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NEUTRON POLARIZATION EXPERIMENT AT 285 MEV

Hugh Bradner and Robert Donaldson

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June 16, 1954

This letter describes the polarization of neutrons from carbon, beryllium, and lithium targets bombarded with a polarized proton beam from the Berkeley cyclotron.

The polarized proton beam was that developed by Chamberlain, Segrè, Tripp, Wiegand, and Ypsilantis,¹ and was found by them to have a polarization of 65.0% and a mean energy of 285 Mev.

The neutrons were counted in 90-degree coincidence with their recoil protons. Figure 1 shows the counter arrangement in the target area and the events recorded.

Alignment of the apparatus was checked by measuring the asymmetry of double scattered protons as in the experiment of Chamberlain et al.¹ Our data were found to agree at all points, within statistical errors, with their results.

Polarization by two successive scatters in the same plane can be expressed in terms of the resulting asymmetry between left and right counting rates. In the present experiment the polarization, P , is given by $e = L-R/L+R = 0.65 P$.

Figures 2 and 3 give the quasi-elastic asymmetry for neutrons from carbon, beryllium, and lithium targets. For angles greater than 90 degrees c. m. the neutrons were defined by the large resolution telescope, although coincidence was still demanded in the conjugate counter with a small angular resolution.

A subsequent experiment by Chamberlain et al.² using a liquid-deuterium target yields results in good agreement with our data on carbon.

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1. O. Chamberlain, E. Segrè, R. Tripp, C. Wiegand, and T. Ypsilantis, Phys. Rev. 93, 1430 (1954).
 2. O. Chamberlain, R. Donaldson, E. Segrè, R. Tripp, C. Wiegand, and T. Ypsilantis, Phys. Rev., this issue.

It should be noted that the nonzero neutron polarization at 90 degrees indicates the presence of both odd and even terms in the scattering analysis.³

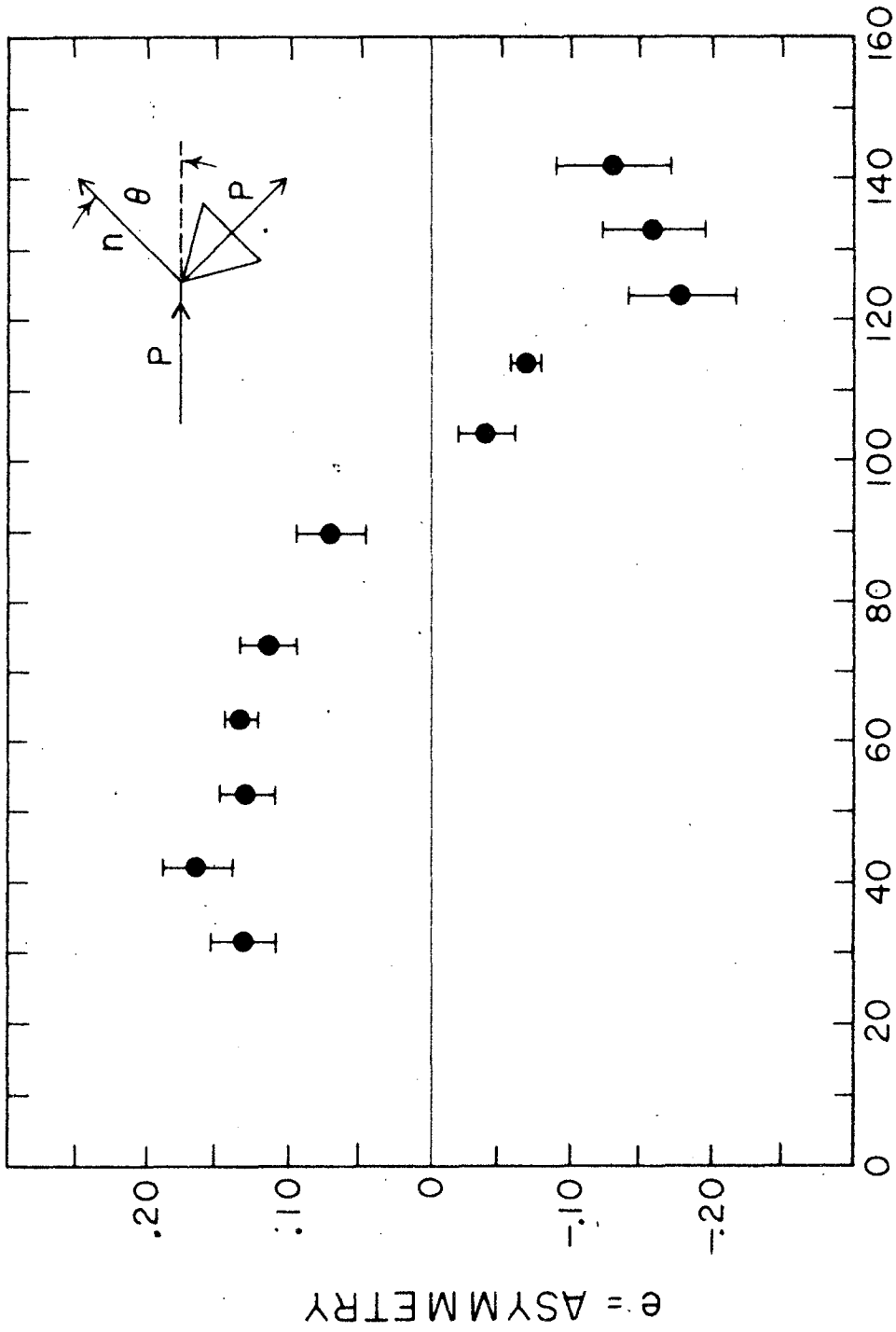
Figure 4 gives the p-p quasi-elastic asymmetry for carbon.

