In order to compare with unseparated uranium under identical geometrical conditions, 40 mg of U_3O_8 were deposited on a platinum surface of 3 square centimeters area, and were irradiated under the same conditions as in the preceding experiment. After irradiation an ether separation of fission products was made. From this sample 8.564 mg of U_3O_8 were deposited on a fresh platinum foil and the initial specific beta-activity determined as before. This gave a value of 3240 counts per minute per milligram of U_3O_8, in good agreement with the value 3290 obtained from the separated isotope.

Substantially the same results were obtained from another sample of 30 micrograms of $U^{238}{}_3O_8$.

The decay period and the specific activity of the neutron induced beta-activity in separated samples of U^{238} are in good agreement with those obtained from the capture in ordinary uranium and leave no doubt that the 24-minute resonance capture in uranium is due to U^{238}. This result was previously anticipated on theoretical grounds by N. Bohr and others.

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[1] A. O. Nier, E. T. Booth, J. R. Dunning and A. V. Grosse, Phys. Rev. **57**, 748 (1940).

Period of Photon Emission in a Counter Discharge

That the ionization in a Geiger-Mueller counter takes place in a very early stage of the discharge and before the wire has changed appreciably in potential is an essential element in the mechanism proposed by C. G. Montgomery and D. D. Montgomery.[1] The investigation to be described here leaves no doubt that photon emission in a counter takes place during a short time interval following the initiation of the discharge, and that few, if any, photons are emitted during the greater part of the time required by the wire to reach its maximum negative potential.

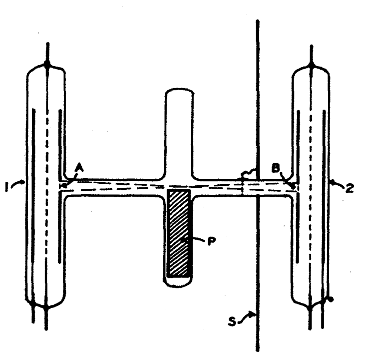

FIG. 1. Arrangement of Geiger-Mueller counters.

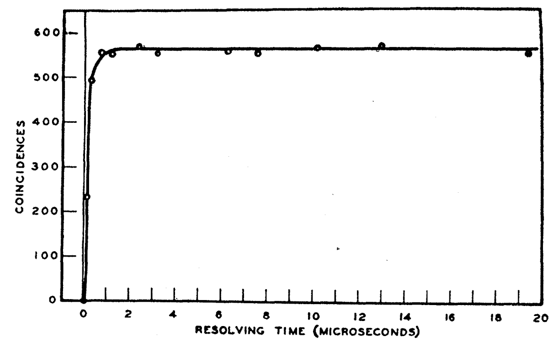

FIG. 2. Relation between coincidence rate and resolving time in experiment A.

Two counters, 1 and 2, Fig. 1, share a common glass envelope. Although the counter wires are carefully shielded electrostatically from each other by S, photons emitted by one may pass to the other through holes A and B in the counter cylinders. This photon transmission is controlled by the plunger P which may be moved to expose any desired portion of the transmitting and receiving areas A and B. The voltage pulses from these counters are applied to a coincidence circuit. The resolving time of this circuit may be varied from $<10^{-7}$ second to 10^{-3} second and special care is exercised to prevent this variation from influencing in any way the discharge phenomena in the counters themselves. These resolving times were determined experimentally employing a pulse generator previously described.[2] With P in such a position as to screen the openings A and B from each other, no coincidences are observed. As A and B are exposed to each other by moving P, coincidences appear, and a point is reached where all discharges in one counter are accompanied by discharges in the other.

In Fig. 2, representing an experiment to be called A, the coincident rate is plotted as a function of resolving time for the case where P was so placed that 90 percent of the discharges in one counter were accompanied by discharges in the other (resolving time 2.0×10^{-4} second). There is no observable increase in the number of coincidences between one and twenty microseconds. In another experiment (experiment B) where P was in such a position that the probability of one counter setting off the other in a time of 2.0×10^{-4} second was 0.42, there was an increase in the number of coincidences between one and twenty microseconds of only (3.1 ± 3.6) percent.

Measurements by the author[3] on a counter of the diameter and pressure used in these experiments indicate that the counter wire experiences one-half of its potential change in the interval between one and twenty microseconds. If the number of photons emitted by a counter in a given time interval were proportional to the change of potential of the wire during the interval, we should expect an increase of the coincidence rate between one and twenty microseconds which amounts to 20 percent for the case A, and 60 percent (or 20 times that found) for the case B. It is safe to assume that any condition, such as has been formerly assumed in counter discharge theory, in which measurable changes of wire potential were assumed to be accompanied by measurable photon emission, is at variance with the present observations. These experiments are, however, in agreement with the discharge mechanism formulated by C. G. Montgomery and D. D. Montgomery. The lags which actually occur are to be expected, and can be accounted for by electron capture in the gas. This phenomena has been reported elsewhere.[2,4]

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Bartol Research Foundation of the Franklin Institute,
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July 24, 1940.

