

- 9) G. Sutter, *Ann. d. Physique* **8** (1963) 323;
- 10) P. Harihar and C. S. Wu, *Bull. Am. Phys. Soc.* **9** (1964) 457;
- 11) T. Alväger, H. Ryde and P. Thieberger, *Arkiv f. Fysik* **21** (1962) 559;
- 12) J. C. Vanderleeden and P. S. Jastram, *Phys. Letters* **19** (1965) 27;
- 13) K. Knauf and H. Sommer, *Z. Physik* **183** (1965) 10;
- 14) Z. Grabowski, S. Gustafsson and G. Bäckström, *Nucl. Phys.* **38** (1962) 648;
- 15) P. Kleinheinz, L. Samuelsson, R. Vukanović and K. Siegbahn, *Nucl. Phys.* **59** (1964) 673;
- 16) K. Knauf, H. Sommer and H. Klewe-Nebenius, *Z. Physik* **197** (1966) 101;
- 17) H. Sommer, K. Knauf and H. Klewe-Nebenius, *Z. Physik* **216** (1968) 153.

E2 Investigation of the $e\gamma$ Process in ^{137}Ba

A. LJUBIČIĆ, B. HRASTNIK, K. ILAKOVAC, M. JURČEVIĆ and V. KNAPP,
Institute "Ruder Bošković", Zagreb

There is a small but finite probability for an excited nuclear state to decay by simultaneous emission of a photon and conversion electron. This

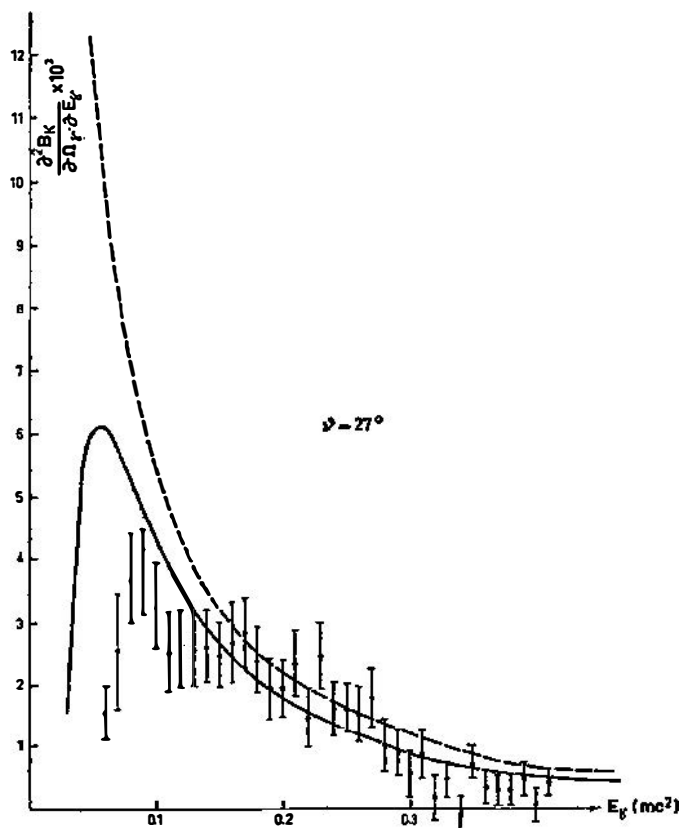


Fig. 1. The ratio of the transition probability for the L.C.E. per unit photon energy interval to the probability for the K -conversion transition in the $e\gamma$ decay of ^{137}Ba . The dashed line represents the theoretical distribution given by Spruch and Goertzel¹⁾ and the solid line is the same distribution modified to account for the attenuation of photons in 1.2 mm of Al, the finite angular resolution, and the photon detector photopeak efficiency.

process can proceed via two different mechanisms in which a real photon is emitted either by a virtual intermediate state of an electron¹⁾ (internal Compton effect — I. C. E.) or of a nucleus²⁾. Earlier experiments³⁾ have shown that the angular distribution in the $e\gamma$ decay in ^{137}Ba is consistent with the I. C. E.

In the present experiment the energy and angular distribution in the $e\gamma$ deexcitation process of the first excited nuclear state in ^{137}Ba was measured by the method of two-dimensional energy analysis, and the triple coincidence technique between photons, electrons and KX -rays. The results for the energy distribution measurements at an angle $\theta = 27^\circ$ of emission between photons and electrons are shown in Fig. 1. In the low-energy region, the discrepancy between the theoretical and experimental data is caused by the divergence of the theoretical transition probability when calculations are based only on the first Feynman diagrams. At energies above ≈ 70 keV the theory gives a rather good fit.

