T_{20} in the inclusive breakup of 4.5 GeV polarized ^{6}Li

V. Punjabi
Norfolk State University, Norfolk, Virginia 23504

C. F. Perdrisat and E. Cheung
The College of William and Mary, Williamsburg, Virginia 23185

J. Yonnet, M. Boivin, and E. Tomasi-Gustafsson
Laboratoire National Saturne, Centre d'Etudes Nucléaires de Saclay, F-91191 Gif-sur-Yvette, France

R. Siebert, R. Frascaria, and E. Warde
Institut de Physique Nucléaire, Université Paris 13, Orsay, France

S. Belostotsky, O. Miklucho, and V. Sulimov
Leningrad Institute for Nuclear Physics, Gatchina, Russia

R. Abegg
TRIUMF, Vancouver, British Columbia, Canada V6T 1W5
and University of Alberta, Edmonton, Canada T6G 2J1

D. R. Lehman
The George Washington University, Washington, D.C. 20052
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The analyzing power T_{20} in the inclusive ^{1}H(^{6}Li,d or α or t)X reaction with 4.5 GeV tensor polarized ^{6}Li nuclei has been measured at an angle of 0.8°. The kinematics chosen favor the detection of spectator fragments; in the impulse approximation the laboratory momentum of such a fragment is then the Lorentz boosted internal momentum. Nonzero T_{20} values have been observed, in agreement with the known nonsphericity of ^{6}Li indicated by its quadrupole moment. The sign of T_{20} in the d channel suggests that near $q=0$ the D state in ^{6}Li has the same sign as in the deuteron; an abrupt change of sign near $q=0.12$ GeV/c is in agreement with theoretical expectation of a node in the αd position wave function. The α-channel data show larger T_{20} values than the d channel; in this case the small-q-region has not been explored enough to establish a similar node. A few data points in the t channel might suggest that T_{20} becomes positive above $q=0.4$ GeV/c in this case.

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I. INTRODUCTION

The experimental characterization of the D state in light nuclei is of interest because of the information it can provide about the tensor force in the NN interaction in a few-body environment. The existence of a D-state component in the $A=2$, 3, and 4 nuclei is experimentally well established, and has been reviewed recently by Ericson and Rosa-Clot [1], by Weller and Lehman [2], and by Lehman [3]. The experimental situation for ^{6}Li is much less satisfactory, although definite predictions for a small D-state probability exist [2,3].

In the deuteron, the D state is revealed by the electric quadrupole moment, by the asymptotic D over S ratio $\eta_d=C_2/C_0$, where C_0 and C_2 are the S- and D-wave asymptotic normalization constants, and to a more limited extent by the magnetic dipole moment. These three quantities, Q_d, η_d, and μ_d, are well defined experimentally. The most recent experimental value of Q_d is $+0.2859(3)$ fm^2 (see Ref. [1]). Three methods have been used to extract η_d; they are (1) distorted wave Born approximation (DWBA) analysis of sub-Coulomb ($\vec{d},p$), (2) pole extrapolation of tensor analyzing power measurements in ^{2}H($\vec{d},p$)^{3}H, and (3) extrapolation of the residue at the deuteron pole from phase-shift analysis of low energy np scattering. As recently described in the review by Lehman [3], the 3 values extracted for η_d are 0.0256 ± 0.0004 from sub-Coulomb ($\vec{d},p$), 0.0273 ± 0.0005 from ^{2}H($\vec{d},p$)^{3}H, and 0.02712 ± 0.00022 from np phase-shift analysis.

Contrasting with the situation for the deuteron, ^{3}H, ^{3}He, and ^{4}He have spin smaller than 1, and therefore no quadrupole moment; the only direct evidence for a D-state component in these nuclei comes from measurements of the D over S ratio, either η or