[1] C. S. Montgomery and D. D. Montgomery, Phys. Rev. **57**, 1030 (1940).
[2] C. S. Montgomery, W. E. Ramsey, D. B. Cowie and D. D. Montgomery, Phys. Rev. **56**, 635 (1939).
[3] W. E. Ramsey, Phys. Rev. **57**, 1022 (1940).
[4] J. V. Dunworth, Nature **144**, 152 (1939).

The Secondary Peak in the Rossi Curve for Tin

The apparatus, already described[1] comprised primarily five separate horizontal counter areas each containing 18 counters 20 cm long and giving a sensitive area (analyzing tray) 20 cm by 20 cm. The areas were arranged in a vertical array and tin was inserted between the top tray (the first) and the next tray (the second). One-centimeter slabs of lead were placed over trays 3, 4 and 5 for subsidiary reasons. Each counter was connected to an individual electroscope. In addition, above the second tray, but below the tin, there was another counter tray (master tray), without electroscopes. The arrangements were such that the electroscopes were only allowed to operate when at least one ray passed through the whole apparatus including the master tray which, by a side lead shield, guarded against electron showers from the side. The electroscopes recorded photographically the shower history of every *event* associated with the passage of a ray through the whole apparatus.

Figure 1, curve A, shows, plotted against thickness of tin, the number of doubles recorded by the second analyzing tray (below the tin) per 1000 events. It will be observed that the curve shows two maxima, the second one being at 29 cm.

Each point for curve A corresponds in actuality to 1000 observations of events except in the case of the points for 20 cm and 30 cm, which correspond to 2000 observations each. The standard deviations are indicated by the vertical lines. At first sight it is surprising that their magnitude permits the degree of regularity exhibited by the curve. The statistics of this matter will be discussed in greater detail in a more complete publication later to be presented. For the present, it will perhaps cement confidence in the reality of the minimum at 20 cm in the case of curve A by replotting, as in Fig. 1, curve B, the results obtained by utilizing, for each point, just half of the observations utilized in drawing curve A. The statistical errors for curve B are, of course, considerably greater, proportionally, than for curve A. However, the minimum is still well marked. It may be added that in order to avoid systematic changes with time, the curve A was not obtained by taking all the observations for the individual points in succession. A smaller number of observations was taken for the whole set of points and repeated backwards and forwards so as to ensure that as far as possible the observations for each point extended over the same period of operation of the apparatus.

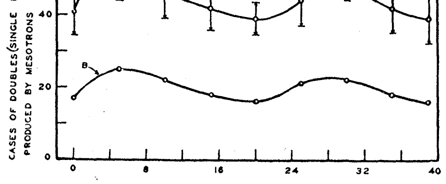

FIG. 1. Number of double coincidences recorded by the analyzing tray (below the tin) as a function of the thickness of the tin.

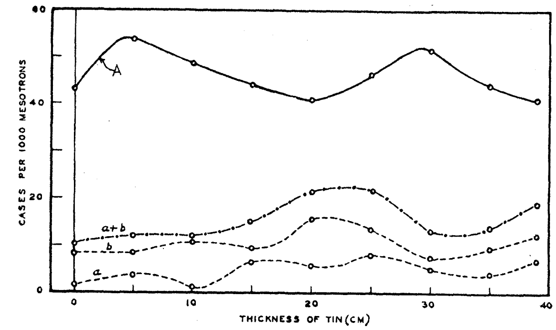

FIG. 2. Curve A, number of double coincidences; curve a, number of quadruple coincidences; curve b, number of triple coincidences at function of the thickness of tin.

It was found that, in 75 percent of the cases, at least one member of each of the two-ray showers disappeared in the lead plate above the third analyzing tray, thus guaranteeing that the shower electrons were in the relatively low energy class.

Figure 2 indicates, in addition to curve A corresponding to Fig. 1, the curve a for quadruple rays, curve b for triple rays, and $a+b$ for the sum of triples and quadruples. In these cases all the curves have been corrected for inefficiency of counter trays, which correction is more important in the case of large showers. Of course, the statistical errors in the large showers are very large, but it is interesting to note that the minimum for doubles is approximately compensated as regards total number of showers by the triples and quadruples.

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Bartol Research Foundation of the Franklin Institute,
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August 2, 1940.

[1] W. F. G. Swann, Rev. Mod. Phys. **11**, 242 (1939).