Brief Communications

POLARIZATION OF NEUTRONS IN THE REACTION D(d, n)He^3

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THE reaction D(d, n)He^3 is frequently used as a source of polarized neutrons, so that it is important to know the angular and energy dependences of the neutron polarization $P_n(\theta_1, E_d)$ with a high degree of accuracy. Measurements of P_n were made by many authors using diverse procedure[1-9]. The results of all these measurements are shown in the figure. We see a noticeable discrepancy between the data for values of E_d exceeding 2 MeV, which seem to gather around two different curves. The results published to date give some values of P_n on one curve, and some on the other.[8,9]

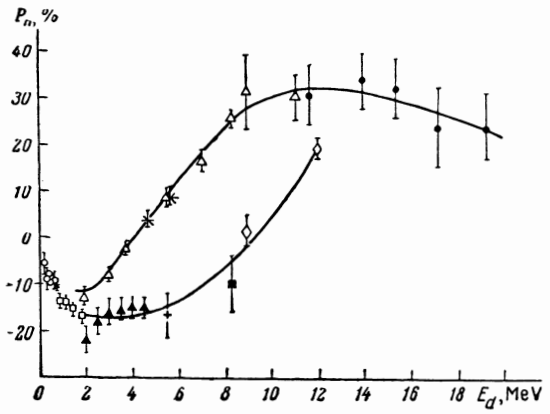
We used our already reported[10] and somewhat improved procedure to measure the polarization of neutrons from this reaction at incident deuteron energies E_d = 4.7 and 5.6 MeV, for a reaction angle $\theta_1 = 45°$ in the c.m.s. The measurements were made with the extracted beam of 6.6 ± 0.1 MeV deuterons from the Radium Institute cyclotron. The target was gaseous deuterium at a pressure of 4.5 atm in a volume bounded by two tantalum foils, the distance between which was 23 mm. The neutrons from the reaction were analyzed with a high-pressure gas scintillation counter (85 atm He^4 + 4 atm Xe) and were registered at an angle $\theta_2 = 135°$ (c.m.s.) with lateral plastic scintillators. The use of fast coincidence circuits ($\tau \approx 3$—4 nsec) decreased the overall background to 5 per cent. The background from the tantalum foils and of the diaphragms was equal to zero.

The measured asymmetry was corrected for both the finite dimensions of the analyzer and detectors and the angular dependence of the reaction cross section. For two values of the incident-deuteron energy we obtain the following results:

$E_d = 5.6 \pm 0.3$ MeV: $\varepsilon_{exp} = 8.2 \pm 2.0\%$ $P_n = +8.7 \pm 2.0\%$
$E_d = 4.7 \pm 0.3$ MeV: $\varepsilon_{exp} = 3.7 \pm 2.0\%$ $P_n = +3.9 \pm 2.0\%$

Here $\epsilon_{exp} = P_n P_2$ —asymmetry corrected for the dependence of the reaction cross section on the angle θ_1. For both values of the energy the analyzing ability $P_2(\theta_2)$, with allowance for corrections for the finite dimensions of the analyzer and detectors, was equal to 94 per cent.

Our values of P_n, as can be seen from the figure, fit well on the curve obtained by the Wisconsin group[6] and by the Moscow group of N. A. Vlasov[9].



Dependence of the polarization of neutrons from the reaction D(d,n)He^3 on the energy of the incident deuterons from data of different authors: o—[1] (47°, l.s.), × —[2] (50°, l.s,), □—[3] (49° l.s,), ▲—[4] (40°, l.s,), ■—[5], (47°, c.m.s.), △—[6] (45°, c.m.s.), + —[7] (40°, l.s,), ◇—[8] (30°, l.s,), ●—[9] (30°, l.s,), * —our data (45° c.m.s.).

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