$$D_2=\lim_{q\to 0}\left[\frac{f_2(q)}{q^2 f_0(q)}\right], \tag{1}$$

where $f_{0,2}$ are the S- and D-state momentum distribution amplitudes, respectively. Measurements of η or D_2 in the $A=3$ systems have given information on the D state at the ^{3}He$\to dn$ and ^{3}He$\to dp$ vertices; an up to date description of the present situation for these two nuclei is in Ref. [3]. Results have been obtained by DWBA analysis of sub-Coulomb single-nucleon transfer reactions like ^{2}H$(d,p)^{3}$H, and $(d,{}^{3}\mathrm{He})$ or $(d,{}^{3}\mathrm{H})$ on various nuclei. For ^{3}He the values are $\eta=-0.047\pm0.007$ and $D_2=-0.24\pm0.04$ fm^2 as obtained by Bhat *et al.* [4]. For the triton, the latest values from Das *et al.* [5] are $\eta_t=-0.043\pm0.002$ and $D_2=-0.217\pm0.010$ fm^2. The total theoretical *D*-state probabilities are in the range 7–10 %.

In ^{4}He a *D* state can occur for a *dd* projection with angular momentum 2 and the two deuteron spins coupled to 2. No direct pole extraction has been made so far, and the empirical results come from forward dispersion relation analysis of the elastic d^{4}He data and tensor analyzing power data for the (d,α) transfer reaction. These measurements agree with theory regarding the sign of D_2, but not the magnitude; presently experimental values for D_2 are -0.19 ± 0.04 in Merz *et al.* [6], to -0.30 ± 0.1 in Karp *et al.* [7]; these values are clear evidence for a nonvanishing *D* state. The total theoretical *D*-state probability for ^{4}He is in the range 11–13 %.

The nucleus ^{6}Li is next in order of increasing *A* values; it has the same quantum numbers as the deuteron: $J^{\pi}=1^{+}$ and $I=0$. The magnetic moments of ^{6}Li and of the deuteron are similar, $\mu_{\mathrm{Li}}=0.8220\mu_N$ and $\mu_d=0.8574\mu_N$, respectively, but the quadrupole moment of ^{6}Li is significantly smaller than that of the deuteron and of opposite sign, $Q_{\mathrm{Li}}=-0.0644$ fm^2, indicating a nonzero *D*-state probability. The only published experimental value for $\eta_{\alpha d}$ is 0.005 ± 0.017, from a forward dispersion relation analysis of elastic αd scattering by Bornand *et al.* [8]. The experimental value of Q_{Li} suggests a negative value for η_{Li}. However, the three-body Faddeev calculations of Lehman *et al.* [9] for the $\alpha(pn)$ wave function of ^{6}Li, when projected on the αd state, leads to a positive value for η_{Li}, and this with or without a tensor force in the interaction of the *NN* pair. Lehman considers two approximations for the αN potential in the $S_{1/2}$ partial wave, one repulsive (*R*) as suggested by the nonbinding of the $A=5$ system, the other attractive (*A*) with an excluded bound state. In this calculation the $J^{\pi}=1^{+}$, $I=0$ part of the *np* interaction was of the Yamaguchi-Yamaguchi [10] form. All four ^{6}Li wave functions of Ref. [5] correspond to total probabilities of about 60% for the αd component, with a very small fraction in the *D* state. Without a tensor force in the *NN* interaction, the *D*-state probability is 0.263% for the *R* potential, compared to 0.046% when a tensor force is included; the numbers are similar for the *A* potential.

More recently, Woloschek and Lehman [11] have redone the three-body calculation using the Paris potential for the interaction in the *NN* pair, again with the *R* and *A* potentials for the αN interaction. The predicted η values in this case are $+0.0194$ and $+0.0169$ for the *R* and *A* αN potentials, respectively; the corresponding D_2 values are 0.226 and 0.218 fm^2. Regardless of the potential used, for these three-body calculations the momentum space wave function for $^{6}\mathrm{Li}\rightarrow\alpha d$ changes sign near $q\approx0.120$ GeV/*c*; such a change of sign is expected theoretically because the *S*-state radial wave function has a node at $r=1.7$ fm. This is a characteristic which has not so far been seen in cross section measurements. An important goal of the present experiment was to search for this node. The best way to find such a node is to measure polarization observables, which are in general dominated by an interference term between two amplitudes.

