Proc. Sixth Int. Symp. Polar. Phenom. in Nucl. Phys., Osaka, 1985
J. Phys. Soc. Jpn. 55 (1986) Suppl. p. 698-699

1.73 Elastic scattering of 80 MeV polarized deuterons by ^{209}Bi

S. Roman, J.D. Brown*, C.C. Foster**, H. Nann** and J. Seubert***

Department of Physics, University of Birmingham, England
*Department of Physics, Princeton University, Princeton, NJ
**IUCF, Bloomington, Indiana
***IUPUI, Indianapolis, Indiana

The vector analysing power and differential cross sections have been measured for the elastic scattering of 80 MeV deuterons by ^{209}Bi nuclei. The motivation for elastic scattering measurements on an odd - A target was to enable a comparison to be made with the existing elastic scattering data on the even - even nuclei: ^{58}Ni, ^{206}Pb and ^{208}Pb [1,2,3]), looking for evidence of possible exchange terms in the optical model potential due to the odd nucleon, and near side - far side decomposition effects.

The experiment has been carried out on the Indiana University Cyclotron Facility using the QDDM magnetic spectrometer. The bismuth target was 15.4 mg/cm^2 thick, and the incident deuteron beam polarization was monitored at regular intervals in a polarimeter placed at injection into the main cyclotron.

The characteristic feature of the elastic scattering of deuterons at 80 MeV is that the angular distributions, both the differential cross sections and analysing power, may be divided into two distinctly different regions: (i) The small angle region, upto 50 or 60°, where the analysing power and cross section distributions exhibit regular oscillatory patterns of large amplitude; (ii) The large angle region, above 60°, where the oscillations gradually disappear and the analysing power assumes very high values close to unity.

The obtained results are displayed in Figure 1. A comparison with the experimental data for ^{208}Pb [2]) and ^{206}Pb [3]) shows a very close resemblance between all three sets of measurements, indicating that there is no need for an exchange interaction. However, the analysing power measurements on ^{208}Pb extend to 53° only, so that a meaningful comparison of the sensitive regions of the angular distributions at large angles is only possible between ^{209}Bi and ^{206}Pb. It has been shown by Stephenson et al. [1]) for the case of ^{58}Ni, that the characteristic features of the elastic scattering of deuterons can be understood in terms of semiclassical considerations.

Optical model calculations have been carried out using a code including relativistic corrections. Predictions obtained using the "global" potential of Daehnick et al. [4]), parameters set F, are shown in Figure 1.

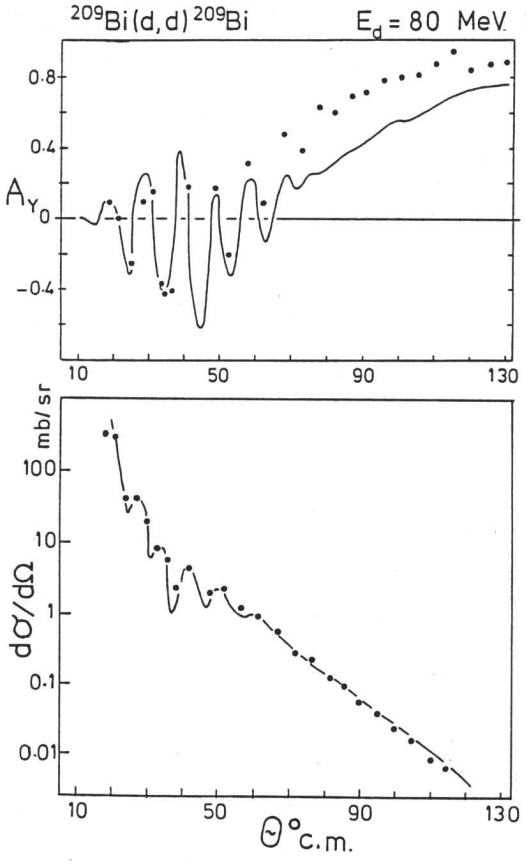

Fig. 1. Differential cross section and vector analysing power of the elastic scattering of 80 MeV deuterons by ^{209}Bi. Optical model prediction using the parameter set F of Daehnick et al. [4] is also shown.

The predictions clearly fail to reproduce the vector analysing power data at large angles. This difficulty is also found in describing the Pb data and to a lesser extent also for ^{58}Ni [1]. Analysis of the results including near side - far side decomposition is proceeding.

References

1) E. J. Stephenson et al.: Nucl. Phys. A359 (1981) 316
2) C. C. Foster et al.: Bull. Am. Phys. Soc. 24 (1979) 594, 838
3) H. Nann et al.: unpublished ^{206}Pb data
4) W. W. Daehnick et. al.: Phys. Rev. C21 (1980) 2253.