On the Decay Scheme of $^{47}$Ca ($^*$).

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1. – Introduction.

As a preliminary measurement of an experimental test on time-reversal invariance in strong interactions, the mean life-times of the excited levels of $^{47}$Sc and the mixing ratio $\delta$ of the $\gamma$-transitions have been investigated.

$^{47}$Sc is the daughter of $^{47}$Ca, whose decay scheme, as reported in the literature (1), is shown in Fig. 1.

The energies of the two coincident $\gamma$’s arc 480 and 830 keV, but the energy of the first excited state of $^{47}$Sc is unknown (2).

The subjects, that we have investigated, are:

a) the mean life-time of the excited levels of $^{47}$Sc,

b) which of the coincident $\gamma$’s is the first and which is the second,

c) the mixing ratio $\delta = E_2/M_1$ between the reduced matrix elements of the electric and magnetic transition in the $\gamma_1$ transition.

2. – The experiment.

a) The measurement of the lifetime of the excited levels of $^{47}$Sc has been performed with the usual method of the time-to-amplitude converter.

The converter has been calibrated by means of the "prompt" coincidence between the $\gamma$ rays of a $^{66}$Co source. The sensitivity of our apparatus is of about $3 \cdot 10^{-10}$ s. The experimental results of $^{47}$Sc are within the sensitivity of the apparatus.

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We conclude that the mean life-time of the two excited levels of $^{47}\text{Sc}$ are less than or equal to $3 \cdot 10^{-10}$ s.

b) The sufficiently short life-time of the excited levels of $^{47}\text{Sc}$ allows us to employ the angular correlations method to investigate the other questions. Firstly we have performed a directional angular correlation experiment.

The directional distribution function $W(\theta)$ is

\begin{equation}
W(\theta) = 1 + g_2 A_2 P_2(\cos \theta) + g_4 A_4 P_4(\cos \theta) + \ldots,
\end{equation}

where $g_2, g_4$ are geometrical attenuation coefficients.

In our geometry the calculated value of $g_2$ is $g_2 = 0.948$.

The experimental results of the angular correlation are presented in Fig. 2.

![Directional Distribution Function](image)

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![Angular Correlation](image)

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The best-fit of the data is consistent with $A_4 = 0$ and

\[ A_2 = (-5.0 \pm 0.6) \cdot 10^{-2}. \]

It is noteworthy that the condition $A_4 = 0$ is consistent with the $\frac{3}{2}$ value of the spin of the first excited level of $^{47}\text{Sc}$.

From the theory of angular correlation it is possible to calculate $A_2$ as a function of the mixing ratio $\delta$. In Fig. 3 the behaviour of $A_2 = A_2(\delta)$ is shown.

![Theoretical Behaviour of $A_2$](image)

\[ A_2(\delta) = \frac{\delta^2}{\pi^2} \sin^2 2\theta. \]

Taking into account the experimental value of $A_2$ the following values of $\delta$ are possible:

\[ \delta = 0.21 \pm 0.04, \quad \delta < -24, \quad \delta > 34. \]

To establish which value of $\delta$ is to be chosen a measurement of the $\gamma_1\gamma_2$ polari-