Zeitschrift: Helvetica Physica Acta
Band: 34 (1961)
Heft: [6]: Supplementum 6. Proceedings of the International Symposium on polarization phenomena of nucleons

Artikel: Polarization of nuclei in direct interaction processes
Autor: Igo, G.
DOI: https://doi.org/10.5169/seals-541270

Polarization of Nuclei in Direct Interaction Processes

By G. IGO, Lawrence Radiation Laboratory, Univ. of Calif.

The residual nuclei following a direct interaction process are left in a polarized state in general. The observation of an up-down asymetry in the emission of beta-particles, the polarization of internal conversion electrons, the circular polarization of gamma rays emitted from the residual nucleus depend on the nuclear polarization moments. The experiment of CHASE and IGO [1] is an example of the first type of observation. The theories of the second and third type of measurement have been developed by BECKER and ROSE [2] and by SATCHLER [3] respectively. The angular correlation of an inelastically scattered particle or reaction product with a gamma ray emitted from the residual nucleus also depends on the polarization moments. An example is the $(p,p'\gamma)$ reaction which has been summarized by LEVINSON and BANERJEE [4].

In a (d,p) reaction, the distorted wave direct interaction (DWDI) theory predicts the polarization of the residual nucleus $B(\theta)$ may reach 100% whereas the proton polarization cannot exceed $33^1/_3\%$. However the proton polarization in the $C^{12}(d,p)C^{13}$ reaction at MeV at a scattering angle of 70 degrees has been found to exceed $33^1/_3\%$ [5]. There is also evidence from the $Be^9(d,p)Be^{10}$ reaction [3] and the $C^{12}(d,p\gamma)C^{13}$ correlation [3] that the DWDI theory is inadequate without at least the addition of spin orbit coupling.

A test of the DWDI theory can be made by measuring the asymetry $A(\theta)$ of the scattered deuterons in the $N^{14}(p,d)N^{13}$ when polarized protons are incident on N^{14}, and the polarization $B(\theta)$ of N^{13} in the $H^1(N^{14},N^{13})H^2$ reaction at the same center of mass energy. The DWDI theory predicts that $A(\theta)/B(\theta)$ is a constant independent of the scattering angle θ. A source of 10^6 sec.$^{-1}$ 100% polarized protons has been prepared at Berkeley to study the pick-up reaction.

REFERENCES

[1] L. F. CHASE, Jr. and G. IGO, Phys. Rev. *116*, 170 (1959).
[2] R. L. BECKER and M. E. ROSE, Nuovo Cimento *13*, 1182 (1959).
[3] G. R. SATCHLER (private communication).
[4] C. A. LEVINSON and M. K. BANERJEE, Ann. Physics *2*, 471 (1957), *3*, 67 (1958).
[5] A. C. JUVELAND and W. JENTSCHKE, Phys. Rev. *110*, 456 (1958).