STUDIES OF THE $^{116}\text{Sn}(d,t)^{115}\text{Sn}$ AND $^{116}\text{Sn}(d,\text{He})^{115}\text{In}$ REACTIONS AT 50 MeV.

R.H. Siemssen
Kerfysisch Versneller Instituut, Groningen, The Netherlands

C.C. Foster, W.W. Jacobs, W.P. Jones, D.W. Miller, M. Saber, and F. Soga
Indiana University Cyclotron Facility, Bloomington, Indiana 47405

An earlier study$^1$ of the reaction $^{116}\text{Sn}(d,t)^{115}\text{Sn}$ located approximately 45% of the deeply-bound hole state strengths (2p$_{1/2}$, 2p$_{3/2}$, and 1g$_{9/2}$) in $^{115}\text{Sn}$. Two of the aims of the present experiment were to determine if additional strength could be located at higher excitation energy and whether a further decomposition of the strength into 2p$_{1/2}$ and 2p$_{3/2}$ components would be possible.

Vector polarized deuterons were accelerated by the IUCF cyclotrons to an energy of 50 MeV. Reaction products were detected in $\Delta E-E$ counter telescopes placed on opposite sides of the beam. The triton and $^3\text{He}$ spectra were separated by setting software windows in the E vs. $\Delta E$ arrays stored in the data acquisition computer. The bombarding energy of 50 MeV was chosen to facilitate comparison with the cross section measurements of ref. 1.

A triton spectrum for the $^{116}\text{Sn}(d,t)^{115}\text{Sn}$ reaction at 15° is shown in Figure 1. The present measurements extend to much higher excitation than those of ref. 1 and permit a better determination of the background underlying the gross structure peaks corresponding to "deep-hole" pickup. The use of region VI to determine the background leads to the extraction of additional strength in the excitation region V from 12 to 18 MeV in $^{115}\text{Sn}$. The new component (thought to be part of the background in the earlier measurements) contains most likely 1f$_{5/2}$ strength in addition to p strength. With the inclusion of the additional cross section the total sum rule strength for pick-up from the 1g$_{9/2}$, 2p$_{3/2}$, and 1f$_{5/2}$ neutron subshells is observed.

The analyzing powers for the deeply bound hole states were found to be rather non-distinctive, indicating admixtures between the different subshells.

![Figure 1. A triton spectrum from the $^{116}\text{Sn}(d,t)^{115}\text{Sn}$ reaction measured at 15°. The areas I through VI show the division of the gross structure described in the text.](image-url)
Figure 2. Cross section and analyzing power angular distributions for the low-lying state of \(^{115}\text{Sn}\) observed in the \(^{116}\text{Sn}(d,t)^{115}\text{Sn}\) reactions. The solid curves are the results of DWBA calculations using the parameters of ref. 1.

\[ \text{In the gross-structure peaks. Consequently, it was not possible to separate the } 2p_{3/2} \text{ strength from the } 2p_{1/2} \text{ strength.} \]

In addition to the data for the deep-lying hole states in \(^{115}\text{Sn}\), transitions to low-lying states in \(^{115}\text{Sn}\) and \(^{115}\text{In}\) resulting from the pick-up of valence shell neutrons and protons, respectively, were studied via the \(^{116}\text{Sn}(d,t)^{115}\text{Sn}\) and \(^{116}\text{Sn}(d,^3\text{He})\) reaction. Figure 2 shows angular distributions and analyzing power measurements for a number of the low-lying states in \(^{115}\text{Sn}\). DWBA calculations with standard optical model parameters in general were found to give a good account of the analyzing powers for the pick-up of the valence shell nucleons. It will be possible to make spin assignments for a few excited states in \(^{115}\text{In}\) on the basis of the present analyzing power measurements.