

FRAGMENTATION OF HIGH-SPIN PARTICLE-HOLE STATES IN ^{26}Mg

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A considerable body of information is now being obtained on the excitation of spin-flip degrees of freedom in medium-energy inelastic scattering and charge-exchange reactions. The isovector spin-flip strength seems to be systematically quenched,¹ but there is no general agreement on the quenching mechanism, and it may be that various mechanisms contribute differently for transitions of high and low multipolarity, or in different regions of the periodic table. There are less data on isoscalar spin-flip excitations, but results from both (p,p') and (π,π') work indicate an even larger quenching for at least some of these transitions.²⁻⁴

Several theoretical explanations have been offered for this reduction in spin-flip strength. These explanations divide into three general classes; valence shell fragmentation, renormalization by admixture of higher energy particle-hole configurations (e.g. $3\pi_{10}$ admixtures into $1\pi_{10}$ states), and the introduction of non-nucleonic degrees of freedom. Among the kinds of valence-shell effects considered have been particle-vibration coupling,⁵ larger-basis shell model calculations,⁶ and the effects of deformation.^{7,8} Admixtures of $3\pi_{10}$ and $5\pi_{10}$ configurations have been considered for both heavy⁹ and light¹⁰ nuclei. In the

final class, mesonic renormalizations of the spin current have been considered,¹¹ and, for isovector transitions, the explicit introduction of delta-hole states.^{12,13} Delta-hole states are thought to affect low-multipolarity modes much more than those of high multipolarity.¹⁴

The aim of this experiment was to try to learn something about the contributions of these mechanisms by studying the quenching as a function of single-particle occupation probability, ground-state isospin, and multipolarity. The sd-shell seemed to provide good targets for the work. In addition to the "stretched" 6^- states,²⁻⁴ several 1^+ states are known from previous work.¹⁵

Measurements of differential cross section and analyzing power have been carried out for ^{26}Mg at 135-MeV bombarding energy. Data were taken in 5° steps from 10° to 60° over an excitation-energy range of 0 to 20 MeV. Based on the data shown in Figs. 1 and 2, five 6^- states have been identified, at excitation energies of 9.18 ± 0.03 , 11.98 ± 0.03 , 12.48 ± 0.03 , 12.85 ± 0.03 , and 18.05 ± 0.05 MeV. The 18.05-MeV level is believed to be a $T=2$ state.

DWIA calculations are being performed to extract transition strengths for these states. With these data

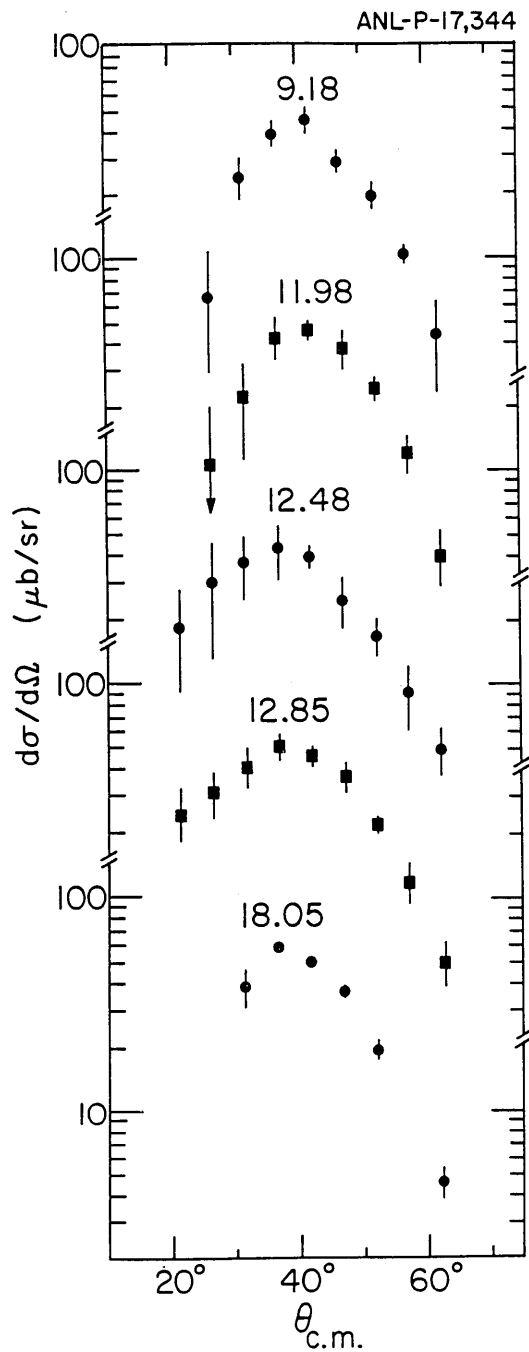


Figure 1. Angular distributions for 5 states identified as 6^- states in the $^{26}\text{Mg}(p,p')$ reaction.

and that previously published^{2,3} on ^{24}Mg and ^{28}Si , we will be able to study the systematics of quenching of spin-flip strength under controlled changes in nuclear structure. This should provide additional insight into the underlying quenching mechanism.