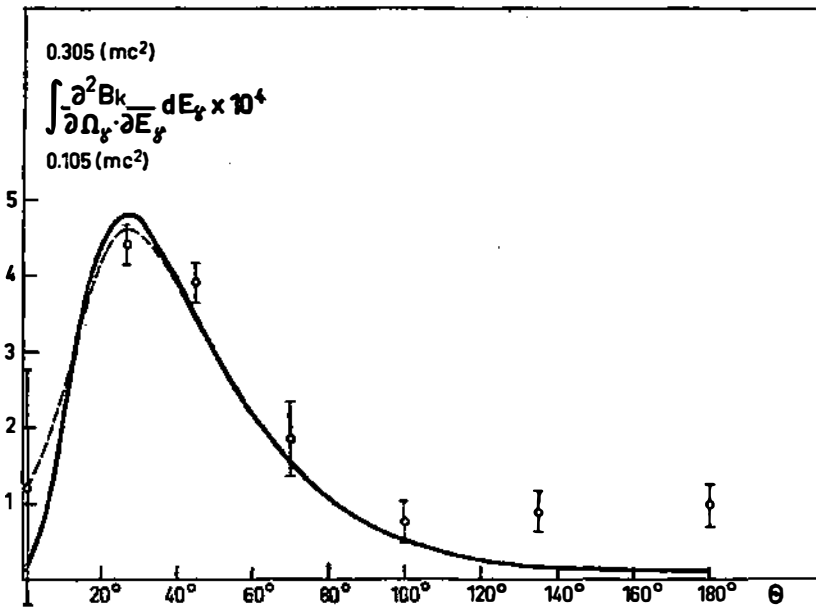


Fig. 2. The angular distribution of the relative transition probability in the $e\gamma$ decay of ^{137}Ba . The solid line is calculated from the Spruch-Goertzel theory¹⁾ and the dashed line represents the correction for the finite angular resolution.

The angular distribution obtained is shown in Fig. 2. The data was summed in the photon energy interval from 50 keV to 150 keV. By integrating over all directions of emission we obtained the experimental value

$$T_{K\gamma}/T_K = (2.24 \pm 0.45) \times 10^{-3},$$

which is in good agreement with the theoretical value for the I. C. E. mechanism

$$T_{K\gamma}/T_K = 1.7 \times 10^{-3}.$$

These results can be compared with the transition probability for the $e\gamma$ process which proceeds via the virtual state of a nucleus. From Beusch's⁴⁾ experiment on the $\gamma\gamma$ process in ^{137}Ba , and by assuming that the energy distribution is known²⁾, we calculated the contribution of this mechanism to be

$$T_{K\gamma}/T_K = 3.8 \times 10^{-8}.$$

This value is very small compared with our experimental result and we can conclude that in the case of ^{137}Ba the $e\gamma$ process proceeds mostly via the I. C. E. mechanism.

References

- 1) L. Spruch and G. Goertzel, Phys. Rev. 94 (1954) 1671;
- 2) J. Eichler, Z. Physik 160 (1960) 333;
- 3) E. Fuschini et al., Nuovo Cimento B41 (1966) 25; T. Lindquist et al., Nucl. Phys. 5 (1958) 47;
- 4) W. Beusch, Helv. Phys. Acta 33 (1960) 363.

E3 Gamma-Gamma Angular Correlation Measurements with a Ge(Li) Detector in one Channel

B. HRASTNIK, *Institute "Ruder Bošković", Zagreb*

A Ge(Li)—NaI(Tl) system with a planar $2.5 \text{ cm}^2 \times 3 \text{ mm}$ Ge detector for coincident and directional gamma-gamma angular correlation measurements with a two-dimensional analysing system is described. The overall work of the system was tested by the lifetime measurement of the 482 keV level in ^{181}Ta and by the anisotropy measurement for the 1.172—1.332 MeV cascade gamma transition in ^{60}Ni . The system was used for angular correlation measurement of the very weak 71.66—249.69 keV cascade gamma-gamma transition in ^{177}Hf . Previous measurements performed using NaI(Tl)—NaI(Tl) systems, were not satisfactory because of their poor energy resolution and high background of the intense gamma transitions in ^{177}Hf . The correlation coefficients obtained in the present measurement were $A_{22} = -0.114 \pm 0.018$ and $A_{44} = 0$. The upper limit $|\delta| < 0.05$ was deduced for the $M2/E1$ mixing ratio for the 71.66 keV transition.

References

- 1) B. Hrastnik, A. Ljubičić, I. Basar, M. Dikšić, K. Ilakovac, M. Jurčević, V. Knapp and B. Vojnović, Fizika 1 (1969) 117;
- 2) B. Hrastnik, A. Ljubičić, B. Vojnović, K. Ilakovac and M. Jurčević, Fizika 1 (1969) 127;