measured decay rate, if detected, would not exceed 0.0004 percent. The contribution to the detected radiation from all the calcium isotopes is also quite negligible.

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Cross Terms in β-Decay

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THE cross terms between S and V and between T and A interaction in β-decay, the so-called Fierz terms, are in general assumed to vanish. This assumption is based on the apparent straightness of Kurie plots for allowed transitions, where the general expression for the β-spectra is given by[1]

$$P_{\mp}=C\cdot pE(E_{\max}-E)^2F(Z,E)(1\pm b/E),$$

$$b_{\mp}=\pm\frac{2[1-(Z/137)^2]^{\frac{1}{2}}\{g_Sg_V|\int 1|^2+g_Tg_A|\int\boldsymbol{\sigma}|^2\}}{[g_S^2+g_V^2]|\int 1|^2+[g_T^2+g_A^2]|\int\boldsymbol{\sigma}|^2}.$$

For low and medium maximum energies, the most important effect of the cross term b/E is a change of the slope of the Kurie plot. This change is, however, not detected since it is equivalent to a change of C. What remains is a curvature which appears as a small deviation from a straight line, the slope of which is adjusted to the experimental points.

If a β-spectrum can be measured accurately from 100 kev up to 100 kev below the maximum energy, and a straight line is drawn in the Kurie plot through these points, the maximum deviation from this line will be a function of $E_{\max}$ and b. This function in percent of the ordinate is illustrated in Fig. 1.

It is seen that even large values of $b(-1\leq b\leq 1)$ give only small deviations and that, consequently, it is difficult to obtain very narrow limits for b. In fact, an analysis of the published β-spectra indicates that in no case can b values as large as 0.4 be excluded. In such experimental comparisons, one should of course remember that b has opposite sign for positron and negatron emission. Furthermore, it should be remembered that b, besides being a function of the coupling constants, also depends on the nuclear matrix elements. The dependence of b on the coupling constants is especially simple in the case where either $|\int 1|^2$ or $|\int\boldsymbol{\sigma}|^2$ vanish. In Fig. 2, we have plotted b as a function of g_A/g_T in the $|\int 1|^2=0$ case.

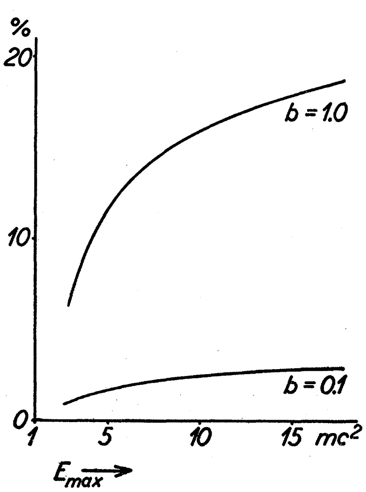

FIG. 1. Maximum deviation of the curved Kurie plot from a straight line drawn through points 100 kev above zero energy and 100 kev below maximum energy for different values of the cross term coefficient b and as a function of $E_{\max}$.

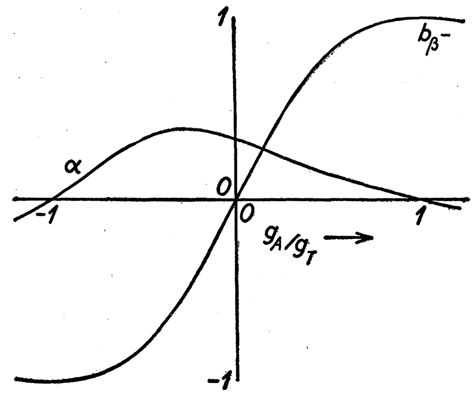

FIG. 2. The experimental angular correlation parameter α and the cross term parameter b_{β^-} for allowed G-T transitions.

The possible existence of cross terms will also influence the interpretation of recoil experiments, where the electron-neutrino angular correlation is investigated. If cross terms exist, this correlation is given by[1]

$$W(\theta_{\beta\nu})=1+a(p/E)\cos\theta_{\beta\nu}+b/E,$$

and the measured angular correlation coefficient will be given by

$$\alpha=a/(1+b/E),$$

where E is a certain mean energy of those electrons for which the angular correlation is measured. In Fig. 2, we have plotted α as a function of g_A/g_T in the case $|\int 1|^2=0$ for $E=2$.

It is seen that a determination of α does not permit a unique determination of g_A/g_T, and therefore, it seems valuable to combine β-spectroscopic measurements with the recoil experiments.

Precision measurements of the shape of allowed β-spectra with high maximum energy are therefore very desirable, and especially for transitions where the ratio $|\int 1|^2/|\int\boldsymbol{\sigma}|^2$ can be estimated so that one can interpret the results in terms of the coupling constants.

A more detailed account of these considerations will be given in *Kongelige Danske Videnskabernes Selskab, Matematisk-fysiske Meddelelser.*

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Heat Pulses in Liquid Helium II below 1°K

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GORTER[1] has suggested that the propagation of heat pulses in liquid helium II well below 1°K can be explained if we assume that the phenomena are not due to second sound but to normal thermal conduction. The purpose of this letter is to agree partially with this suggestion, while pointing out that it is not, as Gorter suggests, inconsistent with the views of Landau,[2] but receives a satisfactory explanation in terms of the development of these views by Khalatnikov.[3,4]

According to Khalatnikov, the mean free path of a phonon at 0.2°K is of the order of 10^3 cm and this is incompatible with the propagation of second sound with a wavelength less than this. The events resulting in the propagation of a heat pulse may therefore be visualized as follows. Phonons are generated at the transmitter and subsequently describe paths during which they suffer no collisions with other phonons. A few phonons travel directly to the