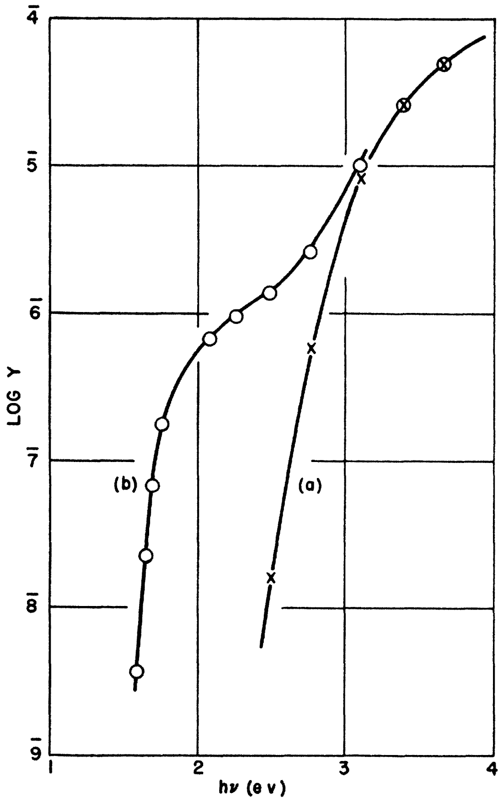

FIG. 1. Spectral distribution of the photoelectric yield Y in electrons/quantum for RbI containing F-centers at 85°K [curve (a)]. After irradiation of the emitter at $h\nu \sim 1.9$ ev, the distribution changes because F'-centers are formed [curve (b)]. The concentration ratio F'/F is of the order of 0.01 in this particular case. (The logarithms are negative.)

the F'-centers are unstable.[2] RbI is convenient because the phenomena appear readily at the temperature of liquid air. It is of interest to note that by this method one may detect F'-center concentrations that are considerably lower than could be measured conveniently by the usual optical absorption techniques.

[1] L. Apker and E. Taft, Phys. Rev. 81, 698 (1951).
[2] See, for example, F. Seitz, Revs. Modern Phys. 18, 384 (1946), and references given there.

Two-Step Isomeric Transition in Sn^{119m} (250 Days)*

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MIHELICH and Hill[1] have found that Sn^{119m} (250 days) decays with a highly converted isomeric transition of $\sim$69 kev. Recently Hill[2] redetermined this energy and found 65.3±0.5 kev. From the K/L ratio of this γ-ray it was concluded[1] that it is a magnetic 2^4-pole transition. In analogy with other isomers in this region (Te, Sn^{117}) and in accordance with the strong spin-orbit coupling model[3] this magnetic 2^4-pole transition is expected to be $h_{11/2} \rightarrow d_{3/2}$. As the ground state of Sn^{119} is known to be $s_{\frac{1}{2}}$, this should be followed by a magnetic dipole transition, as Mihelich and Hill[1] have pointed out. A search for this second γ-ray with a Sn^{119m} source produced by slow neutron bombardment of enriched Sn^{118} was carried out both with a scintillation counter and a proportional counter. No new γ-ray was found, indicating that the second step is either highly converted or too close in energy to the Sn K x-ray to be resolved. Therefore, a technique was evolved which allows one to observe the sum of two or more γ-transitions if they follow each other in $<\sim 1$ μsec. A Tl activated NaI crystal containing Sn^{119m} was grown by the Bridgman method as adapted by Hofstadter.[4] Reagent grade sodium iodide mixed with 0.1 percent thallous iodide was melted down under fore-vacuum in a vycor crucible. After cooling, a few tenths of a mg of SnO_2, containing Sn^{119m}, was introduced into the crucible. The crucible was pumped out again and sealed off. To produce the single crystal, the crucible was lowered at a rate of 0.2″/hr through a combustion tube furnace operated at 700°C. The crystal was used in connection with a 5819 RCA phototube as a scintillation spectrometer. The pulses due to the sum of the conversion electron energies were observed on a Dumont 248 oscilloscope screen and then photographed with a polaroid camera.[5] An oscilloscope trace corresponding to a value of 85±4 kev for the total transition energy was found. Several external γ-ray sources were used for calibration. One example is shown in Fig. 1. At the left the pulse distribution from the Sn^{119m} activated

