NEUTRON POLARIZATION IN THE D(d,n)He³ REACTION

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Values of the polarization of neutrons emitted at various angles θ_n from a deuterium target for deuteron energies $E_d = 12.0 \pm 0.6$ MeV and $E_d = 9.0 \pm 0.7$ MeV have been obtained with the aid of a helium analyzer and by employing the Seagrave phase shifts for $n\alpha$ scattering.

MEASUREMENTS of the polarization of neutrons from the D(d,n)He³ reaction have been carried out by many authors[1-6] using various methods. In their work discrepancies are observed in the behavior of the maximum value of the neutron polarization P_n as a function of the deuteron energy E_d (see the figure). The angle dependence of the polarization has been measured only up to a deuteron energy $E_d = 8.9$ MeV. It would be interesting to supplement the available experimental data on the polarization of neutrons in the D(d,n)He³ reaction for deuteron energies $E_d = 9$—12 MeV.

The measurements of the neutron polarization were carried out with the extracted beam of the cyclotron of the Institute of Theoretical and Experimental Physics with 12.3 ± 0.3 MeV deuterons. The azimuthal asymmetry of the neutron scattering was measured with a helium analyzer.[7] A deuterium-saturated 19-mg/cm² thick zirconium target was used.

The following values of the polarization of neutrons emitted at various angles θ_n from the deuterium target were obtained for two deuteron energies (Seagrave's $n\alpha$-scattering phases were used[8]):

$E_d = 12.0 \pm 0.6$ MeV

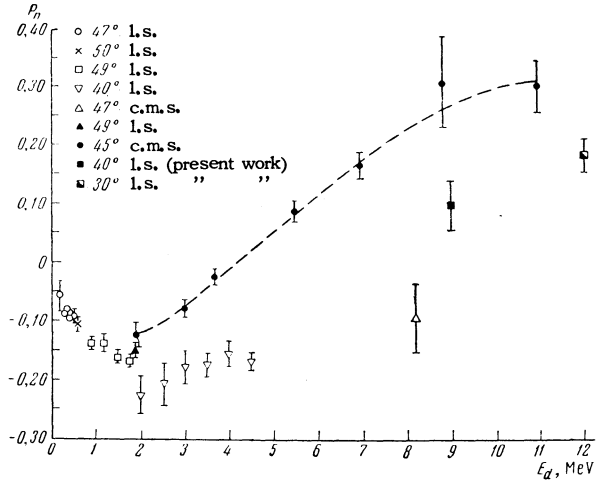
θ_n (l.s.), deg:	20	30	40	50
E_n, MeV:	14.0	13.1	11.9	10.5
P_n, %:	2.2±1.1	18.5±2.3	10.8±3.3	—2.2±3.7

$E_d = 9.0 \pm 0.7$ MeV

θ_n (l.s.), deg:	20	30	40
E_n, MeV:	11.4	10.7	9.8
P_n, %:	—1.6±1.0	1.6±3.4	10.1±3.9

The positive direction was taken throughout to be along the normal $\mathbf{k}_d \times \mathbf{k}_n$.

The maximum values of the neutron polarization obtained from our data are indicated in the figure.



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[1] P. J. Pasma, Nucl. Phys. 6, 141 (1958).

[2] Meier, Scherrer, and Trumpy, Helv. Phys. Acta 27, 577 (1954).

[3] Levintov, Miller, Tarumov, and Shamshev, Nucl. Phys. 3, 237 (1957).

[4] J. A. Baicker and K. W. Jones, Nucl. Phys. 17, 429 (1960).

[5] W. W. Daehnick, Phys. Rev. **115**, 1008 (1959).

[6] P. S. Dubbeldam and R. L. Walter, Nucl. Phys. **28**, 414 (1961).

[7] Trostin, Smotryaev, and Leventov, JETP **41**, 725 (1961), Soviet Phys. JETP **14**, 524 (1962).

[8] J. D. Seagrave, Phys. Rev. **92**, 1222 (1953).

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