There is also a recent analysis of tensor analyzing power data in the reaction $^{6}\mathrm{Li}(d,\alpha)^{4}\mathrm{He}$ at 10 MeV by Santos *et al.* [12]. By comparing the data to a single- and double-step DWBA calculation and assuming $\eta_{\alpha}=-0.2$, these authors estimate $\eta_{^{6}\mathrm{Li}}$ to be between -0.015 and -0.010, that is, opposite in sign to that of the deuteron, and opposite to the prediction of Refs. [9,11].

Unlike the situation with the αd projection, for the ^{3}H^{3}He projection of the ^{6}Li ground state neither the η value nor the total *D*-state probability, P_D, are known; but they are not expected to be zero.

The fact that *Q* is nonzero in ^{6}Li is presently the only unambiguous indication of the existence of a *D*-state component in this nucleus. It appeared therefore worthwhile to attempt to get information on the *D*-state of ^{6}Li from the breakup reaction at high energy, in a kinematical region dominated by quasielastic processes, where one expects that the plane wave impulse approximation (PWIA) will give a fair description of the reaction. Recent studies of the inclusive $^{1}\mathrm{H}(\vec{d},\vec{p})X$ reaction at zero degrees at Saclay [13] and Dubna [14] at energies from 1.25 to 7.2 GeV have given detailed information on the deuteron momentum density at least up to internal momenta of 200 MeV/*c*. In these experiments the detected proton is predominantly a spectator of the reaction. Both the tensor analyzing power T_{20} and the polarization transferred in the reaction provide definite information on the *D*-state part of the deuteron wave function; it was also demonstrated [15] that at least for the Saclay data, multiple scattering or final state interaction remained reasonably small up to $q=200$ MeV/*c*. Although in the case of the breakup of ^{6}Li leading to the αd or ^{3}H^{3}He channels, the effect of rescattering and final state interaction should be stronger than for the deuteron, it was hoped that at small-*q* values information on the *D* state of ^{6}Li could be obtained from such data. The T_{20} data reported here for the α and *d* inclusive channels, in the spectator region, clearly show the presence of a *D* state. They give nonzero T_{20} values over a range of *q* values, with a change of sign near $q=0.12$ GeV/*c*, as predicted, and with the expected sign for D_2 in the region $q<0.1$ GeV/*c*, in agreement with the prediction of Ref. [11].

In Sec. II the connection between wave function and T_{20} is discussed, establishing the methodology of the experiment. In Sec. III the experiment is described, and the results are given in Sec. IV. Finally a discussion of the results can be found in Sec. V.

II. CROSS SECTION AND POLARIZATION OBSERVABLES

The momentum density $|\phi|^2$ can be obtained from cross section measurements using the plane wave impulse approximation (PWIA); keeping only the first term of the Glauber model expression derived by Bertocchi and Treleani [16], the invariant, inclusive cross section for $^1H(^6Li,d)X$ has the form

$$E_{Li}\frac{d^3\sigma}{d\mathbf{p}_{Li}} = E_{Li\to\alpha d}\phi_{\alpha d}^2(q)\sigma_{\alpha p}^{total} ,$$

with

$$\phi_{\alpha d}^2 = f_0^2 + f_2^2 , \quad (2)$$

where the f_l are momentum-distribution amplitudes in the $^6Li\to\alpha d$ decomposition vertex amplitude (see Ref. [2])

$$\langle \alpha d;\mathbf{q},1,m_d|^6Li;1m_{Li}\rangle = \sum_l f_l(q)\langle lm_l 1m_{Li}|1m_d\rangle\sqrt{4\pi}Y_{m_l}^{[l]}(\hat{q}) . \quad (3)$$

Here the spherical harmonics is connected to the Condon-Shortley Y_l^m functions by $Y_m^{[l]} = (-i)^l Y_l^m$. In the spirit of the PWIA, if the detected particle (here the deuteron) is truly a spectator of the reaction, then the Lorentz transform of its laboratory momentum to the ^6Li rest frame is the internal momentum for the αd vertex, as illustrated in Fig. 1.

