where

$$A=G_1^{23}=G_3^{21},$$
$$B=G_1^{21}=G_3^{23},$$
$$C=G_1^{31}=G_3^{13},$$
$$D=G_2^{13}=G_2^{31}.$$

Advantage may now be taken of the factorable nature of the interactions t_i and a partial-wave separation of these equations carried out. From this point the derivation of the set of four coupled one-dimensional integral equations for each partial wave proceeds exactly as in HS1.

PHYSICAL REVIEW VOLUME 141, NUMBER 4 JANUARY 1966

Photodisintegration of the Deuteron from 500 to 1000 MeV*

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(Received 26 July 1965)

The photodisintegration of the deuteron has been studied at energies comparable with the second and third pion-nucleon isobars using the Stanford Mark III linear electron accelerator. No evidence has been found for any resonant behavior in the energy region of interest.

EXPERIMENTAL PROCEDURE

We have measured the angle and momentum of the protons produced in the reaction

$$\gamma+d\rightarrow p+n,$$

using the double-focusing magnetic spectrometer of Hofstadter's group.

The same experimental apparatus and data-handling technique described in Ref. 1 has been used. The lower counting rate of this experiment required some increase in the shielding around the counters in order to reduce the accidental coincidence rate to a tolerable level. In this way the accidental coincidence rate was reduced to less than one-third of the true rate for $\theta_p^{\text{c.m.}}=130°$ and to less than $\frac{1}{10}$ for $\theta_p^{\text{c.m.}}=90°$. Two cells were filled, respectively, with liquid deuterium (full target) and with liquid hydrogen (empty target).

The emission of protons from liquid hydrogen at the angle and with the momentum accepted by our spectrometer was forbidden by kinematics for all of our points. However, the proton yield from a liquid-hydrogen target was slightly higher than the comparable yield from an empty target. We have interpreted this phenomenon as the result of two-step processes. As an example we can consider pion photoproduction in the target's walls followed by pion-nucleon scattering in the target.[2] For this reason we have assumed that the proton yield from a liquid-hydrogen target was a better approximation of the background processes contributing to our full target counting rate, than the yield from a true empty target. In these conditions the yield from the hydrogen target was comparable with the photo

Table I. Center-of-mass differential cross section in microbarns/steradian as a function of the gamma-ray energy k and the proton angle $\theta_p^{\text{c.m.}}$ in the c.m. system.

k (MeV)	$\theta_p^{\text{c.m.}}$ (degree)	$d\sigma/d\Omega$ (μb/sr)
975	130	0.0343±0.0133
950	130	0.0356±0.0134
925	130	0.0547±0.0143
900	130	0.0442±0.0108
850	130	0.0347±0.0118
800	130	0.0755±0.0145
975	90	0.0681±0.0093
950	90	0.0488±0.0075
925	90	0.0543±0.0089
900	90	0.0688±0.0107
875	90	0.1038±0.0082
850	90	0.1235±0.0068
825	90	0.1483±0.0096
800	90	0.1571±0.0080
775	90	0.1935±0.0164
750	90	0.2643±0.0177
725	90	0.2984±0.0197
700	90	0.3374±0.0206
675	90	0.3908±0.0238
650	90	0.3948±0.0175
625	90	0.5620±0.0210
600	90	0.5822±0.0367
575	90	0.6900±0.0280
550	90	0.6860±0.0412
525	90	0.8021±0.0441
800	137	0.0678±0.0098
800	120	0.1144±0.0128
800	110	0.1323±0.0149
800	100	0.1360±0.0166
800	80	0.1948±0.0138
800	70	0.2040±0.0151

* Work supported in part by the U. S. Office of Naval Research, Contract Nonr 225(67).

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[2] The kinematical conditions of the experiment prevented contributions from all two-step processes involving stationary nucleons.

disintegration yield for $\theta_p^{c.m.}=130°$ and for $\theta_p^{c.m.}=90°$; it was between 10 and 30%.

The energy of the primary electron beam was adjusted for each point to prevent contributions from three-body final-state processes.

The absolute normalization of our cross sections has been obtained by comparison with elastic electron-proton scattering. Because of counting statistics and the presently limited knowledge of the proton electromagnetic form factors it is reasonable to assume a normalization error of 10%.

