THE (p,t) REACTION AT HIGHER ENERGY

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As the first portion of a study of the energy dependence of the (p,t) reaction, the $^{54}Fe(p,t)^{52}Fe$ and $^{208}Pb(p,t)^{206}Pb$ reactions were observed at E_p=80 MeV. The $^{12}C(p,t)^{10}C$ reaction was also observed. Data for these reactions will also be acquired at about 160 MeV bombarding energy upon completion of an intrinsic germanium counter telescope presently under construction at the University of Colorado.

Data were acquired using the QDDM spectrometer and an 80 MeV proton beam from the Indiana University cyclotron. A typical spectrum for the $^{54}Fe(p,t)$ reaction with about 100 keV (FWHM) resolution is shown in Fig. 1. Angular distributions for 3 of these levels are shown in Fig. 2. The solid curves are the results of DWBA calculations using proton parameters[1] obtained at 61.4 MeV and an energy dependent ^3He potential from ref. 2. Based on an $(f_{7/2})^2$ configuration and using a normalization D_o^2=22 x 10^4MeV^3-fm^3, the DWBA calculations reproduce the shapes of the angular distributions reasonably well. The magnitudes are less well predicted, however. Although an enhancement factor of 1.34 is obtained for the ground state, enhancements of 0.30 and 0.06 are obtained for the 0.81 and 3.56 MeV levels. Numerous other proton and ^3He optical potentials were tried without changing the predicted enhancements by more than 50%. In all cases the shapes of the angular distributions were less well reproduced.

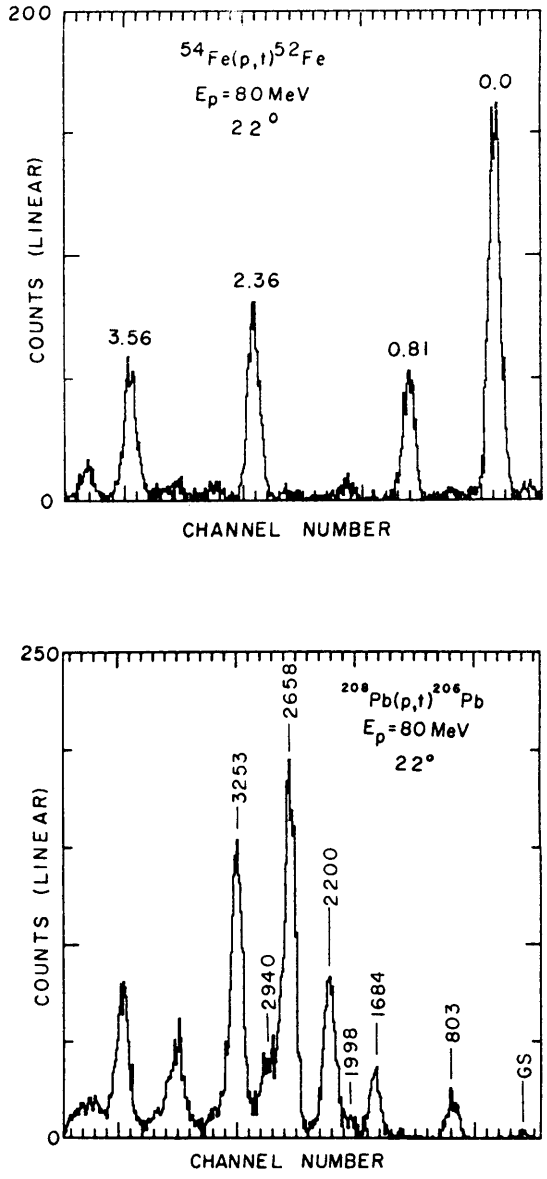

Figure 1. Typical spectra observed in the $^{54}Fe(p,t)^{52}$ and $^{208}Pb(p,t)^{206}Pb$ reactions.

The sensitivity of the data to small changes in the other optical model parameters is gratifying

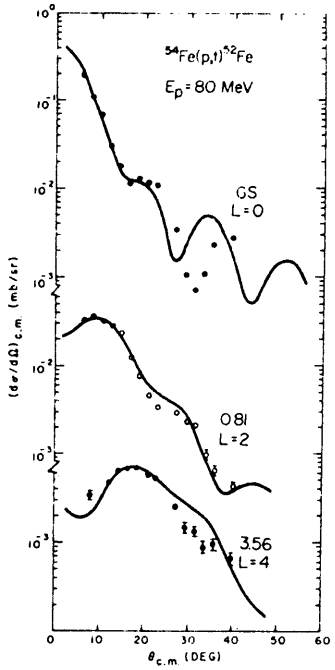

Figure 2. Angular distributions for several levels observed in ^{52}Fe. The solid curves are the results of DWBA calculations described in the text.

since one of the aims of this work is to assess the applicability of the two families of mass-three optical potentials which are presently available. These two families of potentials are classed as "deep" or "shallow" potentials depending on the value of the volume integral. A deep potential has a volume integral J ≈ 440 MeV-fm^3 while a shallow potential has J ≈ 330 MeV-fm^3. The calculations shown in fig. 2 use a deep mass three potential. No calculations have as yet been attempted using a shallow potential.

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1) C.B. Fulmer et al., Phys. Rev. 181 (1969) 1565.

2) J. R. Shepard et al., Nucl. Phys. A275 (1977) 189.