JOURNAL OF THE PHYSICAL SOCIETY OF JAPAN VOL. 34, SUPPLEMENT, 1973
PROCEEDINGS OF THE INTERNATIONAL CONFERENCE ON NUCLEAR MOMENTS AND NUCLEAR STRUCTURE, 1972

VI–13

Magnetic Moment and Beta Decay of RaE

MASATO MORITA and HISAO OHTSUBO

Department of Physics, Osaka University, Toyonaka, Osaka

The magnetic dipole moment of beta radioactive nuclei can be determined by measuring the angular distribution $W(\theta)$ of beta-rays from polarized nuclei,

$$W(\theta) = \sum_n A_n P_n (\cos\theta) \ . \tag{1}$$

For example, the asymmetry for the $1^- \to 0^+$ transition is given by

$$A = \frac{W(0) - W(\pi)}{W(0) + W(\pi)} = \mp \frac{P}{E}\frac{\langle m \rangle}{j} D(E) \text{ for } \beta^{\mp}, \tag{2}$$

p, E, and $\langle m\rangle/j$ being the electron momentum, energy, and degree of nuclear polarization, respectively. In eq. (2), a factor $D(E)$ is nearly equal to unity for most of the case. Therefore, the sign of the magnetic moment can be derived from the sign of the asymmetry, if the direction of the internal magnetic field in the source is known.

We made a theoretical investigation of $D(E)$, since a group of the University of Tokyo[1] is performing measurement of the magnetic moment of RaE in terms of the beta-ray asymmetry. The factor $D(E)$ for RaE is energy dependent and it is less than unity. We can express it as a function of the nuclear matrix element ratios

$$X = \frac{C_V \int i\boldsymbol{r}}{C_A \int \boldsymbol{\sigma} \times \boldsymbol{r}} \quad \text{and} \quad Y = \frac{C_V \int \boldsymbol{\alpha}}{C_A \int \boldsymbol{\sigma} \times \boldsymbol{r}} \ . \tag{3}$$

We found a linear relation in X and Y in a good approximation from the least chi-square fit of the shape correction factor $C(E)$ of beta particles which is strongly dependent on the electron energy. The factor $D(E)$ is positive and less than unity for all possible pairs of X and Y. From these pairs, we can choose a particular one by measuring $D(E)$ or by adopting the CVC theory. Furthermore, magnitudes and relative signs of the matrices $\int \boldsymbol{\alpha}$, $\int i\boldsymbol{r}$, and $\int \boldsymbol{\sigma} \times \boldsymbol{r}$ are determined by using the experimental half life.

We obtained a set of configuration mixing ratios in the RaE wave function which is consistent with all experimental data on beta decays and on magnetic moment. It is also consistent with nuclear forces commonly adopted.

Reference

1) K. Nagamine *et al.*, presented at this conference II.d.