EXPERIMENTAL RESULTS AND COMPARISON WITH THEORY

The result of our experiment is indicated in Table I and Figs. 1 and 2. The errors indicated have been obtained from counting statistics only. These results are in good agreement with the less extensive earlier results of Myers *et al.*[3] We have compared our results with the theory of Matsumoto,[4] which takes into account all multipole transitions and their retardations, and found no agreement. If we consider the result of the calculations, taking into account only electric transitions, the result is too low. If we add the contribution from the magnetic multipoles, then the theoretical results are way above the experimental points. Our interpretation of this discrepancy is that the theory does not take into account meson exchange currents. These contributions have been recently estimated in the energy region of interest to us by Felicetti[5] using the model proposed by Wilson.[6] Unfortunately this calculation yields only values of the total cross section, and are thus not directly comparable with our experiments. However, there seems to be a fairly good agreement with our data. From a phenomenological point of view we notice in this calculation and in our experiment no evidence of a resonant behavior around the second and third nucleon isobars. This contrasts with the pronounced peak present at the position of the first isobar. This difference can be understood in terms of the Wilson model if we take into account the different position of the resonance's peak in the photoproduction of π^+ and π^0 in hydrogen which make the position of a maximum in the photodisintegration cross section less distinct.

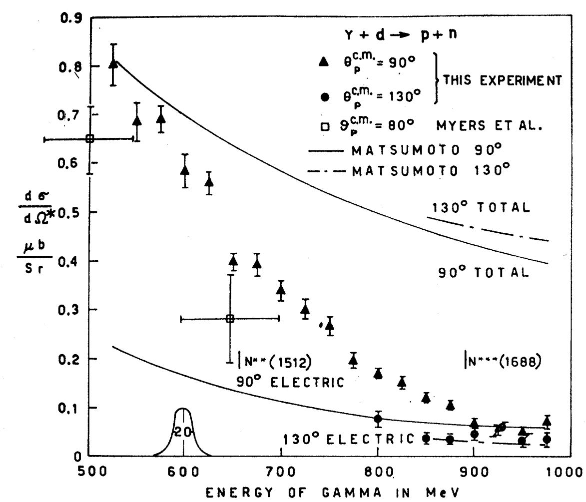

FIG. 1. Measured differential cross section in the center-of-mass system as a function of photon energy for two different angles. We have indicated the positions at which the contributions from the second and third pion-nucleon resonances should appear. A typical gamma-ray energy resolution is indicated for one particular point ($k=600$ MeV, $\theta_p^{c.m.}=90°$).

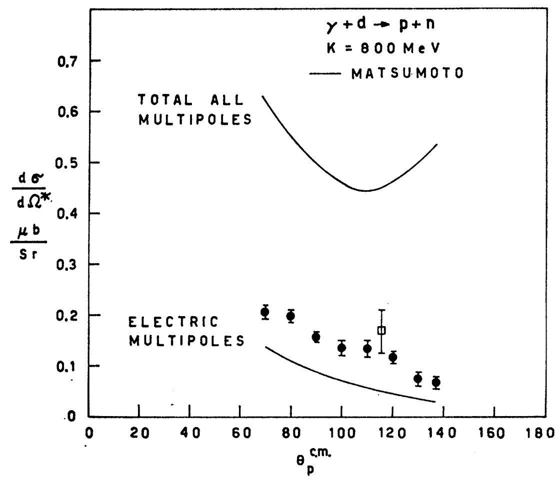

FIG. 2. Angular distribution at $k=800$ MeV.

CONCLUSIONS

The fact that our experimental results are more understandable in terms of the simple Wilson model than when compared with more complicated theories which neglect meson effects is an indication of the importance of meson exchange contributions to the photodisintegration matrix element. To gain further information on the structure of the deuteron from this experiment a detailed theory which explicitly takes into account meson effects and contributions from higher multipoles seems to be necessary.

ACKNOWLEDGMENTS

It is a pleasure to thank Professor C. Barber and Professor R. Hofstadter for continuous encouragement and support and Professor P. Noyes for many helpful discussions. The assistance of J. Grant and M. Ryneveld in setting up the experiment and the machine crew headed by Dr. P. B. Wilson and R. G. Gilbert for continuous and reliable machine operation is also gratefully acknowledged.

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