Correlation in the Direction and Polarization of Two Successive Quanta for Rh^{106}, Co^{60}, and Cs^{134}

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DEUTSCH and Metzger[1] have reported their observation of the correlation between the polarization of one quantum and the direction of emission of the other for the two successive gamma-rays of Rh^{106}. We have used a polarimeter of a type similar to that described by Deutsch and have verified their results. In assuming that the two excited states have J-values 020, the angular correlation function $W(\theta)$ can be reasonably well duplicated if one uses half the values of the coefficients α_2 and α_4 as given by Hamilton.[2]

By this same device it is possible also for the data to be in agreement with the theoretical curve in the case of the polarization correlation. Spiers,[3] however, has pointed out that by assuming one of the excited levels to consist of two levels which are close together in energy but which have different spins, then it is possible to account for $W(\theta)$. The expression I_θ/I_ϕ for the polarization correlation, which has been developed by Hamilton[4] can also be accounted for by the assumption of the additional level.

The three spin values ($J_1'=1, 2, 3$) and the two types of transitions (electric dipole and magnetic dipole) suggested by Spiers allow six combinations to be tried for this additional level. Our data, as shown in Fig. 1, indicate that the most likely transitions are $J_1'=3$ (magnetic dipole) or $J_1'=1$ (magnetic dipole or electric dipole). These choices with the resulting parities are shown in Fig. 2.

The experimental curve for Co^{60} is shown in Fig. 1. The directional correlation experiments have shown that both transitions are quadrupole. The polarization correlation experiment indicates that both transitions are electric. The parities of the two excited states are then the same as that of the ground state.

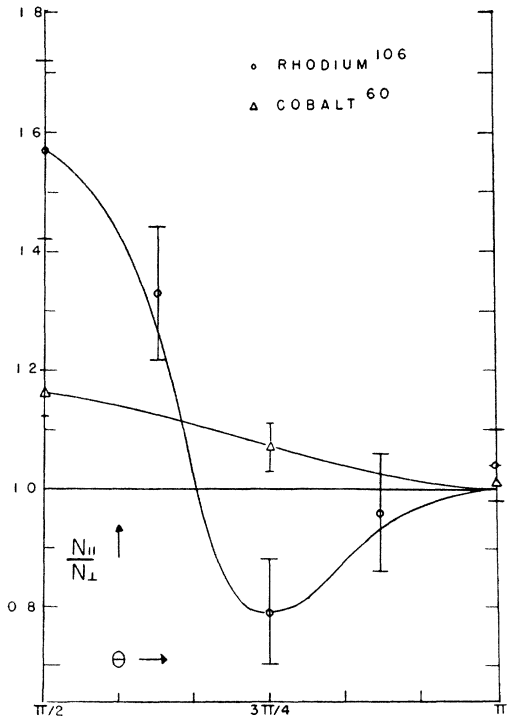

FIG. 1. Polarization of Rh^{106} and Co^{60} gamma-rays.

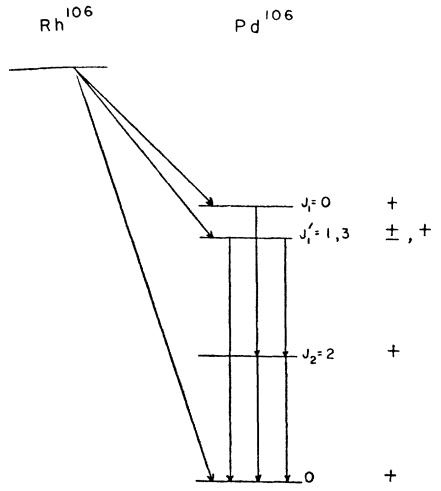

FIG. 2. Energy level scheme for Rh^{106}. The parity for $J'_1=1$ is even or odd, that for $J_1'=3$ is even.

In the case of Cs^{134}, no polarization correlation was observed. According to the theory a correlation should be found for two quadrupole transitions, one of which is magnetic and the other electric, only if the experimental arrangement is such that one can distinguish between which of the two quanta goes to the polarimeter or to the individual counter. In our case this discrimination was not possible. If both transitions are electric or both magnetic, this discrimination is not necessary in order to observe a correlation. If one assumes then that both transitions are quadrupole, the conclusion is that one is electric and the other magnetic.

[1] M. Deutsch and F. Metzger, Phys. Rev. **74**, 1542 (1948).
[2] D. R. Hamilton, Phys. Rev. **58**, 122 (1940).
[3] J. A. Spiers, Phys. Rev. **78**, 75 (1950).
[4] D. R. Hamilton, Phys. Rev. **74**, 782 (1948).

Double Beta-Decay of Te^{130}

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IN a previous letter[1] the authors described the preliminary results of a study of the double beta-transition $Te^{130}\rightarrow Xe^{130}$ by the method of isotopic analysis of xenon extracted from geologically old tellurium ores. The ore on which that work was based was blasted from an outcrop at Mångfallberget, Sweden, and it contained 12 percent by weight of the mineral Bi_2Te_3. Although the age of the telluride minerals in Mångfallberget and in Boliden, Sweden is known to be 1500 ± 500 million years, there exists an uncertainty in the "xenon age" of the Mångfallberget material owing to the possibility of comparatively recent crystal alteration by percolating surface waters.

As a result of the generous cooperation of Dr. Erland Grip of the Boliden Mining Company, we have recently obtained some excellent samples of 70 percent rich Bi_2Te_3 from the 240-meter level of the Boliden mine. According to geologists, it is improbable that the crystals of this Bi_2Te_3 have been affected by a recent alteration. A 371-g sample of this material, containing 124 g of tellurium, was broken up to pea size and vacuum roasted at temperatures high enough to decompose the mineral and produce vigorous boiling of the molten bismuth and tellurium. The rare gases evolved were purified as before,[1] and were found to consist of 2.4×10^{-2} cc S.T.P. argon plus 2.6×10^{-7} cc S.T.P. xenon. The results of an isotopic analysis of this xenon are presented in Table I. The percentage composition of the excess or radiogenic