EXCITATION OF HIGH-SPIN STATES BY INELASTIC PROTON SCATTERING

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Results on the excitation of $(d5/2)^{-1}(f7/2)$ states in ^{28}Si and ^{24}Mg (see last year's report) have been published.[1] Conclusions about the 6^-, T=1, state in Mg, at 15.14 MeV, were in excellent agreement with those of the Toronto-Bates (e,e') group.[2] Calculations of cross sections for the 6^-,1 (14.35 MeV), 4^-,1 (12.66 MeV), and 6^-,0 (11.58 MeV) states in Si, using a new energy-independent pseudopotential in plane-wave impulse approximation[3] provided good agreement with the data. Excitation energies for the 47 states observed in ^{24}Mg, the 70 observed in ^{28}Si, and the 97 observed in ^{40}Ca, together with differential cross sections for many of these excitations, are listed in Adams' thesis.[4] Further analysis of the ^{28}Si data[4] led to a tentative identification of the 4^- component of the $(d5/2)^{-1}(2p3/2)$ multiplet for which there was some evidence in earlier (e,e') work.[5] The strength seems about equally split between levels at 15.59 and 15.67 MeV. The expected dip in the cross section is evident, though it falls at slightly larger momentum transfer than expected from the oscillator form factor.

Data on $^{208}Pb(p,p')$ taken at 135 MeV showed considerable structure in the 4-7 MeV excitation region. Since the resolution in that data was 70-80 keV, the experiment was repeated at 100 MeV in an attempt to get narrower lines and thus to see if the apparently single peaks were indeed single. With a carefully prepared beam and dispersion matching line widths of 35-40 keV were observed. A comparison of data from the two runs, at the same momentum transfer (about 375 MeV/c) is shown in Fig. 1. In addition to the well-known 3^- (2.61 MeV) and 5^- (3.20 and 3.71 MeV) excitations, a positive-parity, even-spin, band was seen to be strongly excited: 2^+ (4.09 MeV), 4^+ (4.32 MeV), 6^+ (4.42 MeV), 8^+ (4.61 MeV), and 10^+ (5.07 MeV). These results are in good correspondence with results from electron inelastic scattering.[6] The origin of the other strong peaks is not yet fully understood, but the peak at 5.53 MeV has a differential cross section suggesting that its spin is low, while the peak at 7.04 MeV shows the bell-shaped angular distribution characteristic of a high-spin, stretched-angular momentum, particle-hole state (14^- ?, or perhaps 12^- ?). Some of the ^{208}Pb results were reported at the Rochester meeting.[7]

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4) G.S. Adams, thesis, Indiana University, 1977 (unpublished), available as IUCF Internal Report 77-3.

5) T.W. Donnelly, et al., Phys. Lett. 32B, 545 (1970).

6) J. Friedrich, et al., Phys. Lett. 64B, 269 (1976); E. Weber, et al., Phys. Lett. 65B, 189 (1976).

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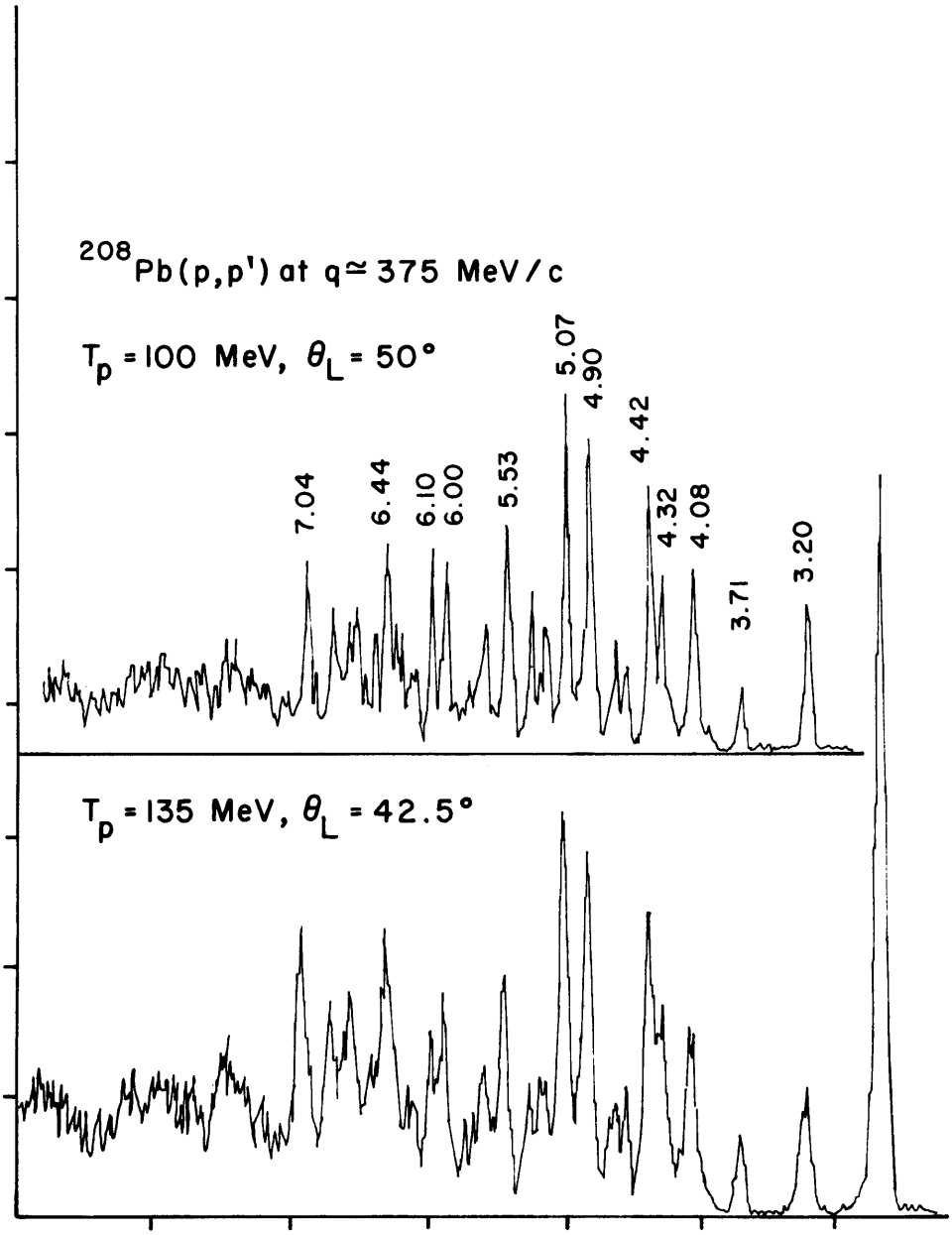

Figure 1