using a mirror-type galvanometer. Under good conditions absorption coefficients determined in this way are reproducible to 0.1 percent. The ratio of absorption coefficients for different mixtures has only a second-order dependence on the crystal law. The crystal law was known to be approximately 2.2 power from calibrated attenuator measurements.

Mix ratios of 10 to 1 and 3 to 1 were employed for H_2, and mix ratios of 3 to 1 and 6 to 1 for O_2. No dependence of collision diameter on mix ratio was observed.

I wish to thank Mr. Susumu Otsuka for able assistance in making certain calculations in the course of this work.

* Department of Electrical Engineering.

[1] J. Weber and K. J. Laidler, J. Chem. Phys. (to be published).
[2] W. V. Smith and R. Howard, Phys. Rev. **79**, 132 (1950).
[3] P. W. Anderson, Phys. Rev. **76**, 647 (1950).
[4] P. W. Anderson, Phys. Rev. **80**, 511 (1950).

Decay of 10.7-min Co^{60m}

M. DEUTSCH* AND G. SCHARFF-GOLDHABER
Brookhaven National Laboratory, Upton, New York†
(Received July 19, 1951)

THE 10.7-min excited state of Co^{60m} is known to decay predominantly by a highly converted isomeric transition of 0.0589 Mev[1] to the ground state (Fig. 1). A small fraction of the disintegrations is known to decay directly to the first excited state of Ni^{60} at 1.331 Mev.[2] This fraction has been reported only as "less than 10 percent."[3] We have redetermined this quantity by comparing the number of cobalt K x-rays with the number of 1.33-Mev γ-rays from Co^{60m} prepared by neutron bombardment of spectroscopically pure Co metal in the BNL reactor, and find a beta-decay branch of (0.28±0.06) percent. The comparison was made by the use of calibrated proportional and scintillation counters.

The efficiency of the argon-filled proportional counter for the K x-rays of Cr, Fe, and Cu was determined by coincidence measurements using the radioactive decay of Mn^{54}, Co^{57}, and Zn^{65}. The x-ray pulses were selected by means of a differential pulse height analyzer. The efficiency thus determined includes the solid angle, window absorption and fluorescent yield as well as the intrinsic efficiency for the K x-ray. The observed variation of efficiency with x-ray energy is consistent with that expected from the variation of fluorescent yields and absorption coefficients. The efficiency for cobalt K x-rays obtained by interpolation was $(2.0 \pm 0.3) \times 10^{-2}$ count per K-shell excitation.

The efficiency of the NaI scintillation counter for 1.3-Mev γ-rays was measured by the use of a small aliquot of a standard solution containing Co^{60}(5.2 yr). This solution was supplied by the Bureau of Standards. The value of $(1.0 \pm 0.15) \times 10^{-2}$ for the gamma-ray efficiency was in line with the values obtained for the 0.84-Mev and 1.14-Mev gamma-rays from coincidence measurements on Mn^{54} and Zn^{65}.

The ratio of gamma-ray to x-ray counting rates due to a source of Co^{60m} was 1.7×10^{-3}. Using the above values for the efficiencies, we obtain $(3.4 \pm 0.7) \times 10^{-3}$ for the ratio of γ-rays to K-conversion processes. Allowing for a $K:L$ conversion ratio of 4.55,[1] the branching ratio of direct beta-decay to the isomeric transition is $(2.8 \pm 0.6) \times 10^{-3}$.

A search was made for a 2.9-Mev beta-transition to the ground state of Ni^{60}, using an anthracene scintillation spectrometer. No evidence for beta-rays of more than 1.56-Mev energy was found, and we can set an upper limit of one ground state beta-transition in 10^6 isomeric transitions. The value of logft for the 1.56-Mev transition is 7.15, that for the 2.9-Mev transition >9.67; for the 5.2-yr beta-transition the value of logft is 7.46. Both of the observed β-transitions could therefore be first-forbidden or possibly allowed. The shape of the 0.32-Mev spectrum and the absence of $\beta-\gamma$ angular correlation preclude a spin change of 2 in this transition. Thus the spin of the Co^{60} ground state must be 5 (or 4).

