SPECTRAL SHAPE OF THE $0^- \rightarrow 0^+$ BETA TRANSITION OF ^{144}Ce

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INTRODUCTION

THE shapes of beta spectra with only two axial vector matrix elements[1] contributing to the $0^- \rightarrow 0^+$ decays are of considerable interest for the theory of weak interactions. After the great success of the concept of CVC theory, the question of whether the axial-vector current is partially conserved, arose. Tadic[2] pointed out that one may expect (*a*) almost statistical shapes (*i.e.*) C (W) = constant for all $0 \rightarrow 0$ transitions with parity change and (*b*) small Fierz-type deviations from the statistical shape for allowed GT transitions, if the axial-vector current is partially conserved. It can be useful to investigate whether all the $0^- \rightarrow 0^+$ decays really have an almost statistical shape. It is the purpose of this work to analyse in detail the $0^- \rightarrow 0^+$ transitions in the decays of Ce^{144}, Pr^{144} and Ho^{166}.

There was only one measurement of the shape of the $0^- \rightarrow 0^+$ transition in ^{144}Ce by Daniel *et al.*[4]. They[4] have also subtracted the extrapolated spectrum of ^{144}Pr down to low energies by assuming the shape of the ^{144}Pr spectrum to be allowed. But the high energy component of ^{144}Pr was not well studied by that time. A systematic study[3] of the ^{144}Pr spectrum for its shape and then its use in the extrapolation down to low energies will help in determining the shape of the $0^- \rightarrow 0^+$ transition in ^{144}Ce. Hence a detailed analysis of the $0^- \rightarrow 0^+$ transition in ^{144}Pr has been undertaken. A continuous measurement down from 100 KeV to 3 MeV will be of very great accuracy rather than using the published data of C (W) for the high energy group of ^{144}Pr.

EXPERIMENTAL DETAILS AND RESULTS

Carrier free ^{144}Ce, ^{144}Pr sources were obtained from Bhabha Atomic Research Centre, Bombay, in the form of $CeCl_3$ in HCl solution in two different consignments. Uniform sources were prepared on thin aluminised mylar backing of thickness-180 $\mu g/cm^2$. The source thicknesses ranged from 25 to 35 $\mu g/cm^2$.

The Siegbahn–Slatis beta ray spectrometer used in the present investigation with a plastic well type detector is described elsewhere[6]. The mode of analysis is described in Ref. 6.

A very complete and accurate analysis of the high energy beta group in ^{144}Pr has provided the facility to study the $0^- \rightarrow 0^+$ low energy transition in ^{144}Ce.

It is possible to extend the 100% detection efficiency range of the detector used in the present work[5] down to 50 KeV by lowering the discriminator bias and raising the anode voltage. For this purpose a 6810 A RCA photomultiplier was operated at its best performance conditions with minimum discrimination bias so as to get a 100% efficiency range upto 100 KeV. At this discriminator level the photomultiplier noise was also low.

The beta spectrum was scanned from 150 KeV to 350 KeV in steps of 5 KeV and from 400 KeV to 3 MeV in steps of 25 KeV in order to get a number of points in the interested energy region to get a detailed analysis. The 3·002 MeV beta group after i.s correction with the observed shape correction factor is extrapolated down to 150 KeV and a subtraction analysis as described in Ref. (6) is carried out. There is an inner beta component in ^{144}Ce decay with an end-point energy of 230 KeV and with an intensity of 4·6%. The thoretical spectrum of the 230 KeV beta group was constructed with allowed shape and with an intensity of 4·6% obtained from the data sheets. This was normalised with the total beta spectrum for countrate. The shape corrected F. K. plot of the inner beta group was subtracted from the gross spectrum. The resulted spectrum was subjected to Fermi–Kurie analysis. The correct end point energy was judged from the behaviour of the shape factor plot near the end point end for a variation of a few KeV in the end point energy. The shape is analysed for shape factor coefficients with the correct end point energy 320 ± 1 KeV using the programme 'SHAPFIT'. The experimental points were found to be best fitted with a shape factor of the form $C(W) = K(1 + aW)$. A weighted least-squares fit of the results has resulted in a value of a as $a = -0{\cdot}537 \pm 0{\cdot}023$. This result is in good agreement with that of Daniel *et al.* The results for three runs are given in Table I. The shape factor plot for one of the runs is given in Fig. 1.

TABLE I

Shape factor results

Run No.	T_0 (KeV)	'a'
1.	320 ± 1	−0·54 ± 0·02
2.	320 ± 1	−0·51 ± 0·02
3.	320 ± 1	0·52 ± 0·02

As shown by the present investigations, the spectra of $0^- \rightarrow 0^+$ transitions of ^{144}Ce, ^{144}Pr and ^{166}Ho are not at all statistical. These results do not support the concept of a partially conserved axial vector current theory as suggested by Tadic[1].