This work was done under the auspices of the Atomic Energy Commission.

3. Don R. Swanson, Phys. Rev. 84, 1086 (1951).

CAPTIONS

- Fig. 1 Experimental setup showing counter arrangement and events recorded. Solid angle subtended by the 1, 2 counter was approximately 0.2×10^{-2} to 0.8×10^{-2} steradian; that of 3, 4 was approximately 0.03 to 0.3 steradian.
- Fig. 2 Asymmetry e plotted as a function of the center-of-mass neutron angle for proton-neutron quasi-elastic scattering off carbon. The errors shown include only counting statistics.
- Fig. 3 Asymmetry e plotted as a function of the center-of-mass neutron angle for proton-neutron quasi-elastic scattering off lithium and beryllium. The errors shown include only counting statistics.
- Fig. 4 Asymmetry e plotted as a function of the center-of-mass proton angle for the proton-proton quasi-elastic scattering off carbon. The errors shown include only counting statistics.



$\theta =$ NEUTRON ANGLE IN CM

Sh's 2



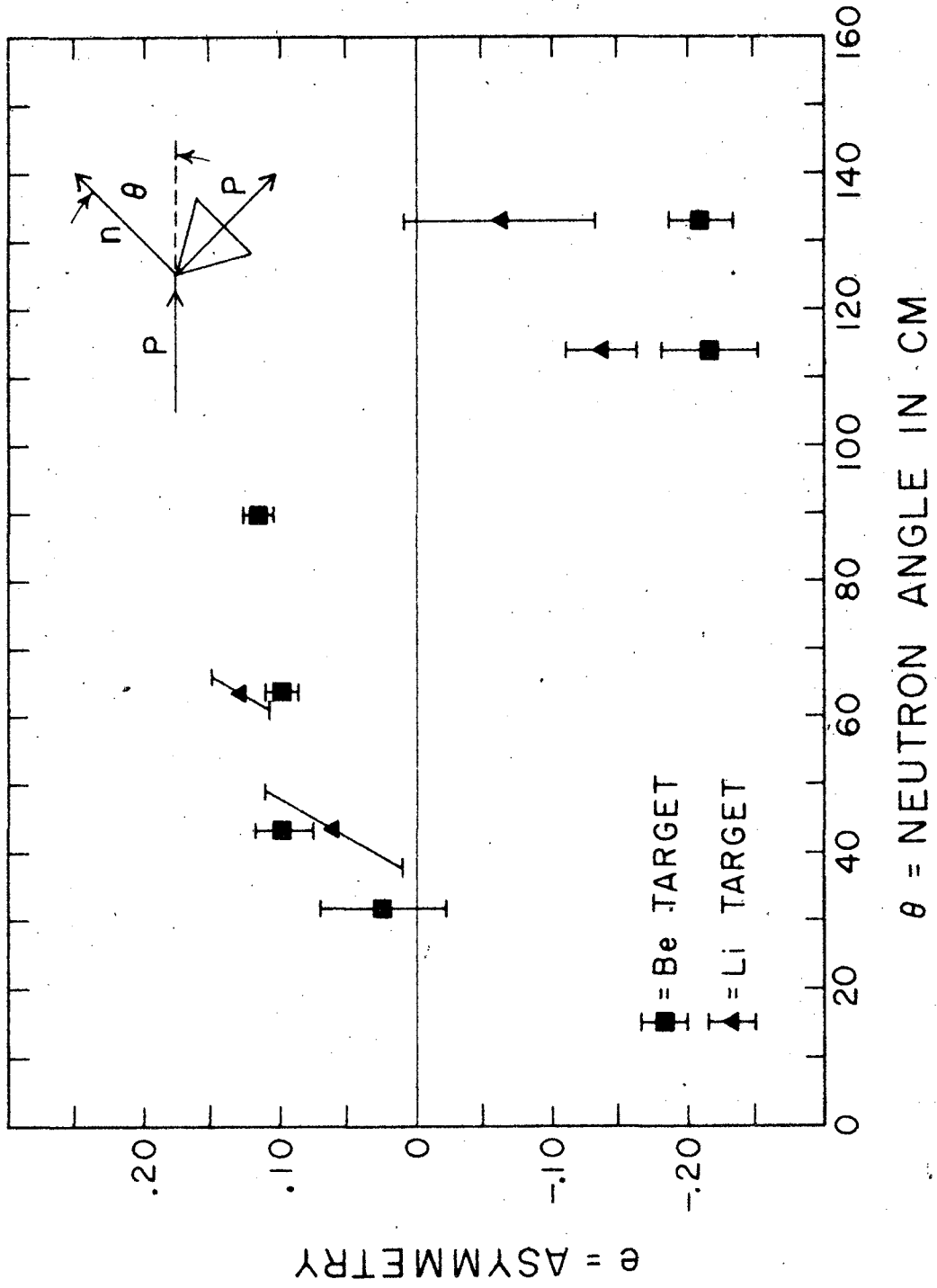
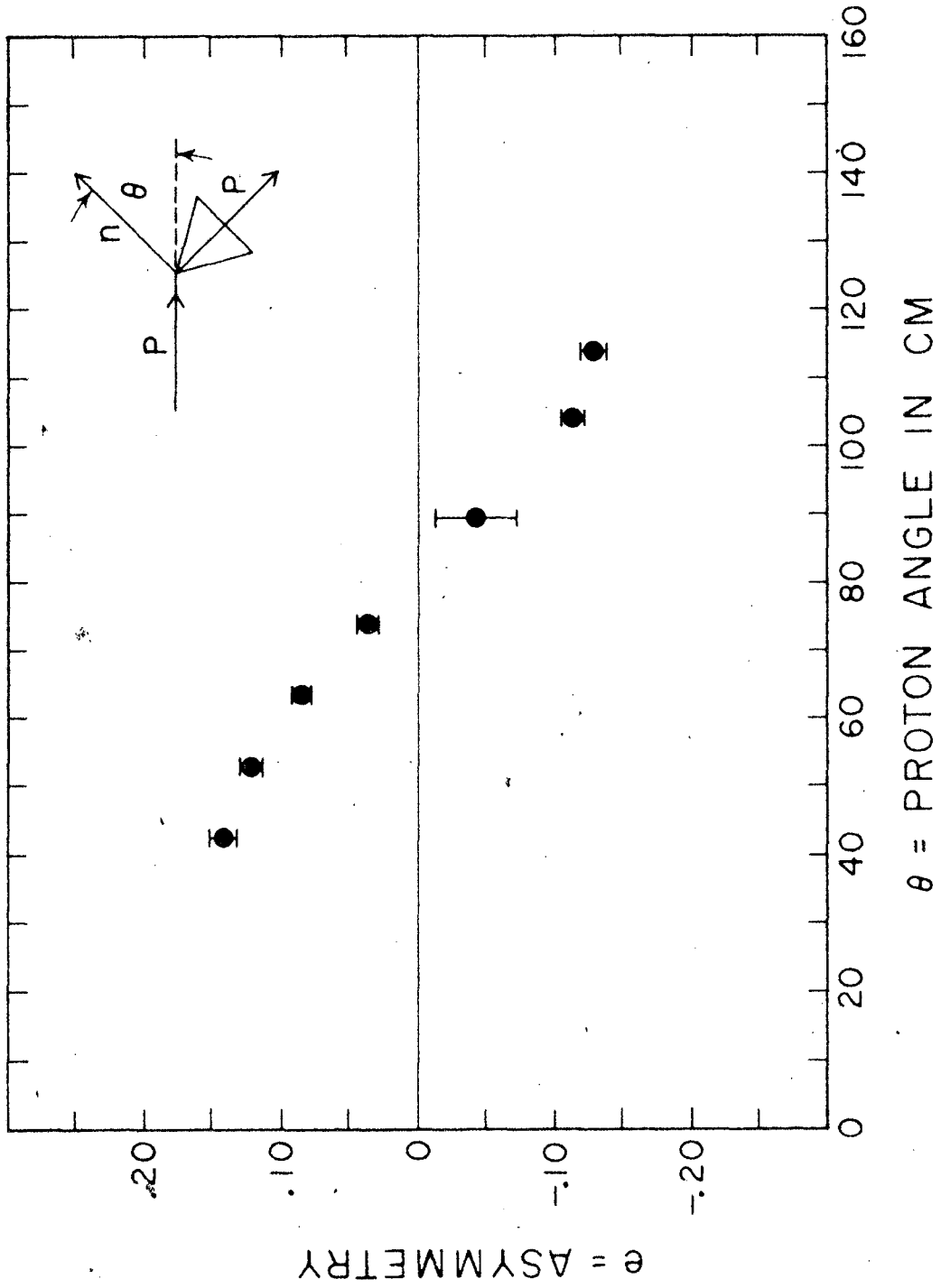
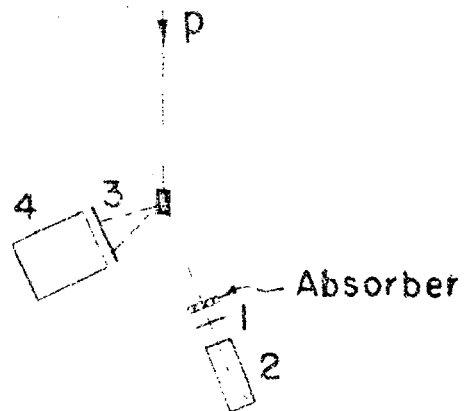


Fig. 1
M.D.



2/19/4



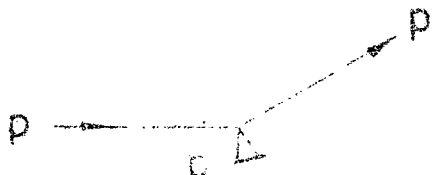
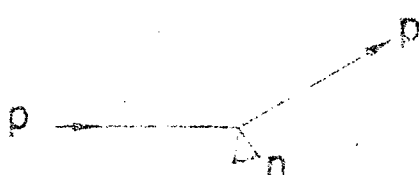
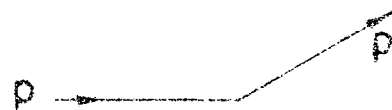
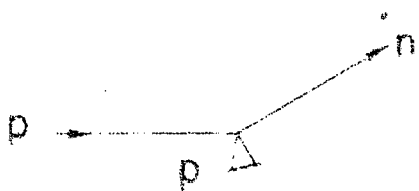
10^{-8} sec. coinc

12
34
14
23
2d3*
14d*

10^{-6} sec. coinc

12, 23
14, 34
14d, 34
12, 2d3

$\approx 6 \times 10^{-8}$ sec delay to determine accidentals



2/5/1

