Letters to the Editor

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On the Measurement of Short-Lived Isomers of Nuclei*

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THE method of delayed coincidences between two anthracene scintillation counters has been extended to measure time intervals in the region 10^{-6} to 10^{-7} sec. The pulses from two 1*P*21 or 1*P*28 type multipliers are supplied to linear amplifiers[1] whose output signal has a rise time of approximately 1.5×10^{-7} sec. and whose pulse height selectors were replaced by circuits which minimize the variation in delay.[2] The maximum variation in delay was measured using pulses of different heights from a signal generator and was found to be 8×10^{-8} sec. After pulse height selection, the pulses are fed to a coincidence circuit through terminated coaxial cables which introduce a delay of 1.0-μ sec. per 24 ft. of line length (RG65/U; characteristic impedence 1000 ohms). The delay time can be varied from 0 to 2.0-μ sec. in discontinuous steps of 2×10^{-8} sec. The dependence of delay time on line length was measured with a synchroscope; all delays were found to be linear with the length of the coaxial cable. The resolving time of the coincidence circuit is 7×10^{-8} sec. and is kept constant. The clear anthracene crystals[3] and multiplier tubes are cooled to dry-ice temperature, and the tubes are operated at 60 volts per stage.

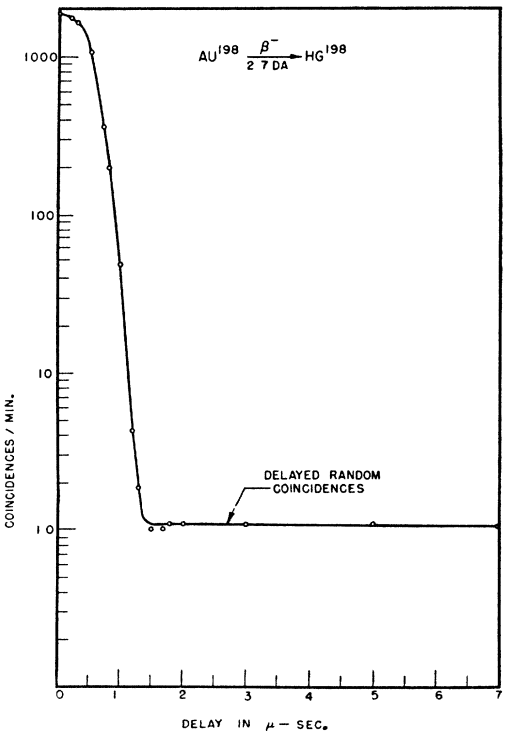

FIG. 1. Number of coincidences as a function of delay time.

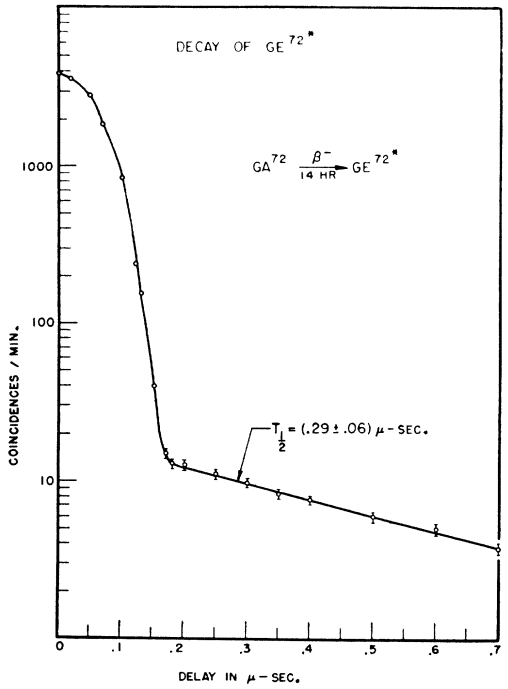

FIG. 2. Delayed coincidences as a function of delay time.

Figure 1 shows the number of coincidences as a function of delay time obtained with a source of Au^{198}. The majority of the sources used gave similar curves exhibiting a sharp break at 1.5×10^{-7} sec. The coincidences observed for shorter delays are mostly due to the scattering of β^--particles from one to the other detector. The width of the peak is just equal to the resolving time of the coincidence circuit plus the variation in delay introduced by the pulse height selectors. For delays larger than 1.5×10^{-7} sec. the number of coincidences is constant and equal to the computed random coincidence rate.

The present observations with Au^{198} are difficult to reconcile with the reported half-life of (2 to 3)$\times10^{-7}$ sec.[4] for the state following the β^--decay of this isotope.

The existence of short-lived isomeric states of Re^{187*} [5] and Ge^{72*} [6] was confirmed. The value of the half-lives was found to be $(5.5\pm0.5)\times10^{-7}$ and $(2.9\pm0.6)\times10^{-7}$ sec., respectively. These values are somewhat different from those previously reported and probably more accurate. Figure 2 shows the delayed coincidence curve obtained with a source of Ga^{72} (decaying to Ge^{72*}) after subtraction of random coincidences. If the 0.41-Mev γ-rays following the β^--decay of Au^{198} had a half-life of (2 to 3)$\times10^{-7}$ sec., they should contribute a number of delayed coincidences about ten times larger than those observed with Ge^{72*}.

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[6] Bowe, Goldhaber, Hill, Meyerhof, and Sala, Phys. Rev. **73**, 1219 (1948).