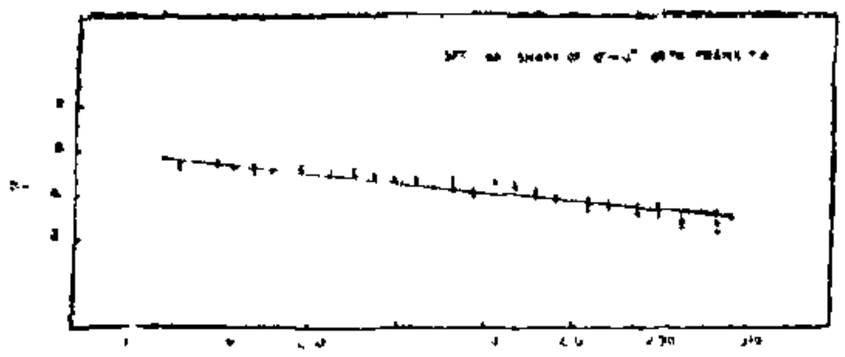

FIG. 1. Shape factor plot for the $0^- \rightarrow 0^+$ beta Transition of ^{144}Ce. Solid line is the least square fit for $C(W) = (1 + aW)$ with $A = -0.537 \pm 0.023$ and $W_0 = 320$ KeV.

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SILVER (I) COMPLEXES OF SULFATHIAZOLE, SULFADIAZINE, SULFAMERAZINE AND SULFAMETHAZINE

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ABSTRACT

Silver (I)-Sulfadrug complexes of the ype, AgD and Ag (HD) NO_3 where HD = sulfathiazole, sulfadiazine, sulfamerazine and sulfamethazine, have been prepared and characterized. The complexes are white, insoluble in water and organic solvents and decompose without melting well below the melting points of the drugs. The drug molecules co-ordinate in anionic or neutral form.

INTRODUCTION

IN our recent publications[1–3], we have reported the preparation and characterization of the complexes of sulfadrugs with Cu (II), Zn (II), Cd (II) and Hg (II). Since the sulfadrugs are known for their bacteriostatic properties and their interactions with metal ions are not well understood, we are presently reporting their reactions with Ag (I) in aqueous and in ammoniacal media.

EXPERIMENTAL

Silver (I) chloride, nitrate and sulphate, B.D.H., A.R. Grade were used for the preparation of the complexes. Purity of the drugs was judged from their melting points and were used as such. Ag (I) chloride and sulphate complexes were prepared by adding hot ammoniacal solution of metal salt (0·01 M) to the hot solution of sulfadrug (0·01 M) in dilute ethanol keeping the drug slightly in excess while Ag (I) nitrate complexes were prepared by mixing aqueous solution of the metal-salt (0·01 M) in minimum amount of water to the hot ethanolic solution of sulfadrug (0·01 M) keeping silver nitrate in excess. The reaotion mixtures were heated for about ½ hr. The complexes were filtered, washed free from the sulfadrug or silver nitrate with dilute ethanol and dried in a desiccator.

Metal part and sulphur in the complexes were estimated gravimetrically and nitrogen microanalytically, using a Coleman Nitrogen Analyzer. I.R. and electronic spectra were recorded on Perkin-Elmer-257 and Cary-14 respectively. The analytical data and some general characteristics of the complexes are summarized in Table I. Some important i.r. bands are given in Table II.

RESULTS AND DISCUSSION

The sulfadrugs form 1:1 complexes with Ag (I) both in water and ammoniacal solutions. The original anion is present in the complexes isolated from aqueous solution while it is absent in those isolated from ammoniacal solution. In the former case the sulfadrugs act as neutral coordinating ligand while in the latter case they act as anionic coordinating ligands. The complexes are white and insoluble in water and organic solvents. They decompose in the range 228–289° C. In the case of silver (I) chloride or sulphate complexes with drugs, the course of reaction may be as follows :

$$Ag\,Cl\ (\text{or } \tfrac{1}{2}\,SO_4^{=}) + NH_3 + HD \rightarrow Ag^+ D^- + NH_4^+ + Cl^-\ (\text{or } \tfrac{1}{2}\,SO_4^{=})$$

Sulfadrugs $\left(H_2N^+ = \langle\bigcirc\rangle = SO_2^- NHR \longleftrightarrow H_2N - \langle\bigcirc\rangle - SO_2\,NHR \right)$ essentially have