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# V-7 The $g$-Factor of the 133 keV Excited State of $^{131}$Cs

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The $g$-factor of the 133 keV excited state ($T_{1/2}$ = 9.3 nsec) of $^{131}$Cs has been investigated by measuring the perturbed angular correlation of the 487 keV–133 keV gamma-gamma cascade in $^{131}$Cs in an applied external magnetic field. Samples of barium nitrate (enriched to 48.3% in $^{130}$Ba) were irradiated with thermal neutrons in Research Reactor of Kyoto University at Kumatori for 1–3 weeks, and disolved into dilute HCl solution. The directional correlation was measured with NaI(Tl) detector, which was set on the 487 keV and the 496 keV composed peak and was rotated through 90°, 105°, 120°, 135°, 150°, 165° and 180°, and a fixed 22 cc Ge(Li) detector. A coincidence gate signal from the two detectors was used to obtain the coincidence spectrum of each angle, and from the photo peak areas of separated 133 keV and 124 keV peaks, we obtain $A_2 = 0.306 \pm 0.035$, $A_4 = 0.003 \pm 0.050$ for the 487 keV–133 keV cascade, while the 496 keV–124 keV cascade shows isotropic correlation. In the measurement, liquid sources were used so that the influence of the time-dependent quadrupole interaction should be minimized, and $G_2 = 1$ was confirmed by delayed angular correlation measurement.

The time-differential angular correlation was measured with a fixed 22 cc Ge(Li) detector, which was set on the 487 keV peak, and a movable NaI(Tl) detector (photomultiplier tube: Philips *XP1021*) which was set on the 133 keV composed peak. An output pulse of Ge(Li) detector was amplified and formed by ORTEC 454 timing amp. 453 constant-fraction discriminator, and used for a start pulse of ORTEC 437A time-to-pulse-height converter. An output pulse of NaI(Tl) detector was used as stop pulse of the T.P.H. converter. The FWHM of the system was 7 nsec for the 511 keV–511 keV prompt coincidence of $^{22}$Na annihilation gamma rays. Time spectra were measured at 135° and 225°. An external magnetic field of 15900 G was applied normally to the cascade plane. After subtruction of accidentals and small contribution of

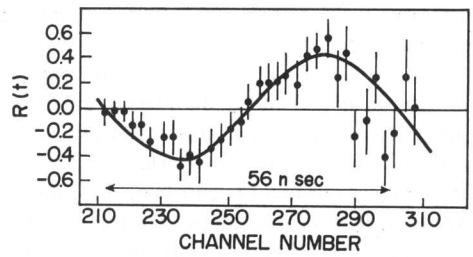


Fig. 1

the 596 keV–124 keV cascade which occurs from Compton part of the 496 keV gamma rays, the ratio $R(t) = 2[C(135°) - C(225°)]/[C(135°) + C(225°)]$ was calculated and the result is plotted in Fig. 1. Where $C(\theta) = C^+(\theta) + C^-(\theta)$ and $C^+(\theta)$ and $C^-(\theta)$ are coincidence counts of field up and of field down. Since the result of the directional correlation experiment provides small $A^4$ value for the 486 keV–133 keV cascade, we neglect the $A^4$ term in the analysis of the ratio $R(t)$. Then, one obtains $R(t) = 12A_2 \sin(2\omega_L t)/(8 + 2A_2)$, where $\omega_L$ is a frequency of Lamor precession. The solid curve in Fig. 1 shows most fitted curve and from the period of $R(t)$, we calculated the $g$-factor of the 133 keV level as $g = 0.74 \pm 0.03$. Our result is in good agreement with that of Fechner *et al.*[1]: $g = 0.787 \pm 0.50$, which was determined from a time-integral perturbed angular correlation experiment measured with a Ge(Li)-NaI(Tl) coincidence system. The value of $g = 0.99 \pm 0.06$, however, which was reported by Brandão *et al.*[2] from a time-differential perturbed angular correlation experiment measured with a NaI(Tl)-NaI(Tl) coincidence system, disagrees with ours over the experimental error.

## References

1) Fechiner *et al.*: Nuclear Phys. **A130** (1969) 545.
2) Brandão *et al.*: Nuclear Phys. **56** (1964) 65.