This quadrupole coupling increases the frequency of the strongest line (previously measured) by 0.54 mc. Allowing for this effect and using the latest frequency measurements, the mass ratio $(S^{33}-S^{32}/S^{34}-S^{32})$ can be determined as 0.50066 ± 0.00015. This is in good agreement with the value 0.50060 ± 0.0005 obtained from recent measurements of nuclear reaction energies.

Some additional rotational lines of OCS molecules in excited vibrational states were measured incidentally to this work. They give the results shown in Table II.

* Work supported by the Signal Corps.
** Also recently measured by A. Roberts (private communication).

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[2] C. H. Townes, A. N. Holden, and F. R. Merritt (to be published).
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The Radioactive Lanthanum and Cerium Isotopes of Mass 137

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July 9, 1948

A SAMPLE of CeO_2 (Hilger Lab. No. 13386) was submitted to long neutron bombardment in a graphite-moderated pile. The activities were studied by the mass spectrographic transfer technique[1] and shown to consist principally of 30.6-day Ce^{141}, 1.4-day Ce^{143}, and 13.5-day Pr^{143}. After the sample had "cooled" for ten months, its isotopic constitution was compared with that of normal cerium using the surface ionization type of mass spectrometer previously described.[2]

Normal cerium showed ion currents at masses 152, 154, 156, and 158, due to the oxide ions $Ce^{136}O^{16}$, $Ce^{138}O^{16}$, $Ce^{140}O^{16}$, and $Ce^{142}O^{16}$. In addition, weak peaks were observed due to the two weaker oxygen isotopes. Pertinent impurities present were Ba, La, and Pr. The lanthanum and praseodymium were detected as $La^{139}O^{16}$ and $Pr^{141}O^{16}$, appearing at masses 155 and 157; the barium, as metallic ions at masses 130 to 138. The bombarded sample showed in addition to the above peaks a new peak at mass 153. That this peak is due to a new isotope of lanthanum was proved by eliminating in turn all the other elements which might give rise to this peak. That it was not cerium was proved by the fact that the ratio of the 152 to 153 peaks varied by a factor of 100 as the temperature of the filament varied. Barium was eliminated because barium ions are emitted as oxides. It is thus concluded that the isotope observed at mass 137 is lanthanum which has been formed by radioactive decay of Ce^{137}. In the particular sample under investigation the ratio of La^{137} to La^{139} was 0.15.

From the fact that at the time of isotopic analysis no Ce^{137} could be detected, it is concluded that the half-life of Ce^{137} is less than two months. By further consideration of the fact that the amount of radioactivity at mass 137 was too small to show by the transfer technique and that all of the La^{137} was the daughter of the Ce^{137} it may be concluded that the half-life of Ce^{137} is less than two weeks. Since the isotopic composition of the barium impurity was not detectably changed as the result of decay of La^{137}, the half-life of La^{137} must be greater than thirty years.

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The Velocity of Discharge Propagation in Geiger Counters

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THE importance of the finite speed of propagation of the Geiger counter discharge was indicated some years ago by Dunworth,[1] and its existence was indicated by various workers.[1-3]

It was only recently that various and widely different experimental methods have been used by Hill and Dunworth,[4] Huber *et al.*,[5] and Wantuch[6] to measure the velocity of discharge spread along counters filled with self-quenching gas mixtures, such as argon/ethyl alcohol vapor. The results of the above authors disagree to an appreciable extent, as discussed by Wantuch.[6] The purpose of this note is not to comment further on the measurements with self-quenching ("fast") counters, but to submit measurements taken with externally quenched counters containing hydrogen. The use of elementary gases should enable simpler analyses of the results to be made and, it is hoped, might ultimately provide data on photo-ionization in such gases.

The method used in the present experiments was different from any of those used by the above authors and is shown schematically in Fig. 1. A pulse resulting from discharge build-up in one of the short end cylinders ("start cylinder") in the long counter shown (we have used them up to 2 m in length) connects a 4-mc/sec. quartz-controlled oscillator through a gate circuit to a fast scaler and recorder; the discharge then spreads along the counter.

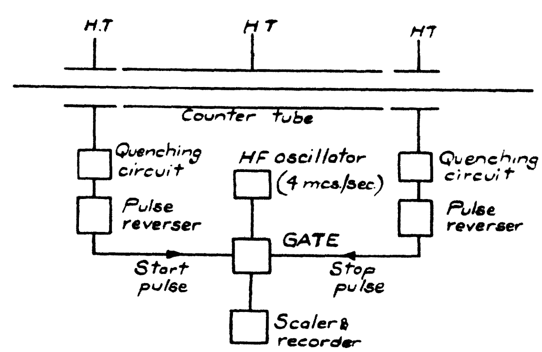

FIG. 1. Method used in experiments shown schematically.

