Energy dependences of proton polarization in the $\gamma d \rightarrow np$ reaction at angles of 43, 78, and 120°

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(Submitted 19 December 1979; resubmitted 23 January 1980)
Pis'ma Zh. Eksp. Teor. Fiz. **31**, No. 5, 295–297 (5 March 1980)

The energy dependences of proton polarization at angles of 43, 78 and 120° were investigated in the c.m.s. in the energy range of 400 to 700-MeV photons. The obtained results are compared with the data of other papers.

PACS numbers: 13.60.Rj

The polarization of protons in the $\gamma d \rightarrow np$ reaction at angles of 43, 78, and 120° was measured in the c.m.s. at photon energies of 400–650 MeV. The experiment was performed in the electron bremsstrahlung beam of the Kharkov 2-GeV linear accelerator. The polarization of protons was measured by means of a spark chamber telescope which was placed at the exit of a magnetic spectrometer.[1] The polarization values at

 0021-3640/80/050270-03$00.60

TABLE 1. Polarization values obtained in our experiment.

E, MeV	43°	78°	120°
375	0,47 ± 0,11	–	–
400	– 0,39 ± 0,07	–	– 0,53 ± 0,13
425	– 0,31 ± 0,08	– 0,40 ± 0,07	–
450	– 0,24 ± 0,08	– 0,45 ± 0,06	– 0,53 ± 0,10
475	– 0,38 ± 0,08	– 0,48 ± 0,06	–
500	– 0,37 ± 0,09	– 0,62 ± 0,07	– 0,50 ± 0,10
525	– 0,27 ± 0,09	– 0,57 ± 0,09	–
550	– 0,20 ± 0,09	– 0,59 ± 0,08	– 0,53 ± 0,10
575	– 0,29 ± 0,10	– 0,55 ± 0,06	–
600	– 0,23 ± 0,14	– 0,62 ± 0,06	– 0,54 ± 0,08
625	–	– 0,68 ± 0,06	–
650	–	– 0,65 ± 0,08	– 0,52 ± 0,08
675	–	– 0,55 ± 0,11	–
700	–	–	– 0,43 ± 0,10

the 43 and 78° angles were obtained with an energy resolution of $\pm$ 12.5 MeV, and at the 120° angle $\pm$ 25 MeV. The corresponding energy dependences for these angles have 25 and 50-MeV intervals.

The polarization of protons was determined from the asymmetry of their scattering by carbon nuclei (pC scattering) by means of the maximum likelihood method.[2] In the course of the experiment 425,000 proton stereotracks were recorded; 29,700 of these were pC-scattering cases, this satisfied the sampling criteria[2] and were used to calculate the polarization. The direction of the vector $\mathbf{k}\times\mathbf{p}$, where $\mathbf{k}$ and $\mathbf{p}$ are the photon and proton momenta in the c.m.s., respectively, was taken as the positive polarization value. The results obtained for the proton escape angles of 43, 78, and 120° in the c.m.s. (the corresponding laboratory angles are equal to 32, 59, and 99.5°) are listed in Table I.

Figure 1 shows the energy dependences of the polarization of protons in the $\gamma d \rightarrow np$ reaction at angles of 43, 78, and 120° in the c.m.s. The experimental results, which were previously obtained in Refs. 3–5, are shown for comparison. These data are in satisfactory agreement with our results.

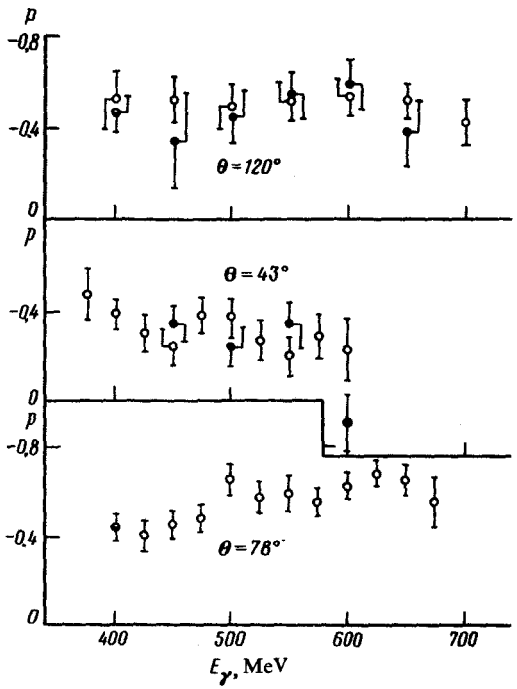

FIG. 1. Energy dependences of the proton polarization in the $\gamma d \rightarrow np$ reaction. ◐-Results of Ref. 3; ●-results of Refs. 4 and 5; ○-our results.

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