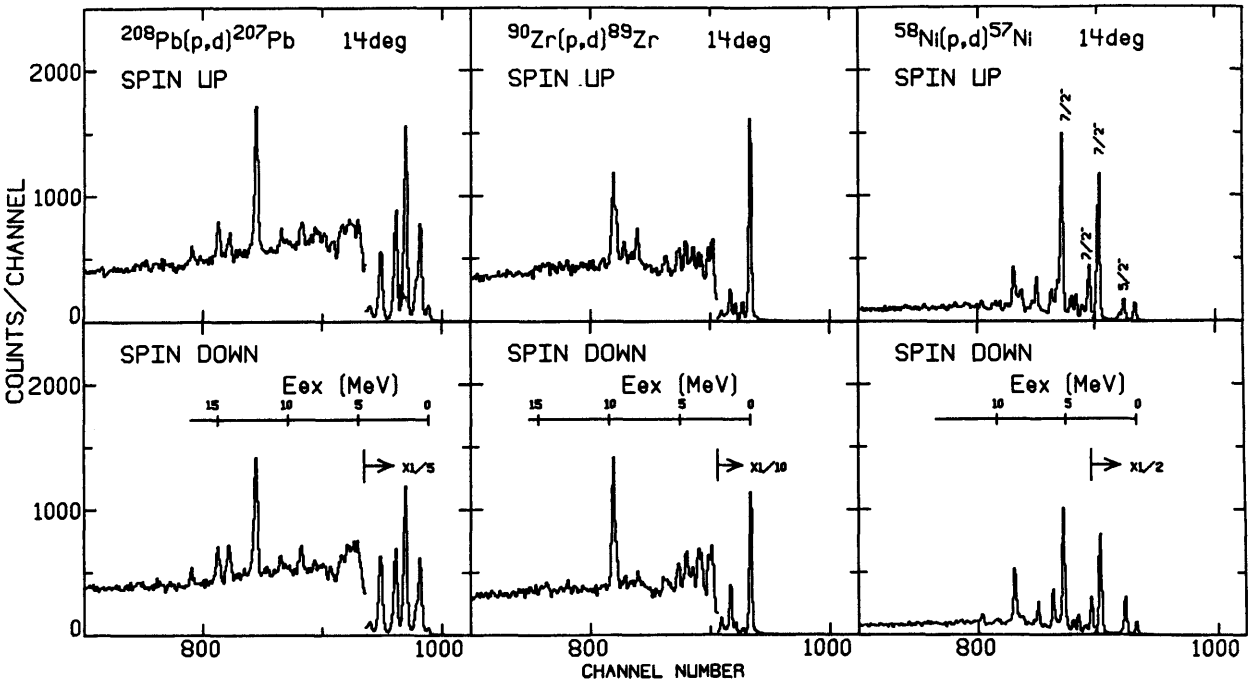

Figure 1. Deuteron spectra obtained from ^{208}Pb, ^{90}Zr, ^{58}Ni(p,d) reactions at an angle of 14°.

THE j-DEPENDENCE OF $\vec{p}$,d) ANALYZING POWERS AT 95 MeV

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During the past few years an increasing amount of data on deeply-bound hole states has come forth from investigations of the (p,d) reaction at IUCF for bombarding energies near 100 MeV. The spin-dependent signature of the analyzing-power angular distributions was exploited in a few selected cases to determine the spin values of the states populated.[1] The aim of the present work is to establish a phenomenological, systematic behavior of the j-dependence of the analyzing power in the $\vec{p}$,d) reaction at 95 MeV as a function of the target mass throughout the periodic table.

Differential cross sections and analyzing powers have therefore been measured for the $\vec{p}$,d) reaction on ^{24}Mg [ref. 2], ^{60}Ni, and ^{86}Sr. The reaction products were momentum analyzed with the QDDM magnetic spectrometer and detected in the focal plane by a position-sensitive helical detector backed by two plastic scintillators with thicknesses of 0.64 and 1.27 cm. The beam polarization was typically about 74%.