According to the prediction of three-body calculations, in ^6Li the D-state probability is too small to be detected from cross section data; for example, the D state was not seen in the $^6Li\,(e,e'p)\,^4He$ data of Ent *et al.* [17]. However, the tensor analyzing power T_{20} is much more sensitive to the D-state component of the wave function than the cross section. The observables T_{20} or A_{yy} are defined in terms of the cross sections for the three-spin orientations of $m_{Li} = +1$, 0, and -1 as

$$T_{20}(q) = -\sqrt{2}A_{yy} = -\sqrt{2}\frac{\sigma(+1)+\sigma(-1)-2\sigma(0)}{\sigma(+1)+\sigma(-1)+\sigma(0)} . \quad (4)$$

In the pole approximation for the graph in Fig. 1, or the PWIA, and using Eqs. (2) and (3), T_{20} can be written as

$$T_{20}(q) = -\frac{1}{\sqrt{2}}\frac{2\sqrt{2}f_0(q)f_2(q)+f_2^2(q)}{f_0^2(q)+f_2^2(q)} . \quad (5)$$

Expressions like Eq. (5) have been discussed by Wilkin [18]. Equation (5) shows explicitly that T_{20} results from the interference of the S and D parts in the $f_0 f_2$ term, which is generally larger than f_2^2; also, the sign of T_{20} is opposite to the sign of f_2/f_0. Analytically, T_{20} has extrema at $f_0/f_2 = +1/\sqrt{2}$ and $-\sqrt{2}$, with values $+1/\sqrt{2}$ and $-\sqrt{2}$, respectively.

The measurement of T_{20} in $^1H(^6Li,\alpha)X$ and $(^6Li,d)X$ should then determine the presently unknown sign of f_2/f_0 at small-q values, although not the quantity D_2 of Eq. (1), which is defined as $q\to 0$; the lowest value of q investigated in this experiment is 0.042 GeV/c in the d channel. Predictions for T_{20} vs q are shown in Fig. 2. These are based on Eq. (5) using two different wave functions of Ref. [9] with αN potential of type R, with and without the tensor force in the NN interaction, and the two wave functions from Ref. [11] with (R) and (A) αN potential and Paris NN potential. In all cases T_{20} is large only in the immediate vicinity of the node in the S-state q-space wave function near $q = 0.150$ GeV/c. At $q \approx 0.12$ to 0.15 GeV/c the prediction for T_{20} changes sign abruptly, from $-\sqrt{2}$ to $+1/\sqrt{2}$, over a few tens of MeV/c in q. The observation of this signature gives information on the sign of D_2 at small q, and simultaneously, establishes the existence of a node in the S-state radial wave function $u(r)$. As discussed by Lehman and Parke [19], η and D_2 are not trivially connected in ^6Li because of the node in the S-state wave function.

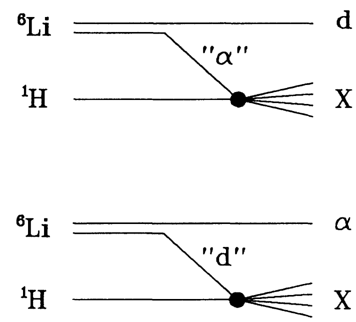

FIG. 1. The impulse approximation graphs for the reaction in which the spectator, d or α, is detected.

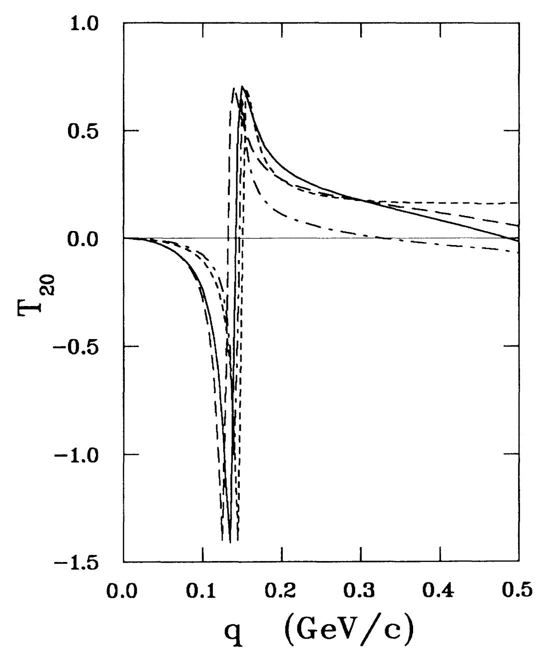

FIG. 2. Theoretical expectation for the analyzing power T_{20} measured in the present experiment. The short-dashed and dot-dashed curves correspond to a repulsive (R) αN potential, with and without tensor force in the NN potential of Ref. [5], respectively. The long-dashed and solid curves correspond to the attractive (A) and repulsive (R) αN potentials of Ref. [4], but with the Paris NN interaction of Ref. [7].

