TABLE I. Some examples of stripping reactions whose angular distributions should give direct information concerning the accuracy of the independent particle model of nuclear structure.

Reaction	Spin and parity Initial	Final	l Required by shell model	Allowed values
(1) $P^{31}(d,p)P^{32}$	1/2+	1+	2	0 and 2
(2) $Cl^{35}(d,p)Cl^{36}$	3/2+	2+	2	0, 2, and 4
(3) $Cl^{37}(d,p)Cl^{38}$	3/2+	2−	3	1 and 3
(4) $K^{41}(d,p)K^{42}$	3/2+	2−	3	1 and 3
(5) $Sc^{45}(d,p)Sc^{46}$	7/2−	4+	3	1, 3, 5, and 7
(6) $V^{51}(d,p)V^{52}$	7/2−	2 or 3+	3	1, 3, 5 (and 7)

cross on a number of occasions. In the region where the $d_{5/2}$ levels are being filled, therefore, if a reaction which is expected on the shell model to require an orbital momentum transfer of $l=2$ in fact shows strong evidence of an $l=0$ change, the reason might well be merely that for the case considered the $d_{5/2}$ and $s_{1/2}$ levels have crossed.

Near the end of the shell just discussed, however, when the $d_{5/2}$ and $s_{1/2}$ levels have all been filled, there should be no such difficulty, and it is in this region that our first two examples lie. These should be particularly good cases for our purpose since the next $s_{1/2}$ orbits on the independent particle model lie very much higher in energy than the ground state $d_{3/2}$ levels. Examples (3), (4), and (5) correspond to filling the $f_{7/2}$ shell in the region $20<N\leqslant 28$, and the aim of the experiments would be to detect any p admixture in the predicted $f_{7/2}$ orbital states. These again should be clear-cut cases, since the next p levels occur in a higher shell. The last example, however, lies in the region $28<N<38$ where the $f_{5/2}$ and $p_{3/2}$ levels have about the same energy, and this case must therefore be considered as doubtful. On Nordheim's rule[3] it is perhaps more likely that a spin of 2 or 3 for V^{52} be produced by a combination of the $f_{7/2}$ state for the odd proton with an $f_{5/2}$ rather than a $p_{3/2}$ state for the odd neutron, but this is of course not certain.

In order that, in the angular distributions, there be appreciable separation between the peaks of interest, the most favorable incident deuteron energy is probably about 10–15 Mev. For these energies, the transition $l=2$ in our first two examples will produce a maximum at about 20–30 degrees from the forward direction, whereas that for the $l=0$ transition will lie directly forward; in the other cases the $l=3$ transition will produce a peak at about 35–45 degrees, while the maximum resulting from $l=1$ will be at angles of about 5–15 degrees. Moreover, if the probability of the smaller angular momentum transfer be only 1/10th the probability of the transfer required by the shell model, the two resulting maxima will be of approximately the same height.

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Radiations of Rh^{99}, Rh^{101}, Rh^{105}, and Ru^{105}

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RUTHENIUM metal of high purity was bombarded with 6.3-Mev protons and 10-Mev deuterons and the spectra of the activities obtained were examined in a 180° beta-ray spectrometer. The spectrometer sources consisted of the activated metal spread out evenly on thin Zapon foil ribbons. The source and backing had a thickness of about 15 mg/cm². The spectra were scanned in the spectrometer at suitable intervals of time. By correcting for decay the component spectra were separated.

Both the positron and negatron spectra were examined when the ruthenium metal was bombarded with protons. The positron spectra of 4.5-hour Rh^{99} and 19-hour Rh^{100} were observed. A Kurie plot of the corrected positron spectrum of Rh^{99} indicated that the spectrum is allowed and probably simple, having an end-point energy of 0.74±0.01 Mev, for which the log(ft) value is 4.95. No gamma-rays of 4.5-hour half-life were observed. The intensity of the Rh^{100} positrons was not sufficiently high to give a reliable Kurie plot. Examination of the negatron spectrum showed the presence of several well-defined internal conversion peaks, decaying with a half-life of 4.5 days. These peaks were attributed to K and L conversion electrons from gamma-rays of Rh^{101}. The energies of the corresponding gamma-rays are 0.148±0.005 and 0.300±0.005 Mev. The former value is in fair agreement with 0.13 Mev previously reported[1] from beta-ray spectrograph measurements, and the latter roughly agrees with the value 0.35 Mev reported from lead-absorption measurements.[2]

With deuteron bombardment of ruthenium two negatron spectra with half-lives of 4.5 hours and 36 hours were observed. The 4.5-hour activity is attributed to Ru^{105} which is obtained by a (d,p) reaction on Ru^{104}. A Kurie plot of the corrected Ru^{105} negatron spectrum indicated a simple spectrum of allowed shape. The end-point energy is 1.15±0.02 Mev. The 36-hour activity was attributed to Rh^{105} obtained by the reaction $Ru^{104}(d,n)Rh^{105}$ and by negatron decay of Ru^{105}. A Kurie plot of the corrected Rh^{105} spectrum indicated a simple spectrum also of allowed shape. The end-point energy is 0.57±0.01 Mev. The above results for Ru^{105} and Rh^{105} spectra are in agreement with those obtained by Duffield and Langer.[3] High internal conversion peaks at 1140 and 1250 gauss-cm with half-life of less than 6 hours were found superposed on the negatron spectra. These peaks are believed to be K and L conversion lines from a gamma-ray of Rh^{105}.[3] The corresponding energy of the gamma-ray is 0.127±0.005 Mev.

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Energy Absorption During Twin Formation in Zinc Single Crystals*

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THE energy absorbed during the formation of twins in single crystals of 99.999 percent pure zinc was measured by means of ballistic pendulums in a manner first used by Chalmers[1] to measure the twinning energy in tin. The method was also used by the present author in measuring the energy absorbed during kink formation in zinc and cadmium.[2] It should be noted that in the very early stages of the latter work the kinks were thought to be twins and were erroneously reported as such.[3]

The single crystals were grown in a vacuum using a Bridgeman-type furnace. In order to study twin formation by impact it is necessary to have the (0001) plane nearly normal to the specimen axis. Using the Bridgeman technique the author had previously found that most of the crystals grew with the (0001) plane nearly parallel to the specimen axis.[2] In the current work, however, it has been possible to produce crystals with the (0001) plane nearly normal to the specimen axis by making short right angle bends in the Pyrex crucibles just beyond the seed point of the crucible. The crystals grown in this manner were rods 15 to 30 cm long and about 6 mm in diameter with the basal plane (0001) within 16° of the normal to the specimen axis. These rods were sectioned into lengths of about 2.5 cm for the twinning experiments.

As indicated in metallurgical literature, twins when produced in compression in pure zinc are rather narrow and frequently do not