found to be

$$x = -0.08 \pm 0.03.$$

III. DISCUSSION

The result of the present investigation is in excellent agreement with the work of Ambler, Hayward, Hoppes, and Hudson.[24] Although the measured ratio between Fermi and Gamow-Teller contributions to the decay is small, it is definitely negative and not zero. This is completely in accordance with the theoretical expectations,[27,28] and with the conserved vector current concept.[43–47] Large interference terms, however, would not fit well in this concept. This question has been discussed extensively by Bouchiat.[28]

The observation of the *small* but not vanishing Fermi-Gamow-Teller interference term for Mn^{52} agrees well with recent experiments[17,18] on Sc^{46}, V^{48}, Co^{56}, and Ag^{110m} performed in this laboratory.

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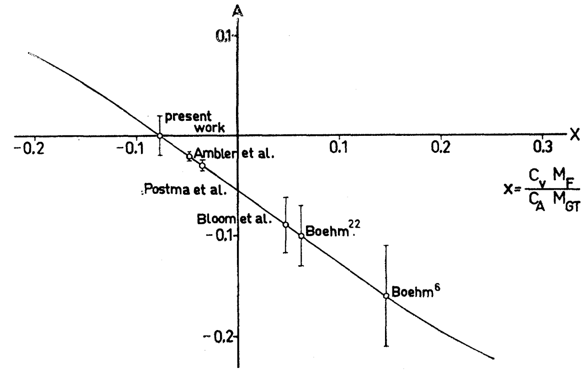

FIG. 2. A vs x, $x = C_V M_F / C_A M_{GT}$ being the ratio between Fermi and Gamow-Teller contributions to the decay. The results of Ambler *et al.* (reference 24) and Postma *et al.* (reference 25) are drawn as if obtained with the β-γ circular-polarization correlation.

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$Li^6(d,p_1)Li^{7*}$ Reaction at 2-MeV Bombarding Energy

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Absolute differential cross sections and reduced widths have been obtained for the reactions $Li^6(d,p_0)Li^7$ and $Li^6(d,p_1)Li^{7*}$.

THE angular distributions from the reactions $Li^6(d,p)Li^7$ and $Li^6(d,p_1)Li^{7*}$ have been determined using deuteron energies up to 3 MeV by several investigators.[1–6] Absolute differential cross sections are quoted in only three cases,[1,4,5] in two of which the values differ by approximately a factor of 10.

The $F^{19}(d,p)F^{20}$ reaction has been investigated at a bombarding energy of 2 MeV, using a target of LiF of natural isotopic content.[7] The spectrum of protons, which included those from the $Li^6(d,p)Li^7$ reaction, was analyzed by a broad-range magnetic spectrograph and recorded in nuclear emulsions. The method of analysis of the results has been described previously.[7]

The angular distribution of $Li^6(d,p_1)Li^{7*}$ was determined over the angular range 5 to 115° lab. Since this experiment was secondary to that of $F^{19}(d,p)F^{20}$, the proton group from $Li^6(d,p_0)Li^7$ was not observed at angles less than 55° lab because it lay outside the energy range of the instrument at forward angles. This partial angular distribution is not shown here.

The relative angular distribution of $Li^6(d,p_1)Li^{7*}$ is given in Fig. 1, the ordinate scale being the same as that of the groups from $F^{19}(d,p)F^{20}$.[7] The errors on the points are the combined statistical errors arising from counts in the spectrograph and monitor groups. This angular distribution is similar in form to that given by Nickell[6]

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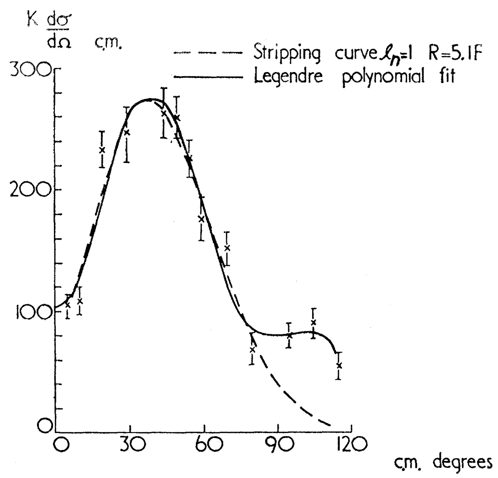

FIG. 1. Angular distribution [group $Li^6(d,p_1)Li^{7*}$].

and that from $Li^6(d,p_0)Li^7$ agrees, over the limited angular range which we observed.

Two methods have been used to estimate the absolute differential cross sections for the lithium groups, since the absolute beam-charge incident on the target could not be reliably measured. The first is based on the results obtained by Ôno *et al.*[8] for the $F^{19}(d,p_0)F^{20}$ reaction at a deuteron energy of about 2 MeV. The angular distributions obtained by these authors and ourselves are closely similar, so that their values of absolute differential cross section, which are quoted to an accuracy of 30%,[9] can be used to determine K, the constant of proportionality in Fig. 1. The value so obtained is 37 with the same uncertainty of 30%, the present error being negligible in comparison.

TABLE I. Comparison of values of absolute differential cross sections.

Level	Absolute differential cross sections (mb/sr) $\theta=0°$	$\theta=90°$	$\theta=0°$	$\theta=90°$
	(Present work)		(Whaling[a]	Nickell[b])
Ground state	···	2.8	5.3	3.3
First excited state	2.6	2.1	3.7	2.7

[a] See reference 4.
[b] See reference 6.

The second method for obtaining K uses the measured absolute cross section of the $C^{12}(d,p_0)C^{13}$ reaction[10] and the ratio of the number of Li^6 to C^{12} atoms in the target. The value of K so obtained was 42 with an estimated uncertainty of a factor of 2 due to uncertainty in the latter ratio.

The experimental points on the angular distribution $Li^6(d,p_1)Li^{7*}$ have been fitted with a Legendre polynomial expansion, drawn as the smooth curve in Fig. 1. A short extrapolation of this curve to 0° gives the values of differential cross section listed in Table I, which compares the present results with those of Nickell[6] normalized using the absolute values of Whaling.[4] The results agree within the experimental errors, but both are greater than the value obtained by André[5] by a factor of about 10.

Both angular distributions have been fitted with simple stripping curves, using the tables prepared by Lubitz,[11] with radius as a variable parameter. In the case of the $Li^6(d,p_1)Li^{7*}$ group, the theoretical curve was normalized to the point nearest to its maximum on the smooth curve obtained by the least squares Legendre polynomial fit to the experimental points. The stripping curve for the p_0 group was calculated similarly, using the same value of interaction radius, 5.1 F.

The neutron reduced width for the first Li^7 level was evaluated from the differential cross section at the stripping peak, neglecting Coulomb and nuclear interactions. The reduced width for the ground state was calculated using both an arbitrary normalization of the theoretical curve to the most forward experimental point, and also by combining the present values with those of Nickell[6] to measure the cross section near the peak of the stripping curve. The value is listed in Table II with the results of the first excited state. Also given in this table are the values calculated[12] from the work of Levine *et al.*[13] at a bombarding energy of 14.4 MeV. The present values of reduced width, which have an uncertainty of about 50% due to inaccuracies in the differential cross section, appear to be somewhat lower than those of Levine.

TABLE II. Comparison of reduced widths.

Level	Q (MeV)	Absolute θ_n^2 (Present work)	Absolute θ_n^2 (Levine[a])
Ground state	5.027	0.016	0.048
First excited state	4.549	0.031	0.063

[a] See reference 13.

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