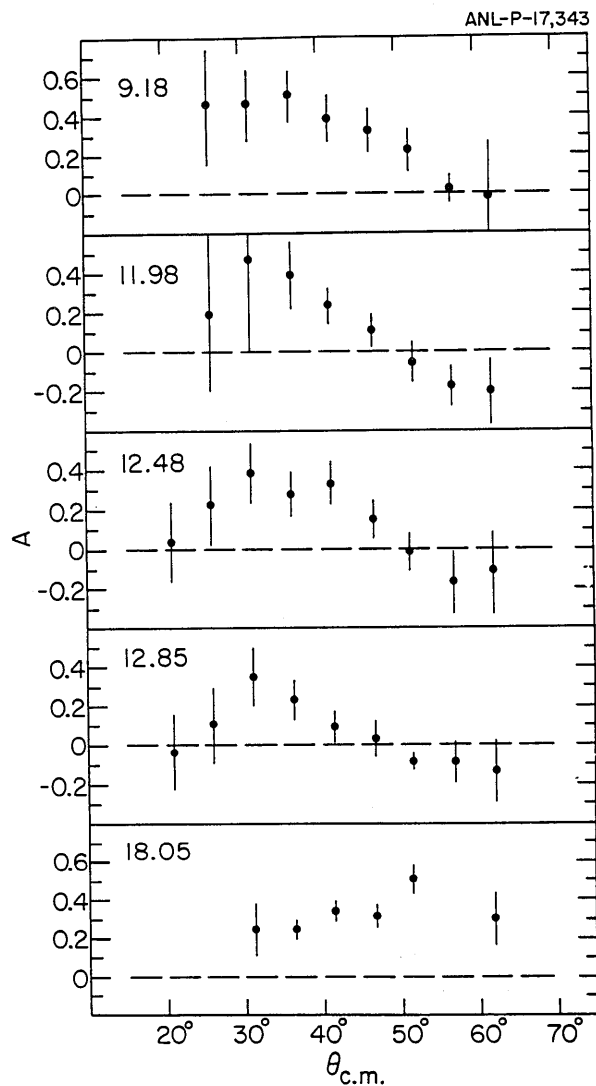


Figure 2. Analyzing powers for the 6^- states observed in the $^{26}\text{Mg}(p,p')$ reaction.

- 1) E.g., F. Petrovich and W.G. Love, Nucl. Phys. A354, 499c (1981).
- 2) G.S. Adams, A.D. Bacher, G.T. Emery, W.P. Jones, R.T. Kouzes, D.W. Miller, A. Picklesimer, and G.E. Walker, Phys. Rev. Lett. 38, 1387 (1977).
- 3) C. Olmer, A.D. Bacher, G.T. Emery, W.P. Jones, D.W. Miller, H. Nann, P. Schwandt, S. Yen, T.E. Drake, and R.J. Sobie, Phys. Rev. C 29 361 (1984).
- 4) C. Olmer, B. Zeidman, D.F. Geesaman, T.-S.H. Lee, R.E. Segel, L.W. Swenson, R.L. Boudrie, G.S. Blanpied, H.A. Thiessen, C.L. Morris, and R.E. Anderson, Phys. Rev. Lett. 43, 612 (1979).
- 5) S. Krewald and J. Speth, Phys. Rev. Lett. 45, 417 (1980).
- 6) A. Amusa and R.D. Lawson, Phys. Rev. Lett. 51, 103 (1983).
- 7) L. Zamick, Phys. Rev. C 29, 667 (1984).
- 8) G.T. Emery, in Proc. Intern. Conf. Highly Excited States and Nuclear Structure, Orsay, France, 1983 (to be published).
- 9) I. Hamamoto, J. Lichtenstadt, and G.F. Bertsch, Phys. Lett. 93B, 213 (1980).
- 10) P. Blunden, B. Castel, and H. Toki, Z. Phys. A 312, 247 (1983).
- 11) W. Knüpfer, M. Dillig and A. Richter, Phys. Lett. 95, 349 (1980).
- 12) M. Ericson, A. Figureau, and C. Thévenet, Phys. Lett. 45B, 19 (1973); M. Rho, Nucl. Phys. A231, 493 (1974); E. Oset and M. Rho, Phys. Rev. Lett. 42, 47 (1979).
- 13) A. Bohr and B.R. Mottelson, Phys. Lett. 100B, 10 (1981).
- 14) F. Osterfeld, S. Krewald, J. Speth, and T. Suzuki, Phys. Rev. Lett. 49, 11 (1982).
- 15) W.L. Bendel, L.W. Fagg, R.A. Tobin and H.F. Kaiser, Phys. Rev. 173, 1103 (1968).

POLARIZED PROTON SCATTERING FROM ^{88}Sr : DETERMINATION OF NEUTRON TRANSITION DENSITIES

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Spectra of 200 MeV polarized protons scattered from ^{88}Sr were recorded at angles from 8° to 44° , chosen such that scattering from target impurities least obscured physics of interest. These spectra have since been reduced to cross sections and analyzing powers for excitation energies less than 4.2 MeV. The data set covers the complete angular range for the ground state, the 2^+ states at 1.836, 3.218, and 4.035 MeV, the 3^- state at 2.734 MeV, and the 5^- state at

3.585 MeV. Data for the 1^+ state at 3.486 MeV at 8° and 9.5° were also obtained. These two cross sections were reduced first, and reported at the 1983 Spring APS meeting.¹

Recently, effort has been directed towards a combined electron scattering and polarized proton scattering analysis of the three lowest lying 2^+ states. Existing electron scattering measurements² performed at the MIT-Bates linear accelerator provide