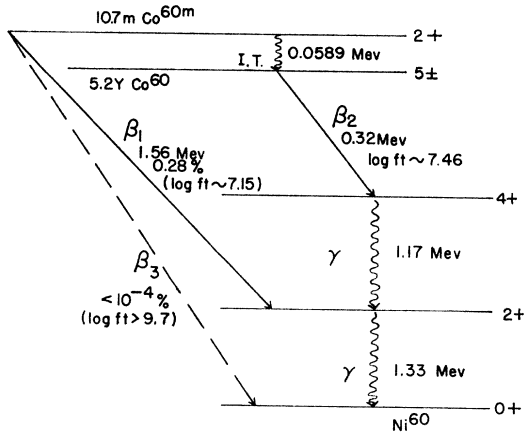

FIG. 1. Proposed disintegration scheme for Co^{60}.

The lifetime of the isomeric transition requires a spin change[4] of 3, making the spin of the 10.7-min state 2 (or 1). Because of the absence of a ground state beta-transition, spin 2 and even parity appears to be the best assignment for this state. The 1.56-Mev transition seems therefore to be allowed.

The parity of the ground state of Co^{60} is not uniquely determined by our results. The isomeric transition is compatible with either an E3 or M3 transition.[4] The lifetime of the beta-transition suggests a parity change. Shell theory would predict states of even parity from combinations $f_{7/2}$ and $f_{5/2}$ or $f_{7/2}$ and $p_{3/2}$. Our knowledge of the decay of Co^{60} is summarized in Fig. 1.

From the observed intensities of the hard gamma-radiation of the 5.2-yr and 10.7-min activities in the same sample we can compute the ratio of the neutron capture cross sections for production of the two states of Co^{60}. For a 10-min bombardment the intensity ratio was 8.9×10^{-3}. Allowing for the growth of the Co^{60} ground state from the 10.7-min isomer and for the ratio of hard gamma-rays to isomeric transitions in the 10.7-min period as reported above, we find $\sigma(5.2\text{ yr})/\sigma(10.7\text{ min}) = 1.4 \pm 0.6$. The much larger value reported by Seren *et al.*[5] is probably due to failure to observe the isomeric transition.

We wish to thank E. der Mateosian for valuable help in some of these experiments and R. L. Chase and A. Del Duca for the design and construction of the coincidence circuit.

* Permanent address: Massachusetts Institute of Technology, Cambridge, Massachusetts.
† Work carried out under the auspices of the AEC.
[1] R. L. Caldwell, Phys. Rev. **78**, 407 (1950).
[2] K. Way *et al.*, Natl. Bur. Standards Circ. 499 (unpublished).
[3] Deutsch, Elliott, and Roberts, Phys. Rev. **68**, 193 (1945).
[4] M. Goldhaber and A. W. Sunyar, Phys. Rev. **83**, 906 (1951).
[5] Seren, Friedlander, Turkel, Phys. Rev. **72**, 888 (1947).

Experiments on the Ultrasonic Unmixing of Liquid Solutions

CHARLES A. BOYD AND ROBERT J. ZENTNER
Naval Research Laboratory, Department of Chemistry, University of Wisconsin, Madison, Wisconsin
(Received July 16, 1951)

IN a Letter to the Editor, Frei and Schiffer[1] reported on experiments which indicated that gross partial unmixing of solutions such as glycerin dissolved in water could be brought about by setting up standing ultrasonic wave patterns in the solution. In view of the present interest in this subject, it seems worth while to report the results of some of our experiments along these lines.

The apparatus used is shown in Fig. 1. The position of the test cell and that of the reflector were adjustable so as to obtain good