Measured analyzing-power angular distributions, $A_y(\theta)$, are shown in Figs. 1 and 2. They exhibit very pronounced oscillatory patterns which are characteristic of the total angular momentum j of the

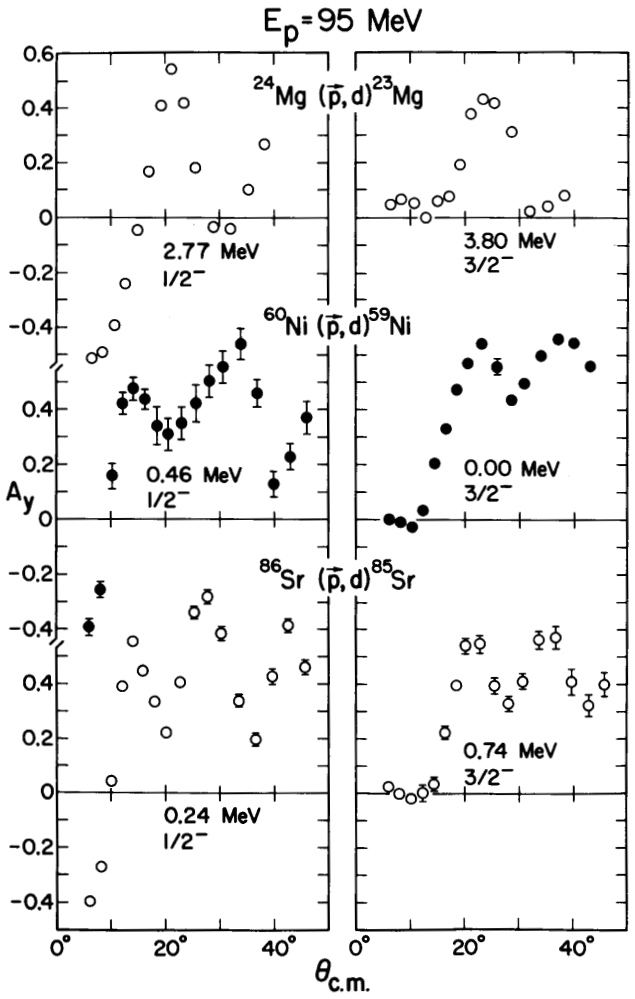

Figure 1. Analyzing-power angular distributions for $p_{1/2}$ and $p_{3/2}$ transfers.

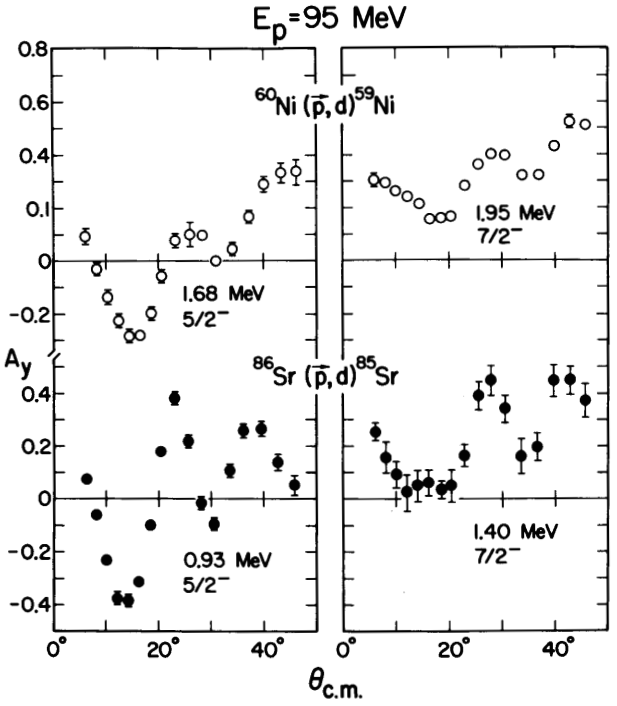

Figure 2. Analyzing-power angular distributions for $f_{5/2}$ and $f_{7/2}$ transfers.