III. THE EXPERIMENT

In our experiment the new beam of $^6\mathrm{Li}^{+++}$ (see Courtois *et al.* [20]), accelerated to 4.5 GeV by the Synchrotron Saturne 2 at Saclay, was directed on liquid hydrogen cells of 4 and 10 cm thickness, and the d's, α's, and t's emerging from the reaction were detected at 0.8° in the SPES 4 magnetic spectrometer. In the configuration used (see Ref. [21], Bedjidian *et al.*) SPES 4 had a 12-scintillator hodoscope in the intermediate focal plane I, and a 13-scintillator hodoscope in the final focal plane F, with a 16 m flight path for time-of-flight (TOF) measurement between I and F. Two XXY drift wire chambers 1 m apart, located near the final focal plane in front of the F hodoscope, allowed reconstruction of the momentum (p/z) and scattering angle at the target. The signals from three long plastic scintillators placed behind the F hodoscope were digitized to provide dE/dx information. A figure showing the configuration of this detection is in Ref. [13], with the difference that in the present experiment the Cerenkov detectors were omitted.

Deuterons and α's with the same p/z have the same velocity; however, they have dE/dx values in a ratio of z^2, i.e., 4, which was used to separate them. Tritons and α's (or d's) of the same p/z have different velocities; the TOF provides the best way to separate them. An example of the particle separation ability of the detection is in Fig. 3; the figure shows the energy loss versus time of flight (both in arbitrary units) at $p/z=2.91$ GeV/c. This picture was chosen for approximately equal probabilities of α's and d's. The α's (larger dE/dx) are well separated from the deuterons. Events were selected within appropriate two-dimensional windows in dE/dx vs TOF to further decrease the background. Not shown in this figure are ^{6}Li's with ≈ 9 times the dE/dx of the d's; they typically accounted for less than 1% of the triggers. For all data points presented the events were submitted, in addition to particle identification, to a selection based on the reconstructed location at the collimator.

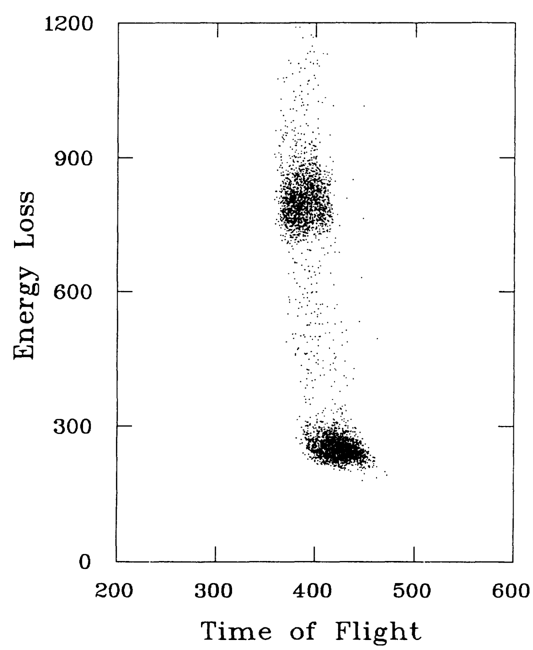

FIG. 3. Dot plot for 5000 events showing the energy loss (dE/dx) vs the time of flight in arbitrary units. The p/z value is 2.91 GeV/c, corresponding to $q_d=0.050$ GeV/c. The α's on top are well separated from the d's, at the bottom of the graph; the vertical tails are due to nuclear reactions in the scintillator.

The experimental trigger consisted of signals from the I and F hodoscope; the electronics has been described elsewhere (see, for example, Ref. [13]), except for a new ultrafast coincidence circuit described by Courtat [22], which allows separation of particles with TOF differences of a few nanoseconds. The d and α data were taken with a narrow gate to eliminate the tritons. Triton data were then obtained separately with a wider gate.

