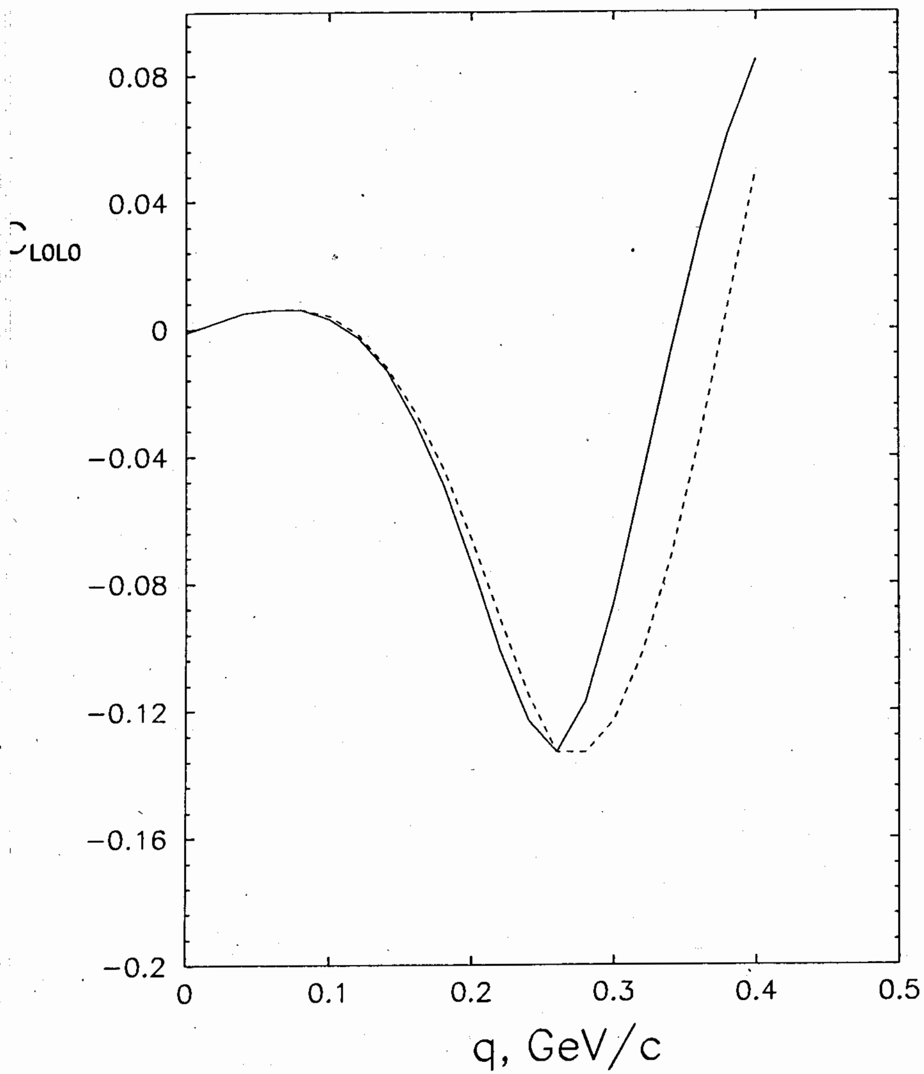

Fig.13. Spin transfer coefficient $C_{L,0,L,0}$ for deuteron breakup at 2.1 GeV of deuteron kinetic energy. Lines are as in Fig.3.

At low energy the values for the spin transfer coefficients for both processes are the same and equal 1/9.

The measurement of $C_{N,0,N,0}$ for deuteron *inclusive* breakup with the proton emitted at zero degree was firstly proposed by Strokovsky [37] in order to study the mechanisms of the reaction additional to IA. The prediction based on correlation between tensor analyzing power T_{20} and κ_o [38] gives a zero value of $C_{N,0,N,0}$ within IA [37, 39]. Our result for spin transfer $C_{N,0,N,0}$ is in the *definitive* disagreement with this prediction.

4 Conclusion

We have considered new observables in deuteron breakup in the collinear geometry and dp backward elastic scattering due to the polarization of the proton target. These observables show their sensitivity to the deuteron wave function at short distances. The observables for breakup process demonstrate the strong energy dependence. This fact is related with the strong variation of the nucleon-nucleon elastic scattering amplitudes versus initial energy of neutron. On the other hand, the spin correlations of np elastic scattering exhibit a rather smooth energy dependence versus energy at $T_n \geq 800\ MeV$ and one can expect that considered in this work observables are defined mostly by the DWF.

Measurements of the spin correlations could be performed at COSY at Zero Degree Facility (ANKE) using internal polarized target with the detection of two charged particles in case of deuteron breakup and with the detection of the fast proton in case of dp backward elastic scattering. Using of the proton polarimeter could allow to measure the spin transfer coefficient $C_{N,0,N,0}$ from polarized proton to the final proton.

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