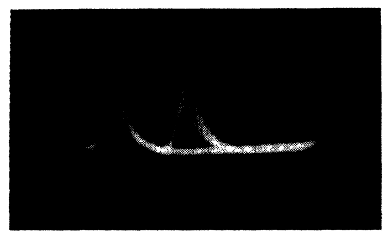

FIG. 1. Oscilloscope traces from Sn^{119m}. At the left is shown the pulse distribution from a sodium iodide crystal impregnated with Sn^{119m} and at the right the same distribution with the spectrum of an external 120-day Tm^{170} source, consisting of an 84.8-kev γ-ray and a 51.4-kev Yb K x-ray, superimposed. Two faint electronically produced pulses of equal height are shown for comparison.

crystal without an external source is shown; and at the right, superimposed, is the photoelectron spectrum of 120-day Tm^{170}, consisting of an 84.8-kev[6] γ-ray and a 51.4-kev Yb K x-ray. The Sn^{119m} radiation is seen to have approximately the same energy as the Tm γ-ray. We therefore conclude that a γ-ray of 20±5 kev follows the 65.3-kev transition. The method of the "impregnated" crystal for measuring the total disintegration energy is further illustrated by Fig. 2, which shows oscilloscope traces from Sn^{117m}. At the left the pulses from a Tl activated sodium iodide crystal containing a small amount of Sn^{117m} are shown. The lower, intense pulse is ascribed to the strongly converted first step[1] (159 kev). The higher pulse corresponds to the sum of the two steps [(159+162) kev]. At the right the lower pulse is intensified by

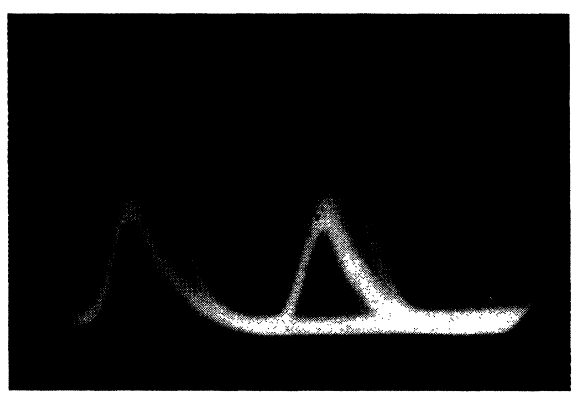

FIG. 2. Oscilloscope traces from Sn^{117m}. At the left are shown the pulses from a sodium iodide crystal impregnated with Sn^{117m} corresponding to 159 kev and 159+162 = 321 kev; at the right the lower pulse is intensified by the 162-kev γ-line from an external Sn^{117m} source.

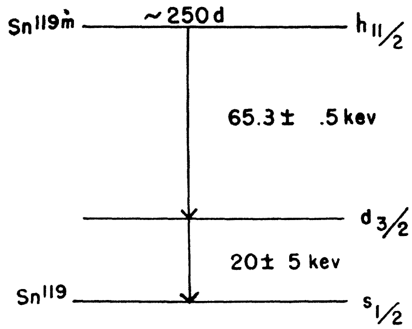

FIG. 3. Proposed disintegration scheme for Sn^{119m}.

adding an external Sn^{117m} source emitting mainly the 162-kev γ-ray, which is too close to the 159-kev line to be resolved from it.

In order to find the conversion electrons from the 20±5-kev transition, a small amount of Sn^{119m} was evaporated on an aluminum disk mounted on the inside wall of an argon-filled proportional counter. Electron peaks corresponding to energies of 19 kev, 37 kev, and 62 kev were observed, which were interpreted, respectively, as the L electrons of a 24-kev γ-ray with perhaps some contribution from Auger electrons, and the K and L electrons of the 65.8-kev γ-ray. Also, a small electron peak of ~80 kev was found, corresponding to the sum of the first and last electron components.

Critical absorption measurements of the photon component of Sn^{119m} carried out with an argon-filled proportional counter indicated that, besides the Sn K x-ray (E=25.09 kev), a radiation of about 24 kev was present which is compatible with the above result. However, since the enriched Sn^{118} sample which had been exposed to neutrons in the reactor contained 0.2 percent of Sn^{112}, this radiation may possibly be the In K x-ray following K-capture decay of Sn^{113}.

Figure 3 shows the proposed disintegration scheme for Sn^{119m}.