The liquid H_2 cells had thicknesses of 0.283 and 0.708 g/cm^2. The solid angle of the collimators were $\Delta\Omega=8.53\times10^{-6}$, 1.92×10^{-5}, and 0.988×10^{-4} sr. The beam intensity could be varied between 1×10^8 and 8×10^8 charges per beam spill, with a repetition rate of 1 spill every 2.4 s and a spill length of 0.5 s. The additional required changes of luminosity were obtained with different combinations of target cells and collimator opening. To check for a possible contamination of the beam with other ions of similar p/z and z/A ratios, data were acquired with the ^{6}Li source closed off: the event rate fell by a factor of 30 to 40. Target empty rates were also 30 times smaller than target full ones. No correction was made for these low sources of background.

The polarized ^{6}Li source was operated in the four-state mode which gives theoretically maximum tensor polarization $P_{zz}=1$, and vector polarization $P_z=\frac{1}{3}$. In this mode successive beam bursts contain ^{6}Li's periodically changing polarization states numbered 3–6, and characterized by vector and tensor polarizations changing from $\rho_{10}=+1/\sqrt{6}$ and $\rho_{20}=+1/\sqrt{2}$ to $-1/\sqrt{6}$ and $+1/\sqrt{2}$, $+1/\sqrt{6}$ and $-1/\sqrt{2}$, and finally $-1/\sqrt{6}$ and $-1/\sqrt{2}$. The tensor and asymmetry of a given reaction is then defined as

$$X_T=(n_3+n_4-n_5-n_6)/(n_3+n_4+n_5+n_6)\ , \qquad (6)$$

where the n_i's are numbers of events collected in each state, normalized to equal numbers of ^{6}Li in each state.

The actual polarization of the beam was measured in the Saturne 2 injection line with the low energy polarimeter routinely used for deuterons; however, the analyzing reaction was $^2\mathrm{H}(^6\mathrm{Li},\alpha)^4\mathrm{He}$ with the α detected at 0°, instead of the usual $^2\mathrm{H}(d,p)^3\mathrm{H}$ used with deuteron beams, as described in Arvieux *et al.* [23]. The analyzing power of the reaction $A_{yy}=0.444$ has been measured by Neff *et al.* [24]; the number of events in the low energy polarimeter is given by $N=N_0(1+\frac{1}{2}A_{yy}P_{zz})$. More details about the low energy polarimeter performance with ^{6}Li can be found in the report by Zupranski [25]. The weighted average of three low energy beam polarization measurements made during the experiment is $P_{zz}=0.645\pm0.075(\mathrm{stat})\pm0.05(\mathrm{syst})$, with corresponding value $\rho_{20}=P_{zz}/\sqrt{2}$. No depolarization is expected during acceleration in Saturne 2.

Among the four independent monitors available to count the particles incident on the target, two were found sufficiently independent of the polarization state of the beam to be used in calculating the asymmetry X_T of the data. They were provided by the sum of the counts in the left and right sides of a double telescope POL oriented at 15° to a thin secondary CH_2 target located upstream from the liquid H_2 cell, and the right telescope of a second double telescope (ARD) oriented at 45° to the same target. These monitors indicated that the number of particles in each one of the four polarization states were sufficiently similar to allow calculation of the tensor asymmetry without any monitor. The mean asymmetries of the monitors POL $(G+D)$ and ARD calculated assuming equal number of particles in the four states, over the whole duration of the experiment, were found to be $X_T^{\rm POL}=0.002\pm0.005$ (standard deviations) and $X_T^{\rm ARD}=0.001\pm0.004$ (standard deviations), with statistical uncertainties $<10^{-4}$, indicating a negligible analyzing power for these monitors. The values of T_{20} for the (^{6}Li, d, or α) reactions obtained with the POL or ARD monitors were compatible within statistical uncertainty with values calculated without monitor. We have chosen to present in the next section T_{20} values obtained without monitor. We notice that the analyzing power of the monitoring reaction, (^{6}Li,x^+) on CH_2, is unknown; therefore the decision not to use any monitor in the asymmetry calculation is justified solely on the basis of the observed internal consistency between T_{20} values obtained with and without monitoring the number of ^{6}Li's in each polarization state.

