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The Polarization of Neutrons from the Stripping of Deuterons on C^{12} [1])

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The polarization of neutrons emitted in the stripping reaction $C^{12}(d, n)N^{13}$ has been investigated at deuteron energy 12.9 MeV and different reaction angles. The polarization was found to be:

Reaction angle in LAB system	Polarization
15°	$-(39 \pm 11)\%$
30°	$+(3 \pm 8)\%$
45°	$+(25 \pm 8)\%$
60°	$+(55 \pm 20)\%$

The positive direction of polarization is that of the product $\boldsymbol{k}_{in} \times \boldsymbol{k}_{out}$, $\boldsymbol{k}_{in}$ and $\boldsymbol{k}_{out}$ indicating the wave-vectors of the incident and outgoing particle respectively.

The resolution of the apparatus was not sufficient to provide the separation of groups of neutrons connected with different energy levels of the resultant N^{13} nucleus. Therefore the figures given above represent the superposition of the polarization effects for several energy groups of neutrons which are related also to different amounts of the angular momentum transferred to the resultant nucleus.

Measurements of the energy spectrum of neutrons at different reaction angles were performed using the nuclear emulsion technique. The knowledge of the result of these measurements is however not sufficient to enable the determination of the polarization of particular groups of neutrons, due to their comparable abundance. New experimental data of the angular dependence of the polarization of at least one separate

[1]) The experiments reported in this communication represent the further development of the previous work: A. Budzanowski, K. Grotowski, H. Niewodniczanski and J. Nurzynski, *Bulletin de l'Académie Polonaise des Sciences*, Série des sci. math., astr. et phys., *7*, 583 (1959).

energy group of neutrons from the $C^{12}(d,n)N^{13}$ reaction are necessary. Experiments having this purpose are now in progress.

At the reaction angle $\theta_{lab} = 15°$ the predominant number of neutrons corresponds to the 3.58 MeV excited level of the N^{13} nucleus. The results of measurements of the energy spectrum of neutrons at this angle gave the following relative numbers of neutrons connected with the first three energy states of the resultant N^{13} nucleus:

Ground state	0.19
2.36 MeV excited state	0.20
3.58 MeV excited state	1.00

Taking into account these figures and the energy dependence of the efficiency of the counter we obtain the following value of the polarization of neutrons connected with the 3.58 MeV energy state of the N^{13} nucleus: $-(39^{+21}_{-11})\%$.

So the negative sign of the polarization of neutrons would be connected with the $l = 2$ transition.

Taking into account the results obtained by JUVELAND and JENTSCHKE, HENSEL and PARKINSON, HILLMAN, and HIRD for the level of the nucleus with $l = 1$ the negative sign of polarization suggests for the energy level 3.56 MeV of N^{13} the value of spin $3/2^+$.

Alternatively, the negative sign of the polarization of protons from the reaction $C^{12}(d,p)C^{13}$ corresponding to the second excited level $5/2^+$ of the C^{13} nucleus with $l = 2$ permits us to suppose that in both these cases the negative sign of the polarization determines the value $j = 1 + 1/2$. This could be connected with the preponderance of the distortion of the wave of the outgoing nucleon.