If one examines the two-step isomeric transitions of Te^{121}, Te^{123}, Te^{125} on the one hand, and Sn^{117} and Sn^{119} on the other hand, one notes that the second steps have a tendency to decrease in energy with increasing mass number. As no second transitions take place in the Te and Sn isomers of higher mass number, it has to be concluded that the $d_{3/2}$ levels move toward the $s_{1/2}$ levels with rising A and eventually cross over.[7]

Extrapolating to lower mass numbers we should expect that the $d_{3/2}$ level of Sn^{115} must be several hundred kev above the $s_{1/2}$ level. This is in agreement with the fact that In^{115} does not decay to the $d_{3/2}$ level, to which a β-transition would be second forbidden, but rather with a fourth-forbidden β-transition to the $s_{1/2}$ ground state of Sn^{115}.[8]

We should like to thank Mr. A. Smith for valuable help with these experiments.

* Research carried out at Brookhaven National Laboratory under the auspices of the AEC.
[1] J. W. Mihelich and R. D. Hill, Phys. Rev. **79**, 781 (1950). See also Nelson, Ketelle, and Boyd, ORNL 685 (1950) (unpublished).
[2] R. D. Hill (private communication).
[3] M. G. Mayer, Phys. Rev. **78**, 16 (1951).
[4] R. Hofstadter, Phys. Rev. **75**, 796 (1949); Proc. Inst. Radio Engrs. **38**, 726 (1950).
[5] For the description of this technique see E. der Mateosian and M. Goldhaber, Phys. Rev. **82**, 115 (1951).
[6] R. L. Caldwell, Phys. Rev. **78**, 407 (1950).
[7] R. D. Hill, Phys. Rev. **80**, 906 (1950).
[8] E. A. Martell and W. F. Libby, Phys. Rev. **80**, 977 (1950).

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Proceedings of the American Physical Society

Minutes of the Meeting of the Southeastern Section at Chattanooga, April 5–7, 1951

THE seventeenth annual meeting of the Southeastern Section of the American Physical Society was held at the University of Chattanooga, Chattanooga, Tennessee, on April 5–7, 1951, and was attended by approximately three hundred members and guests. A splendid program of sixty-five contributed papers and five invited papers was arranged by a committee of which Prof. A. H. Nielsen of the University of Tennessee was chairman. The abstracts of the contributed papers appear below and in the *American Journal of Physics*. At an evening session, Prof. Eric Rogers of Princeton University presented a demonstration lecture on surface tension. The dinner speaker was Dr. F. G. Slack of Vanderbilt whose subject was "Physics and the Emergency." The other invited papers were as follows:

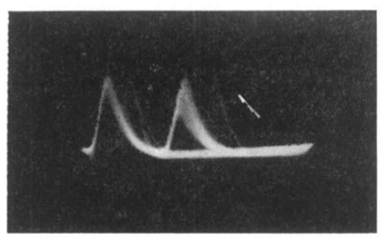
An Experimental Course in Reactor Physics at the Oak Ridge School of Reactor Technology, E. C. Campbell, *Oak Ridge National Laboratory, Oak Ridge, Tennessee.*

Neutrons as Waves and Particles, C. G. Shull, *Oak Ridge National Laboratory, Oak Ridge, Tennessee.*

Structure and Physical Properties of the Interstellar Gas Clouds, Bengt Strømgren, Director of *Yerkes Observatory, University of Chicago, Chicago, Illinois.*

The many details of arrangement of the meeting, including entertainment and visits to some of Chattanooga's industries, were admirably cared for by a committee having Prof. M. S. McCay of Chattanooga as its chairman. An extensive exhibit from the American Museum of Atomic Energy, a part of the Oak Ridge Institute of Nuclear Studies, attracted many visitors.

There were two half-day symposia devoted to work of the National Bureau of Standards, one on the achievements of computing machines in the field of physics, one on stable isotopes and their uses; there were five invited papers in addition to those comprised in the symposia. Our Division of High-Polymer Physics had three sessions consisting



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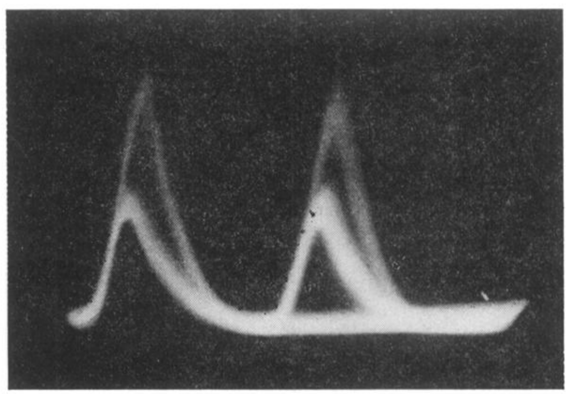

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