IV. RESULTS

Measurements of T_{20} in the breakup channels d and α were made at eight values of p/z between 2.91 and 3.60 GeV/c (the beam momentum was 8.406 GeV/c). For tritons only three values of p/Z were investigated. The relation between p/z for the various fragments detected in this experiment, and the quantities q_j ($j=d$, α, and t), defined as the momentum of these fragments Lorentz transformed to the ^{6}Li frame, is shown in Fig. 4. In the impulse approximation, assuming that the fragments detected were spectators of the reaction, q_j is the internal momentum of fragment j in ^{6}Li.

For each one of the breakup channels, asymmetries X_T were obtained for Eq. (5) at each p/z; for the two lowest p/z values the events were divided into two p/z bins within the 5% momentum acceptance of the spectrometer. The X_T asymmetries are related to the tensor analyzing powers T_{20}, T_{22}, and A_{yy} as follows:

$$X_T=\rho_{20}[\tfrac{1}{2}T_{20}(\theta)+(\sqrt{\tfrac{3}{2}})T_{22}(\theta)\cos2\varphi]=-\frac{\rho_{20}A_{yy}(\theta)}{\sqrt{2}}\ . \qquad (7)$$

Although this experiment was performed at 0.8° rather than 0°, the results will be called T_{20} rather than A_{yy}; the error introduced by this approximation is small because $T_{22}=0$ at polar scattering angle $\theta=0°$ for symmetry reasons.

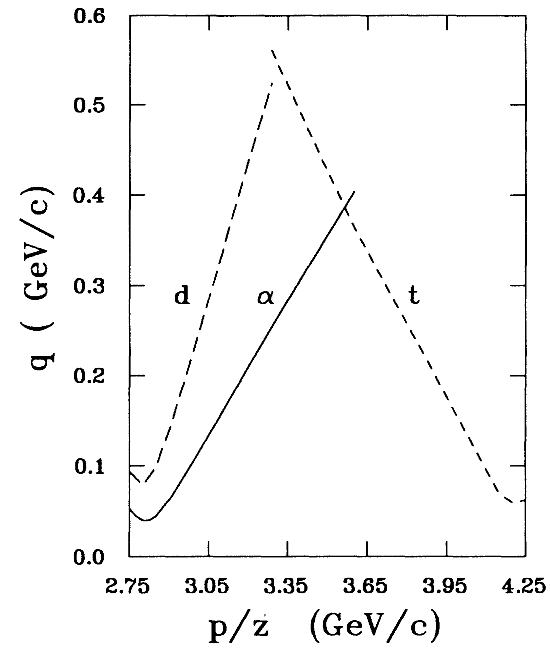

FIG. 4. Kinematical relation between the laboratory p/z values and the ^{6}Li reference frame q values at 0.8° and 4.5 GeV. The solid, long-dashed, and short-dashed curves correspond to the d, α, and t channels, respectively.

The results of our T_{20} measurement vs q are shown in Fig. 5 for ^{1}H(^{6}Li,d)X, ^{1}H(^{6}Li,α)X, and ^{1}H(^{6}Li,t)X. The error bars are statistical only; the systematic error due to the uncertainty in the beam polarization is estimated to be ±14%. As predicted, a definite change of sign occurs

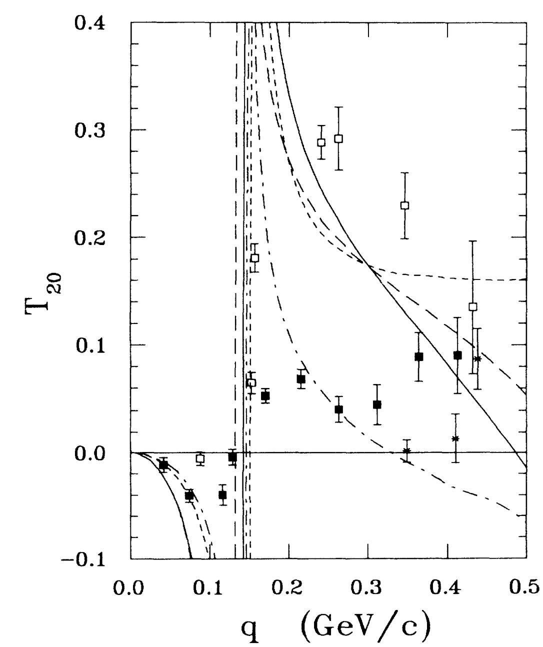

FIG. 5. The results of this experiment for the d (solid squares), α (empty squares), and t channels (stars). The error bars correspond to the statistical uncertainties. The curves correspond to Fig. 2.

