width at half-maximum). The end point of the spectrum as extrapolated from the Fermi plot is 254±3 kev. In constructing the Fermi plot, the non-relativistic Coulomb factor was used. A typical plot for a source of about 200 $\mu g/cm^2$ average thickness is shown in Fig. 1. The graph is linear from the end point to about 90 kev and deviates above the straight line below this energy. Previous experience in the investigation of low energy beta-spectra has shown that a 200-$\mu g/cm^2$ source has quite a distorting effect on the Fermi plot below 90 kev, yielding a greater relative abundance of slow electrons. We therefore attribute the non-linearity of the Fermi plot in the low energy region to the unfavorably thick source used and conclude that thinner and more uniform sources would probably yield a linear Fermi plot to energies below 90 kev.

The above end point combined with the half-life of 152 days gives an approximate *ft* value of 0.7×10^6, which empirically classifies Ca^{45} in the first-forbidden group. The linear Fermi plot is not contra-indicated by theory since, for certain types of interaction, a forbidden transition may yield a linear Fermi plot.

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Temperature Dependence of Scintillation Pulses in Anthracene*

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MEASUREMENT has been made of the decay constant and light output of anthracene scintillation pulses as a function of temperature. Values of the decay constant were obtained by photographing a series of individual pulses at each temperature using an oscilloscope with a vertical rise time of 6×10^{-9} sec. Because of statistical fluctuation in the individual pulses, many pulses had to be averaged in some manner. Two methods of averaging were used. First, exponentials were drawn by eye through twenty pulses selected at random at each temperature and averaged. Then on the suspicion of systematic errors, these twenty pulses were added graphically. This second method was employed at only two points because it was much more tedious and agreed with the first within two percent. It gave evidence, however, that the decay is exponential within the accuracy of the experiment over nearly a decade. Figure 1 shows the dependence on temperature. It appears to be linear with positive slope and to have an intercept with the temperature axis at −273°C. The

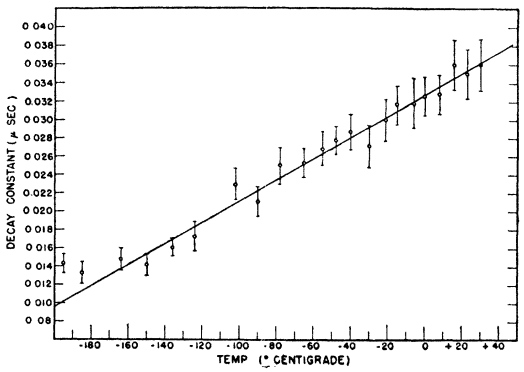

FIG. 1. Decay of scintillation pulses in anthracene. Brackets indicate 95 percent confidence interval based on spread of data.

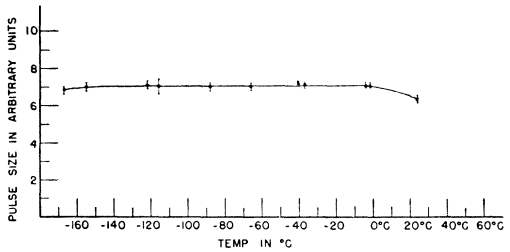

FIG. 2. Variation with temperature of the light pulse size in anthracene. (Conversion electrons from Cs^{137} measured with 1P28 photo-multiplier.)

decay constant at liquid nitrogen temperature is in agreement with the measurements of Collins.[1]

The temperature dependence of the size of the pulses has been investigated with a scintillation spectrometer of the type described by Jordan and Bell.[2] With a 1P28 photo-multiplier, the results, Fig. 2 show an essentially constant pulse size from room temperature to near liquid nitrogen temperature. With a 1P21 tube, however (results not shown), the pulses were some 30 percent larger at −60°C than at room temperature. This confirms qualitatively earlier measurements made at this laboratory by P. R. Bell. Since the 1P28 tube has a lower short wave-length cut-off than the 1P21, it seems likely that the pulse size using the 1P21 may then be attributed either to a lowering of the short wave-length limit of its envelope or to a shift to higher wavelengths of the scintillation spectrum. We have obtained spectrographic evidence for the former. Either explanation requires that the scintillation spectrum extend below 3400A which is the short wave-length cut-off of the 1P21. This is considerably lower than has been reported.[3]

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A 7×10^{-9} sec. Isomeric State in $_{79}Au^{197}$ *

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USING sources of Hg^{197} and an experimental arrangement similar to that described in a previous letter,[1] an excited state of Au^{197} with a half-life $(7.0\pm1.0)\times10^{-9}$ sec. has been observed. In Fig. 1 the number of delayed coincidences is plotted as a function of delay time. The portion of the solid curve for delays less than 3.5×10^{-8} sec. and points indicated by circles represent the gross data. After subtraction of random coincidences the solid curve for delay time $T\geq3.5\times10^{-8}$ sec. represents the decay of the short-lived isomeric state which has been produced by the *K*-capture decay of Hg^{197}.

Figure 2 shows the number of coincidences as a function of delay time obtained with a source of Te^{125*} (~58 day). This resolution curve is typical of a negative result. The majority of the radioactive species investigated give similar curves exhibiting a sharp break at a delay of 3.0 to 3.5×10^{-8} sec. For larger delays the coincidence rate is constant and equal to the computed random coincidence rate.

The stilbene crystals, which are cemented to the tube envelope with Canada balsam, and Type 5819 multiplier tubes were operated at room temperature. The background (single counts) with phosphor in place is ~200 c/m of which only 60 c/m is due to thermionic electrons leaving the photo-cathode. This corresponds to a pulse discrimination level such that incident radiation as low as 50 kev energy is detected.