A Survey of p-α Elastic Scattering as a Polarization Analyzer

By M. J. Scott, A.E.R.E., Harwell

There at present exist at least three different polar graphs of the polarization to be expected in p-α elastic scattering as a function of energy and angle [1], [2], [3][1]). Unfortunately, it is not possible for an

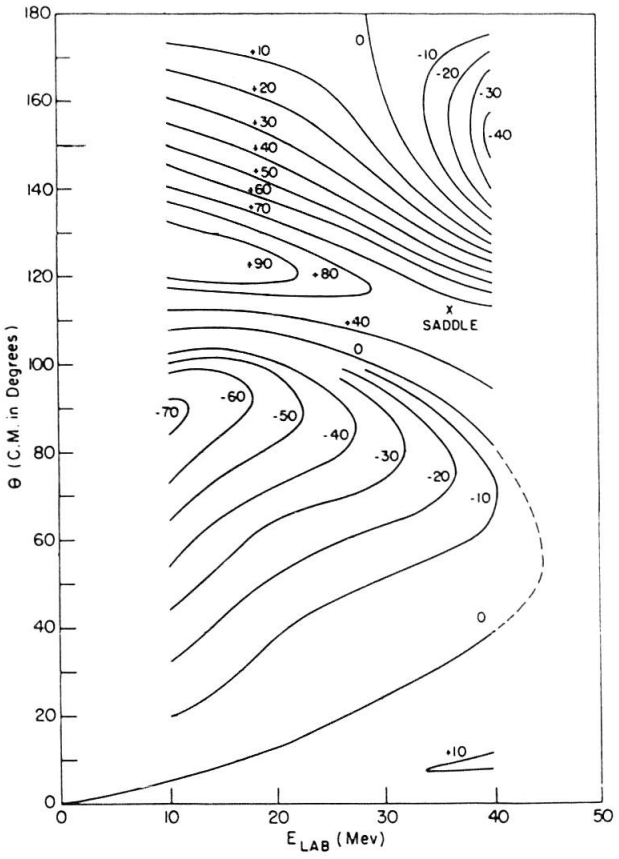

Figure 1

Contour graph of polarization (in %) calculated from a potential [1]

[1]) Numbers in brackets refer to References, page 334.

experimental physicist to use these graphs without an error of roughly $\pm$ 15%. For instance, at $\Theta_{\text{lab.}} = 90°$, $Ep = 10$ MeV, the values read from the graphs are 30% [1], 50% [2] and 60%. This is admittedly the worst disagreement found at 10 MeV. In the energy region up to 18 MeV the polar graph of Brockman is probably the best. One of the polar graphs gives the polarization up to 40 MeV (fig. 1). In this paper a polarization measurement at 15.5 MeV is used to choose a set of phase shifts from five possible sets. The measurement is shown on a plot of polarization as a function of angle at 17.5 MeV (fig. 2). The measurement definitely eliminates sets 1,2 and 3, but lies quite close to sets 4 and 5. Sets 4 and 5 are quite similar, however it is seen that at one angle, at 17.5 MeV, the polarization resulting from set 5 is twice that resulting from set 4. This polar graph is calculated from a potential and using it to extrapolate to 15.5 MeV, it is seen that the agreement of the experimental point with the predicted polarization is indeed excellent. However, the curve of polarization vs. angle for 17.5 MeV read from the polar graph [1]

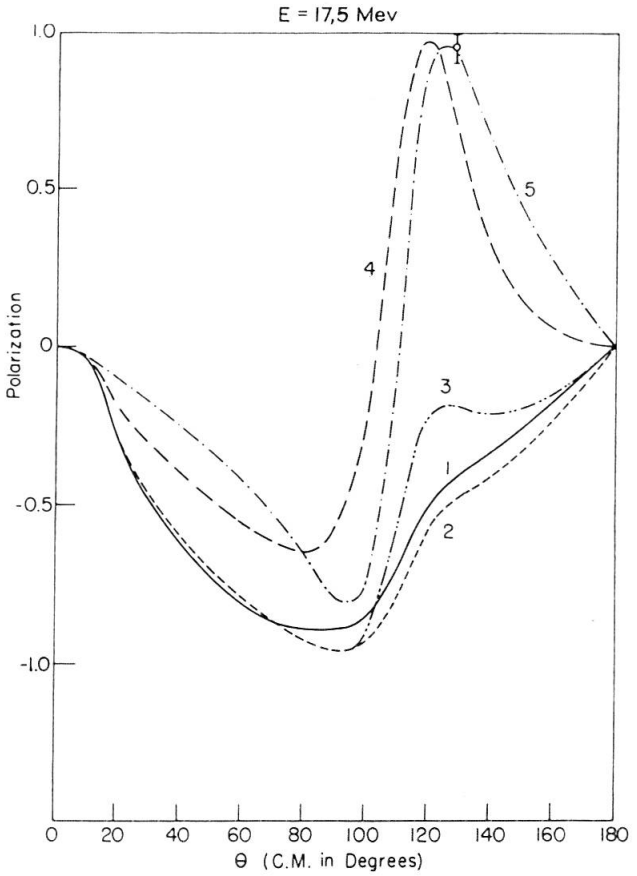

Figure 2

Polarization at 17.5 MeV calculated from five sets of phase shifts. The experimental point is at 15.5 MeV and is due to BROCKMAN

does not agree as well with the experimental data as does a similar curve read from the polar graph of Brockman [2]. It is probable that the polar graph of Gammel and Thaler can be used to choose a region of high polarization in which to make a measurement in order to use p-α elastic scattering as a polarization analyzer.

REFERENCES

[1] J. L. Gammel and R. M. Thaler, Phys. Rev. *109*, 2041 (1958).
[2] K. W. Brockman, Jr., Phys. Rev. *110*, 163 (1958).
[3] G. C. Phillips and P. D. Miller, Phys. Rev. *115*, 1268 (1959).