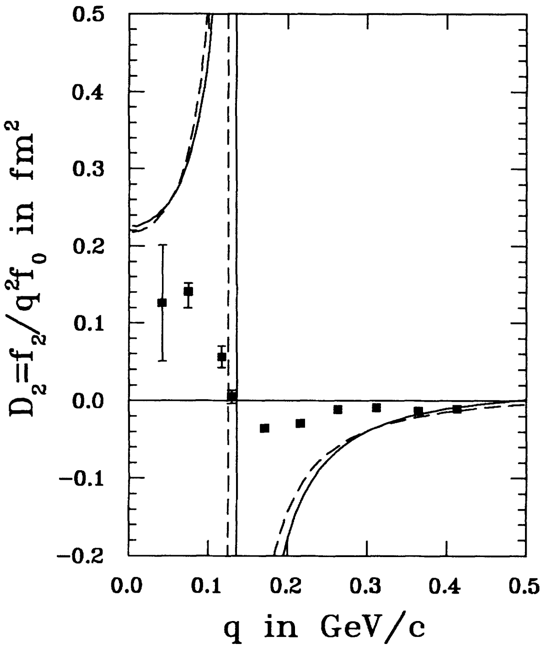

FIG. 6. Ratio D_2 of Eq. (1) calculated from the d data in Fig. 5 with the help of Eq. (4). Also shown are the predictions of Ref. [7], αN potential R and A, Paris NN potential, with the same line definition as in Fig. 2.

near $q=0.120$ GeV/c, a feature not detected in $(e,e'd)$ (Ref. [17]). The four curves in Fig. 5 correspond to those in Fig. 2, but the scale is magnified. It is apparent that in the (^{6}Li,d) channel, the T_{20} values observed are systematically smaller than predicted, but that the overall sign is as expected. The T_{20} data for the α channel are larger than for the d channel. In this case, in the PWIA the substructure exchanged is a "d" with spin 1, and the prediction obtained with Eq. (5) above is not expected to be valid.

The three data points from the triton channel in Fig. 5 suggest that T_{20} might be going from negative to positive values near $q\approx0.4$ GeV/c, a behavior qualitatively different from what is seen in the d and α channels. Obviously more data would be needed to confirm this feature.

Finally, in Fig. 6 the data for the d channel are shown as the ratio f_2/q^2f_0 calculated by inverting Eq. (5), and compared with the same ratio calculated from the wave functions of Ref. [11]. As $q\rightarrow0$ this quantity tends toward D_2. The results are in agreement with the predicted sign, but the magnitude of D_2 observed is a factor of 2 smaller; this smaller experimental value of D_2 may be a manifestation of distortion effects.

V. CONCLUSIONS

To conclude, we have observed a definite signal for T_{20} in the d, α, and t channels of the breakup of polarized ^{6}Li. Given the known, nonzero value of the quadrupole moment of ^{6}Li, this result is certainly expected. Interpretation of the results in terms of the PWIA gives the same sign for the D/S ratio at small-q values as in the deuteron. This result is at variance with the analysis of Ref. [12]. The sign of the D state we observe is in agreement with the prediction of the three-body calculation of Refs. [9] and [11]; the magnitude of T_{20} values observed is less than expected, but the zero crossing observed in the d channel is in good agreement with prediction from the same references. To interpret these data in terms of wave functions for the αd and $t\,^3$He decompositions of ^{6}Li, and evaluate D-state probabilities, will require consideration of the final state interaction among the three or more fragments in the final state. We hope that this work will motivate a distorted wave calculation of the tensor analyzing powers in the three channels investigated here.

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