transferred neutron. Figure 1 shows $A_y(\theta)$ for $p_{1/2}$ and $p_{3/2}$ transfers on ^{24}Mg, ^{60}Ni and ^{86}Sr. The distinctive pattern for a $p_{1/2}$ transfer is the pronounced negative analyzing-power distribution at the very forward angles. In this same angular region, the analyzing-power values for a $p_{3/2}$ transfer are close to zero. At angles greater than about 20°, the observed analyzing powers for $p_{1/2}$ and $p_{3/2}$ transfer oscillate in an opposite manner. Similarly, the observed analyzing-power angular distributions for $f_{5/2}$ and $f_{7/2}$ transfers, which are shown in Fig. 2, again show pronounced differences. The characteristic feature of a $f_{5/2}$ transfer is the negative lobe in $A_y(\theta)$ between 8° and 20° with a minimum around 15°. The analyzing power for a $f_{7/2}$ transfer is positive in this angular region. A nearly opposite oscillatory behavior of the two ℓ=3 transitions for larger angles is also quite distinctive.

Besides this phenomenological study of the analyzing powers, many new spin assignments could be made. They are collected in Tables I and II together with data from recent compilations.

Table I. Results from the $^{60}Ni(\vec{p},d)^{59}Ni$ reaction

E_x(MeV)	J^π present work	J^π Ref. 3
0.00	$3/2^-$	$3/2^-$
0.34	$5/2^-$	$5/2^-$
0.46	$1/2^-$	$1/2^-$
0.88	$3/2^-$	$3/2^-$
1.19	$5/2^-$	$5/2^-$
1.30	$1/2^-$	$1/2^-$
1.34	$7/2^-$	$7/2^-$
1.68	$5/2^-$	$5/2^-$
1.95	$7/2^-$	$7/2^-$
2.63	$7/2^-$	
3.04	$7/2^-$	
3.73	$7/2^-$	
4.16	$7/2^-$	
4.23	$7/2^-$	
4.56	$7/2^-$	
4.69	$7/2^-$	

Table II. Results from the $^{86}Sr(\vec{p},d)^{85}Sr$ reaction

E_x(MeV)	J^π present work	J^π Ref. 4
0.00	$9/2^+$	$9/2^+$
0.24	$1/2^-$	$1/2^-$
0.74	$3/2^-$	$(3/2)^-$
0.78	$5/2^-$	$(5/2)^-$
0.94	$5/2^-$	$(5/2)^-$
1.15	$3/2^-$	$1/2^-$, $3/2^-$
1.26	$9/2^+$	$(7/2,9/2,11/2)^+$
1.40	$7/2^-$	$(5/2,7/2)^-$
1.63	$5/2^-$	
1.67	$3/2^-$	
1.93	$1/2^-$	
2.09	$5/2^-$	
2.32	$(7/2^-)$	
2.60		
2.69		
2.78	$7/2^-$	

1) G.M. Crawley et al., Phys. Rev. C 23, 1818 (1981).

2) D.W. Miller at al., Proc. 5th Int'l Symp. on Polarization, Santa Fe, 1980 (AIP Proc. No. 69, New York, 1981), p. 635.

3) H.J. Kim, Nucl. Data Sheets 17, 485 (1976).

4) J.W. Tepel, Nucl. Data Sheets 30, 501 (1980).

CHANGE OF THE j-DEPENDENCE OF THE $^{208}Pb(\vec{p},d)^{207}Pb$ REACTION WITH BOMBARDING ENERGY

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Recent measurements[1] of analyzing-power angular distributions, $A_y(\theta)$, of the (p,d) reaction on ^{24}Mg, ^{60}Ni and ^{86}Sr targets at 95 MeV bombarding energy exhibit pronounced oscillatory patterns which are characteristic of the total angular momentum j of the transferred neutron. In contrast, results from the $^{208}Pb(\vec{p},d)^{207}Pb$ reaction at 123 MeV bombarding energy[2] show almost no dependence on the transferred total angular momentum j.

In order to investigate whether this weak j-dependence of the $^{208}Pb(\vec{p},d)^{207}Pb$ analyzing power is a feature of the bombarding energy or a property of the