tions of these investigators do not yield direct evidence on the nature of the recorded particles (they could have been protons as well as mesotrons) it can be asserted that in our experiments mesotrons were observed. Our experiments also bring to light an essential singularity—the predominance of secondary slow particles with exceedingly small ranges.

The authors express their gratitude to Professor D. V. Skobelzyn for helpful suggestions and valuable discussions of results.

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[2] B. Rossi and H. Regener, Phys. Rev. **58**, 837 (1940).

[3] V. Veksler and B. Isajev, Comptes rendus Acad. Sci. USSR **17**, 189 (1937); V. Veksler and N. Dobrotin, Comptes rendus Acad. Sci. USSR **19**, 479 (1938).

[4] The probability of such electrons having been recorded by our counters is exceedingly small.

[5] The cathodes of the counters were made of brass nets; the walls of the boxes which enclosed the counters were 0.09 g/cm^2 thick.

[6] V. Veksler, K. Alekseeva and N. Reynov, Comptes rendus Acad. Sci. USSR **21**, 122 (1938); V. Veksler and N. Dobrotin, Bull. Acad. Sci. USSR, Série Physique **4**, 260 (1940).

[7] These observations also pointed to the existence of heavily ionizing particles with essentially longer ranges of the order of a few grams per cm^2, i.e., apparently slow secondary protons.

[8] V. Veksler and N. Dobrotin, Comptes rendus Acad. Sci. USSR **25**, 103 (1939).

Time Lags in Geiger-Müller Counter Discharges

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June 2, 1941

SOME time ago we reported[1] the existence of delayed counts in Geiger-Müller counters in which the appearance of a potential on the counter wire did not take place until several microseconds after the formation of the primary ions responsible for the discharge. We suggested that the cause of this long time lag was the capture of the electrons of the primary ion pairs, forming negative molecular ions which moved relatively slowly into the region of the counter wire. In this region of high field strengths, the molecular ions were broken up and the electrons released were multiplied by the ordinary processes of ionization by collision. These long-time lags are not to be confused with the shorter ones which represent the periods necessary for the building up of the space charge around the counter wire.

Some new experiments have been performed to establish the correctness of this explanation, and to measure the capture probabilities. A counter 18 mm in diameter and 120 mm long, with an oxidized copper cathode, was used. Ultraviolet light could strike the interior of the cathode by passing through a quartz window and a small hole in the cathode, and eject photoelectrons. The light was produced by a spark which caused, at the same time, an electrical pulse. The difference in time between the occurrence of this pulse and the beginning of the change of potential of the counter wire was measured by a vacuum-tube circuit of the type previously described.[1]

If n is the average number of photoelectrons produced by a spark, then the fraction f of the number of sparks which cause a counter discharge is $f=1-e^{-n}$. If α is the probability that an electron be captured in such a manner as to produce a time lag greater than a given amount τ, then the probability p that the spark will give rise to a delayed counter discharge is

$$P=\sum_{m=1}^{\infty}\alpha^m\frac{e^{-n}n^m}{m!}=(e^{\alpha n}-1)e^{-n},$$

since all of the electrons must be captured if the count is to be delayed. Hence, by measuring p and f, n and α may be determined. If the proposed explanation for the delayed counts is correct, then the values α calculated in this way should be independent of n for a given pressure and composition of the gas in the counter. Thus, measuring α provides a sensitive test of the correctness of the picture.

TABLE I. *Values of the probability α that an electron will be captured so as to produce a time lag greater than τ.*

ELECTRONS PER SPARK, n	0.22	0.41	0.64	MEAN
τ, microseconds				
1.4	0.40	0.42	0.39	0.40
2.3	0.19	0.17	0.18	0.18
3.7	0.08	0.10	0.08	0.08

An example of the results of such a test is shown in Table I. The counter was filled with a mixture of argon with six percent oxygen at a pressure of 104.5 mm of mercury. For a given time lag the values of α are the same within the accuracy of the observations.

Other observations show that α increases with increasing pressure. From the knowledge of the time of travel of the negative molecular ions, we can estimate the capture cross section of an electron by an oxygen molecule to be of the order of 10^{-18} cm^2. This is in agreement with the results of Rose and Ramsey,[2] and other more direct determinations.

If the primary ions are produced within the gas of the counter, as when gamma-rays or cosmic rays are being counted, then both n and α increase with the pressure of the counter gas. Hence, as the pressure is increased, the probability of a delayed count p first increases, reaches a maximum value, and then decreases again.

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Superconducting Films as Radiometric Receivers

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May 31, 1941

THREE years ago a series of experiments was undertaken to investigate the usefulness of superconducting films as resistance thermometers in the measurement of small quantities of energy[1] and in particular as receivers in radiometers. The latter application has since been suggested independently by A. Goetz.[2] Because of the interest in the optical properties of superconducting surfaces and the possibilities of this new radiometric method in the infrared, we are presenting a few preliminary results at this time.

Lead films were prepared[3] by evaporating the metal on clean glass in a high vacuum giving a bright metallic