REMARKS ON K-CONVERSION COEFFICIENTS OF E 2 TRANSITIONS IN RARE-EARTH NUCLEI

RECENT work of Subba Rao[1] and Ramaswamy[2] on E 2 transitions in rare-earth nuclei has pointed to the rather interesting conjecture that there may be a correlation between nuclear deformation and deviations of α_K from theory. This was reached in spite of the rather large errors in the available data for E 2 conversion coefficients.

It is the purpose of this note to emphasize that more accurate values for α_K for E 2 transitions can be obtained for comparison with theory by combining the data on measured half-life, the reduced E 2 transition probability determined from inelastic proton scattering experiments and energies accurately determined with a bent crystal spectrometer, which are related by the equation;

$$B\,(E\,2)\,[2^+ - 0^+] = \frac{75\hbar}{4\pi}\left(\frac{\hbar C}{E}\right)^5 \frac{ln\,2}{t_{\frac{1}{2}}\,(1+\alpha)}\,. \quad (1)$$

From this an experimental $\alpha_{expt.}$ can be deduced. If the assumption is made that no deviations from theory occur for K/L ratios as found by Subba Rao,[1] and further if we take $\alpha_M + \alpha_N + \cdots = 1/3\,(\alpha_L)$, then $(\alpha_K)_{expt.}$ can be deduced from the relation:

$$(\alpha_K)_{expt.} = \frac{\alpha_{expt.}}{1+(4/3)\,\alpha_L/\alpha_K}\,. \quad (2)$$

This can be in turn compared with theory as also with direct determination of α_K from magnetic spectrometer data. Such a comparison is made and shown in Table I. The fourth column is theoretically computed[3] The fifth column lists the $(\alpha_K)_{expt.}$ as deduced from equation (2). The last column gives the values labelled as $(\alpha_K')_{expt.}$ and are the conversion coefficients determined from magnetic spectrometer data taken from the compilation of Subba Rao.[1] For $\alpha_{expt.}$ the values given in a recent paper by Fossan and Herskind[4] have been used.

Nucleus	Transition Energy (keV)	$\alpha_{expt.}$ (Ref. 4)	α_L/α_K (Ref. 3)	$(\alpha_K)_{expt.}$	(α_K') (Ref. 1)
Sm^{152}	122	1·26 ±0·1	0·559	0·72 ±0·06	0·7 ±0·1
Gd^{154}	123	1·46 ±0·2	0·653	0·78 ±0·11	0·54 ±0·13
Gd^{156}	89	4·1 ±0·2	1·171	1·60 ±0·04	..
Dy^{160}	84	5·7 ±0·4	1·692	1·75 ±0·12	1·75 ±0·2
Er^{164}	91	5·2 ±0·4	1·759	1·55 ±0·12	1·9 ±0·2
Er^{166}	81	7·2 ±0·4	2·452	1·69 ±0·09	1·88 ±0·18
Yb^{170}	84	7·2 ±0·4	2·878	1·49 ±0·08	1·6 ±0·15
W^{182}	100	4·5 ±0·2	2·742	0·97 ±0·04	..

Some interesting facts emerge from this comparsion.

1. The $(\alpha_K)_{expt.}$ as determined from equation (2), Column 5, in Table I has smaller error than the weighted values of (α'_K) (column six).

2. The two values for α_K agree within statistics with the possible exception of the 123 keV transition in Gd^{154} indicating the need for remeasurement of one of several quantities in equation (1) or (α_K').

3. Since recent (α_K') values as measured by the Internal-External conversion method are by far the most accurate, claiming an accuracy of 3% or better (which might be an underestimate considering the errors that enter into the theoretical calculation of the photoelectric cross-section), it appears as though we have here a good check on the IEC method.

In conclusion, it is to be emphasized that further experimental data on rare-earth transitions are needed to clear up the question of a possible connection between nuclear deformation and deviations of α_K from theory.

Dept. of Physics, — M. K. Ramaswamy.
Karnatak University, — S. M. Brahmavar.
Dharwar-3, *April* 10, 1963.

1. Subba Rao, B. N., *Nuovo Cim.*, 1960, **17**, 189.
2. Ramaswamy, M. K., *Ibid.*, 1960, **18**, 1287.
3. Pancholi, S. C. and Siddique, D., *Annal. Acad. Reg. Sci. Upsala*, 1962, **6**, 59.
4. Fossan, D. B. and Herskind, B., *Nucl. Phys.*, 1963, **40**, 24.