# PROTON STRIPPING TO STRETCHED STATES IN $^{26}$Al, $^{52}$Cr and $^{60}$Ni

R.J. Peterson, B.L. Clausen and J.J. Kraushaar
University of Colorado, Boulder, Colorado 80309

R.A. Lindgren and M.A. Plum
University of Massachusetts, Amherst, Massachusetts 01003

W.W. Jacobs, H. Nann and S. Roman[+]
Indiana University Cyclotron Facility, Bloomington, Indiana 47405

The stretched states of highest angular momentum of an even-mass target formed by a particle-hole combination are accessible by both inelastic scattering and charge exchange reactions, or by single nucleon stripping onto the appropriate odd-mass target. We have populated the $6^-$ states of $^{26}$Al from the $5/2^+$ ground state of $^{25}$Mg by $f_{7/2}$ proton stripping. Similarly, the $8^-$ states of $^{52}$Cr and $^{60}$Ni were populated by $g_{9/2}$ proton stripping on the $7/2^-$ ground states of $^{51}$V and $^{59}$Co, respectively. The states of $^{26}$Al are also accessible by the $^{26}$Mg(p,n)$^{26}$Al reaction, and their T=1 analogs have been studied by $^{26}$Mg (p,p')[1] and (e,e').[2]

Similar studies of scattering[3] and nucleon transfer reactions[4] to the $6^-$ states in A=28 have been reported. Whereas $^{28}$Si exhibits but one strong $6^-$ state of each isospin, T=0 and T=1, a broader array of T=1 $6^-$ levels is known for A=26.[1] This permits a more interesting test of the comparison between coherent (scattering) and incoherent (stripping) excitation of these simple stretched states. A theoretical framework based on the Nilsson scheme has in fact been developed.[5] For $^{60}$Ni, electron scattering data exist[6] to permit this comparison for a wide array of $8^-$ states, while for $^{52}$Cr, new electron scattering results are currently being analyzed.[7]

We used the (α,t) stripping reaction at a beam energy of 80 MeV to enhance the population of the high spin states. Sample spectra for $^{26}$Al and $^{60}$Ni, with an instrumental resolution of 90 keV, obtained with the QDDM spectrometer system, are shown as Figs. 1 and 2.

For $^{60}$Ni, the known $8^-$ states[6] are indicated; as expected, the (α,t) reaction has selectively emphasized these states even at very high excitation energies. For $^{26}$Al, the peaks corresponding to the T=1 analog $6^-$ states[1] in $^{26}$Mg are noted, with our measured excitation energies. Angular distributions for these states in $^{26}$Al have been analyzed, and comparison to

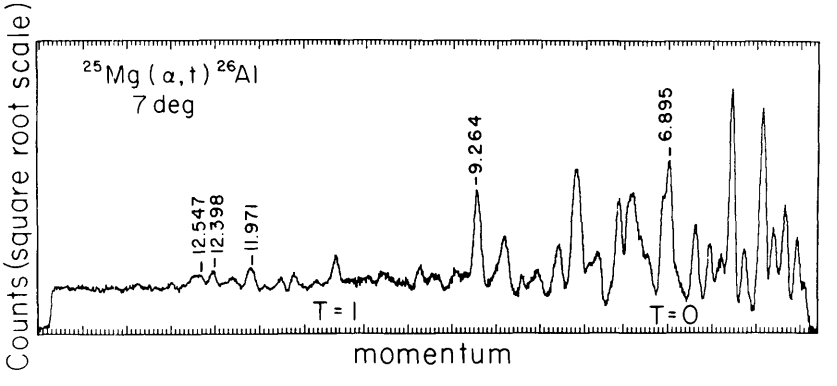


Figure 1. A composite momentum spectrum for the $^{25}$Mg(α,t)Al reaction is shown on a square root scale. Excitation energies are shown for the states assigned spins of $6^-$ from the present work or from previous data (see text).

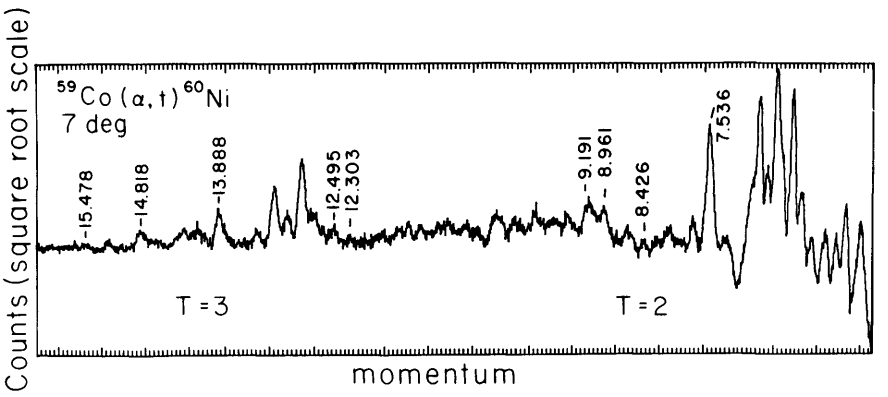


Figure 2. A composite momentum spectrum for the $^{59}$Co(α,t)$^{60}$Ni reaction is shown. States with $8^-$ spin assignment from electron scattering data are indicated and separated into T=2 and T=3 regions.

DWBA predictions and to the known $7/2^-$ transfer on a $^{24}$Mg target confirm the negative parity. Spectroscopic factors will be obtained by use of the exact-finite-range DWBA code DWUCK5.[8]

Analysis of the data for $^{60}$Ni and $^{52}$Cr is now beginning. A very good energy calibration, based on stripping to well known levels with $^{12}$C and $^{60}$Ni targets, has given excitation energies for the $8^-$ states of $^{60}$Ni to an accuracy of ±10 keV, permitting a very clear comparison to the electron scattering data.[6] The values indicated in Fig. 2 are from the on-line peak fitting and may change somewhat with more careful peak fitting.

+Permanent Address: Physics Department, University of Birmingham, Birmingham, B15 2TT England

1) D.F. Geesaman et al., IUCF Scientific and Technical Report 1983, p.17.

2) R.A. Lindgren et al., Bull. Am. Phys. Soc. 27, 697 (1982).

3) G.S. Adams et al., Phys. Rev. Lett. 38 1387 (1977); S. Yen et al., Phys. Lett. 105B, 421 (1981); C. Olmer et al., Phys. Rev. Lett. 43, 612 (1979); S. Yen et al., Phys. Rev. C 27, 1939 (1983).

4) G. Ciangaru et al., Phys. Rev. C 29, 2017 (1984).

5) L. Zamick, Phys. Rev. C 29, 667 (1984).

6) R.A. Lindgren et al., Phys. Rev. Lett. 47, 1266 (1981).

7) B. Zeidman, private communication.

8) P.D. Kunz, University of Colorado, unpublished.