Lawrence Berkeley Laboratory
UNIVERSITY OF CALIFORNIA

To be presented at the 5th International Symposium on
Polarization in Nuclear Physics, Santa Fe, NM, August 11-15, 1980

ANALYZING POWERS OF $^3He(\vec{p},p)^3He$ ELASTIC SCATTERING BETWEEN 30 AND 50 MeV

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June 1980

Prepared for the U.S. Department of Energy under Contract W-7405-ENG-48

DISCLAIMER

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ABSTRACT

Analyzing power data have been obtained for $^3He(\vec{p},p)^3He$ elastic scattering at seven energies between 30 and 50 MeV at laboratory angles between 20^o and 160^o. Errors are typically less than 0.01. These results supplement earlier differential and total reaction cross-section and analyzing power data and new data obtained with a polarised ^3He target.

INTRODUCTION

In a recent phase-shift analysis[1] of p-^3He scattering data unusual behaviour of the ^1S_o, $^1P_1$ and $^1D_2$ phases was observed in the energy range between 20 and 50 MeV. With a view to enlarging the data base and to obtain improved phase parameters, we have made measurements of the $^3He(\vec{p},p)^3He$ analyzing powers at laboratory angles between 20^o and 160^o at proton energies of 32.4, 35.1, 37.6, 40.1, 45.0, 47.6 and 49.6 MeV. These angular distributions complement those[2] at 21.4, 24.8, 27.3 and 30.1 MeV and differential cross section[3] and total reaction cross-section data[4] as well as data obtained with a polarised ^3He target[5].

EXPERIMENT AND RESULTS

The polarised proton beam from the 88" cyclotron of the Lawrence Berkeley Laboratory was transported to a gas cell containing ^3He gas at pressures between 1 and 2 atmospheres. Beam currents on

[†]Work supported in part by the Natural Sciences and Engineering Research Council of Canada and by the U.S. Department of Energy under Contract W-7405-ENG-48.

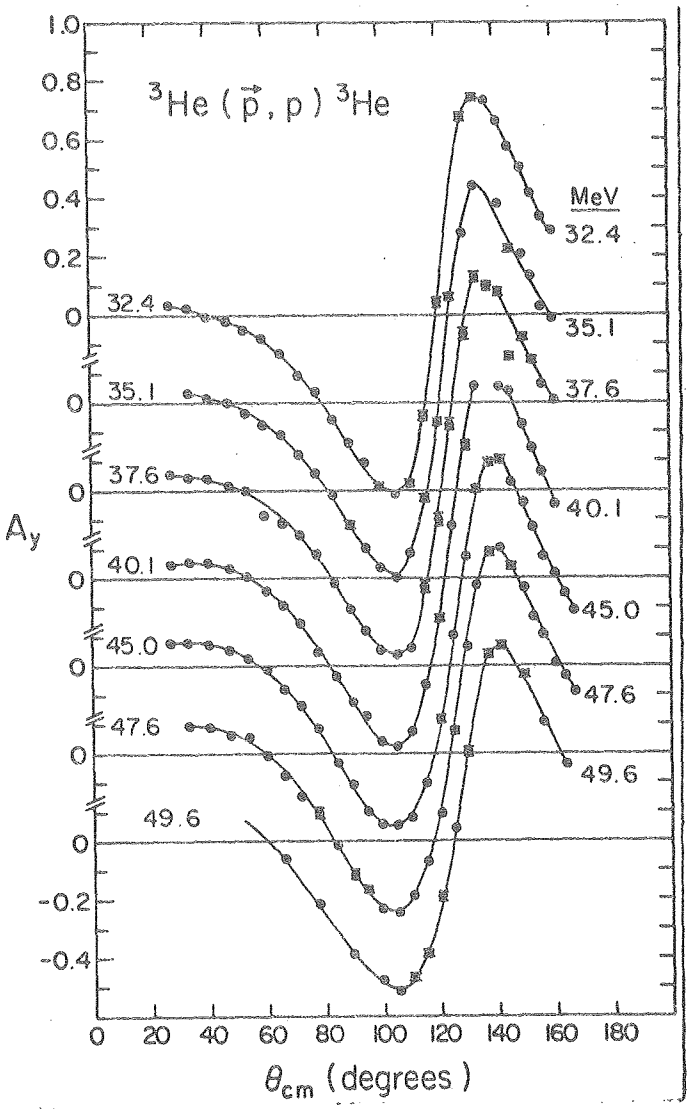

Fig. 1 Analyzing powers A_y for ^{3}He($\vec{p}$,p)^{3}He between 30 and 50 MeV. The curves are to guide the eye.

target were varied between 10 nA and 100 nA while the beam polarization was typically 0.8.

The gas target was contained in a scattering chamber, at the entrance and exit of which collimation slits were fitted. Current falling on the left and right components of these slits was monitored and beam transport parameters adjusted to ensure that these currents were equalised. In the first series of runs (at 32.4, 35.1, 37.6 and 40.1 MeV) these adjustments were made by hand. An automatic control system was installed for subsequent runs.

The scattering chamber contained arrays of detectors placed symmetrically at either side of the beam. Four detector systems in the first and two in the second series of runs were used.

An absorber wheel downstream of the scattering chamber was used to reduce the beam energy to that appropriate for the beam polarimeter. The polarimeter was immediately downstream from the absorber wheel. One detector system at either side of the beam detected protons elastically scattered from the polarisation analyser, which was ^{4}He gas for the first and a ^{12}C foil for the second set of measurements. The ^{4}He and ^{12}C analyzing powers were taken from the data of Bacher et al.[6] and Kato et al.[7]

Beam was collected in a Faraday cup and charge integrated. The beam polarisation was reversed at the source a few times per second on the basis of equal Faraday cup charge per spin state.

The results of the measurements are shown in fig. 1. Corrections for finite geometry were very small (usually less than 0.001) and have been incorporated into the data only at 32.4 and 35.1 MeV. The statistical error bars when not shown are smaller than the size of the dots.

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