The charge which the electron beam induced in this foil was coupled through the identical vertical-deflection amplifier system used above except for the omission of the 931 photomultiplier tube. It was observed that under these conditions, the deflection of the sweep was delayed approximately 0.04 ± 0.01 microsecond, and the rise time was about 0.015 microsecond. These values closely check the calculated delay and rise time for the 9-stage, 18-megacycle-wide amplifier system.

This experiment, therefore, definitely indicates that the light-emission delay in the phosphor was not observable to within the resolving time of this measurement technique, namely, 10^{-8} second. Variation in the electron beam current over wide limits produced no discernible variation in the phosphor excitation time.

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The Mean Life of Negative Mesotrons in Sulfur*

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THE mean lives of positive and negative mesotrons stopping in sulfur were measured separately by means of the apparatus discussed previously.[1] Figure 1 shows the integral disintegration curves of positive and negative mesotrons. The curve marked τ_+, obtained when the magnetic lens was collecting positive mesotrons, has been plotted normalized with respect to the curve of negative mesotrons such that both curves represent the *same* number of mesotrons stopping in the absorber. The actual number of positive disintegration electrons observed was 202 and their mean life was $2.04 \pm 0.23\mu$ seconds.

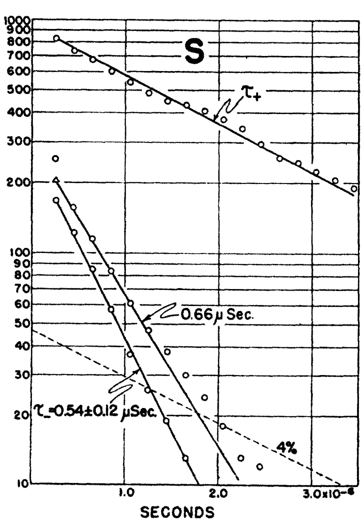

FIG. 1. Disintegration curves of positive and negative mesotrons in sulfur.

For negative mesotrons, the upper set of points shows the disintegration curve actually observed, and the triangular point at 0.25μ second represents the result when counter delays occurring without the absorber are subtracted. Beyond 1.5μ seconds, the curve departs from linearity. This must be due to the fact that the magnetic lens permits a fraction of the positive mesotrons to reach the absorber when it concentrates negative mesotrons. This fraction was found to be about 4 percent. The lower set of points shows the disintegration curve corrected for this positive admixture. From this curve, a value for the mean life of negative mesotrons in sulfur was obtained; $\tau_- = 0.54 \pm 0.12\mu$ second. Hence, the ratio of mean lives in sulfur, τ_+/τ_-, is 4.0 ± 0.7. The ratio of the numbers of positive and negative disintegration electrons, N_+/N_-, corrected for a positive excess of 20 percent, is 3.5 ± 0.4.

The two ratios are the same within experimental error which is in agreement with the result previously obtained in sodium fluoride.[1] On the other hand, $N_+/N_- = 3.5$ does not support the hypothesis[2] of an accelerated decay, in which case N_+/N_- should have been unity. This result also does not give any indication of the large discrepancy between the ratio τ_+/τ_- and the ratio N_+/N_- in aluminum which was reported by Valley and Rossi.[3]

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[2] S. T. Epstein, R. J. Finkelstein, and J. R. Oppenheimer, Phys. Rev. **73**, 1140 (1948).
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Cosmic-Ray Showers Produced by Penetrating Particles*

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RECENT experiments[1] have established that cosmic-ray showers are initiated in some cases by penetrating particles, and that, of these showers, some contain at their origin both penetrating particles and fast electrons. Such showers are of interest because they probably typify the process in which the primary cosmic rays produce their secondaries in the atmosphere.

A series of cloud-chamber pictures has now been taken to investigate the production of showers by penetrating particles at sea level. The cloud chamber was rectangular, 20 inches square and 11 inches deep. For 10 percent of the pictures the chamber contained 9 horizontal lead plates, 12 inches by 10 inches by $\frac{1}{2}$ inch. For the rest of the pictures the lowest lead plate was replaced with an aluminum plate $\frac{1}{16}$ inch thick. The illuminated depth of the chamber was 8 inches. Stereoscopic pictures were taken. A tray of 6