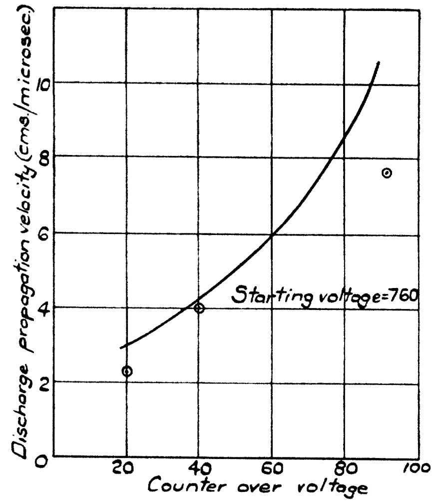

FIG. 2. Results of check measurements taken with an argon/ethyl alcohol-filled counter.

and the subsequent pulse from the other end cylinder ("stop cylinder"), as the discharge reaches it, closes the gate and the intervening number of oscillations, each 0.25μ sec. in duration, is shown upon the recorder.

Some check measurements were taken with an argon/ethyl alcohol-filled counter 1 m in length. Some of the results (9.5 cm Hg argon, 0.5 cm Hg C_2H_5OH) are shown in Fig. 2. The wire and cathode diameters were, respectively, 5 mils (tungsten) and 0.75 inch (copper). The curve in Fig. 2 was taken from the publication of Hill and Dunworth,[4] using an 8-mil wire but with an otherwise similar counter, and the points are the present results. The agreement (see discussion by Wantuch[6]) is considered reasonable.

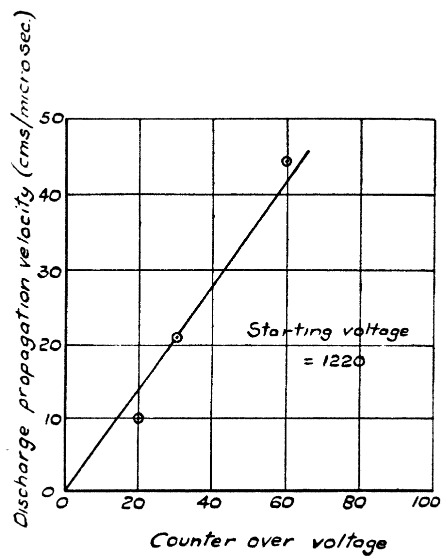

FIG. 3. Results obtained with a counter filling of 10 cm Hg hydrogen.

Using 1-m and 2-m counters (5-mil wire, 0.75-inch dia. cathodes), data have been obtained with certain elementary gases, and Fig. 3 shows some results obtained with a counter filling of 10 cm Hg hydrogen (2 m in length). The speed of discharge propagation is much higher than in Fig. 2, as would be expected in general terms if the discharge spreads along the wire by virtue of a photoionization mechanism, as is generally assumed.[5, 7–9]

This simple picture is complicated by various factors which cannot be fully discussed in a note. For example, some discharges start in the long cylinder (see the schematic counter in Fig. 1) as a result the finite background count and, propagating in opposite directions, give short spread times. Discharges propagating by virtue of cathode emission of electrons and by photons covering distances of some cm[9] will also give short times. These and other related matters will be discussed more fully elsewhere, together with a consideration of the mechanism of discharge propagation and more exhaustive experimental data.

We are indebted to Sir A. P. M. Fleming, Director, and Mr. B. G. Churcher, Manager, of the Metropolitan-Vickers Research Department for permission to publish this note.

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[7] S. A. Korff, *Electron and Nuclear Counters* (D. Van Nostrand Company, Inc., New York, 1946), pp. 95 ff.
[8] W. E. Ramsey, Phys. Rev. **61**, 96 (1942).
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Erratum: Alkali Halide Scintillation Counters

[Phys. Rev. **74**, 100 (1948)]

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THE Editor regrets that Fig. 1 of the above-named Letter to the Editor was printed upside down. It should have been as follows:

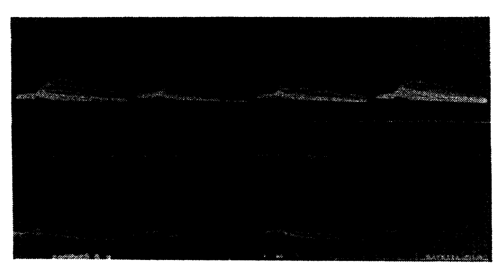

FIG. 1. Oscilloscope screen photographs taken at random for 1/30 second. Above, pulses caused by NaI (Tl) and below, pulses caused by naphthalene under identical circumstances. Sweep calibration: total length of sweep equals 4.3 microseconds.