ELASTIC SCATTERING OF 100 MeV ^{7}Li IONS FROM ^{58}Ni AND ^{12}C

W.D. Ploughe and J.W. Kerns
The Ohio State University, Columbus, Ohio 43212

W.W. Jacobs and P. Schwandt
Indiana University Cyclotron Facility, Bloomington, Indiana 47405

The differential cross sections for elastic scattering of 99 MeV ^{7}Li ions from ^{12}C and ^{58}Ni were measured using the QDDM magnetic spectrometer at the Indiana University Cyclotron Facility. A natural carbon target (thickness 2.08 mg/cm^2) and an isotopically enriched target of ^{58}Ni (thickness 8 mg/cm^2) were used in examining an angular range for θ_{Lab} between 6° and 50°.

The preliminary angular distributions are shown in Fig. 1. Possible contributions to the elastic peak from the 0.477 MeV excited state of ^{7}Li have been subtracted from all spectra for both targets. A similar subtraction was made for the ^{13}C elastic peak arising from the natural carbon target. Absolute calibration of the scattering angle was deduced from measurements made at forward angles on both sides of the beam. The relative errors are smaller than the size of the data points shown in the figure for all lab angles less than 45° ($\theta_{cm} \sim 50°$ for ^{58}Ni and 70° for ^{12}C), with larger angles having relative errors of about ±15%, except for the $\theta_{cm} = 81°$ ^{12}C point, which has a relative error of about ±25%. The overall normalization is known to an uncertainty of about ±7%.

The elastic scattering of lithium ions is of interest as one attempts to understand in more detail those reaction processes which lie between the extremes characteristic of light and heavy ion scattering. Elastic scattering measurements for ^{6}Li ions at 99 MeV from a variety of targets (including ^{12}C and ^{58}Ni) have recently been published and a comparison between those results and the results of this present experiment is a major objective of the present study. Attempts are presently being made to reproduce the ^{7}Li data with a six-parameter phenomenological optical model potential using the optical model search code SNOOPY.[2]

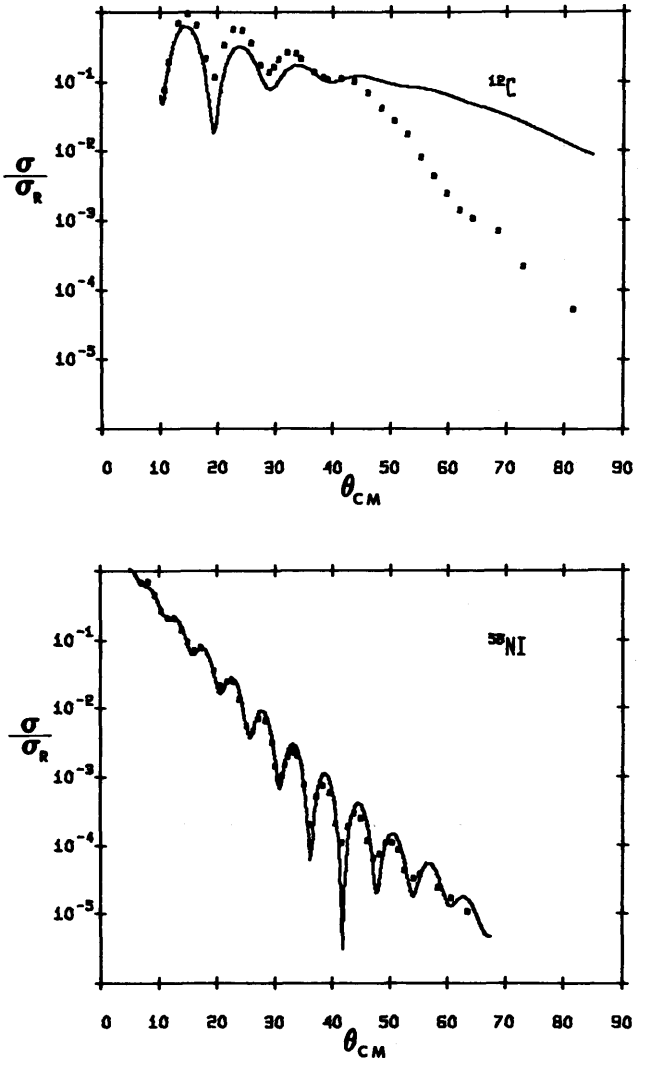

Figure 1. Angular distributions of the differential cross sections for ^{7}Li + ^{58}Ni and ^{12}C at approximately 100 MeV. The curves are optical model calculations using the 99 MeV ^{6}Li optical model parameters of Ref. 1.

Calculations using the 99 MeV ^{6}Li potential parameters of Ref. 1 are in good agreement with the ^{7}Li data for ^{58}Ni, but fail for ^{12}C (see Fig. 1). On the other hand, since the electric quadrupole moment of ^{7}Li is approximately 50 times that of ^{6}Li, the effect of the quadrupole moment on the scattering process is also to be examined.

The angular distributions of the ^{6}Li and ^{7}Li scattering are to be compared with other models as well. Several investigators have tried the double-folding model for generating the real optical potential with limited success.[3-6] The potential so derived usually has to be normalized by a factor of approximately 0.5. One might consider including a quadrupole term in addition to the usual spherical density term in the double-folding model. This has been shown to yield good results for both ^{7}Li and ^{9}Be scattering at lower energies.[7-8] Dreves et al.[9] have been able to obtain reasonable fits to data obtained from aligned ^{6}Li and ^{7}Li ions scattering at low energies with the addition of a phenomenological term added to the real optical potential. We expect to explore these possibilities in the future.

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