^{132}Te -Comments on evaluation of decay data

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Evaluation Procedure

Limitation of Relative Statistical Weight Method (LWM) was applied to average the measured decay data when appropriate (see below).

Decay Scheme

A simple decay scheme was constructed from the gamma-ray studies of 1966Fr02 and 1981Yo02. An earlier study involved the use of low-resolution NaI(Tl) detectors, and these data have been set aside from consideration in this particular evaluation [1958Ch28]. The gamma-ray emission probabilities were expressed in terms of the emission probability of the 228.327-keV gamma ray (100 %), and weighted mean data were derived as appropriate.

All 100 % of the beta decay goes directly to the 277.86-keV nuclear level of ^{132}I, and the resulting four gamma cascade dominates the decay scheme.

Nuclear Data

^{132}Te undergoes beta decay to the 277.86-keV nuclear level of ^{132}I that undergoes gamma decay to the ground state of ^{132}I predominantly through the 49.72- and 228.327-keV gamma transitions.

Half-life (^{132}Te)

The recommended half-life has been determined from the measurements of Cheever *et al.* (1958Ch28), Andersson *et al.* (1965An05), Baba *et al.* (1971BaZW) and Walz *et al.* (1983Wa26). A value of 3.230 (13) days was derived in terms of LWM, with the uncertainty increased to the lowest measured value of ± 0.013.

Half-life measurements (^{132}Te).

Reference	Half-life (days)
1956Fl15	2.8 ± 0.1*
1958Ch28	3.2 ± 0.2
1965An05	3.26 ± 0.03
1971BaZW	3.28 ± 0.02
1983Wa26	3.204 ± 0.013
Recommended value	3.230 ± 0.013

* set aside from the LWM analysis as an outlier.

Gamma Rays

Energies

Gamma-ray transition energies were calculated from the structural details of the proposed decay scheme. The nuclear level energies of 2005Kh07 were adopted, and used to determine the energies of the gamma-ray transitions between the populated-depopulated levels, apart from the 228.327-keV gamma ray which was taken from 1979Bo26.

Emission Probabilities

Although judged to be a rather limited data set, a reasonably consistent decay scheme was derived from the relative gamma-ray emission probabilities measured by Fransson and Bemis (1966Fr02) and Yousif *et al*. (1981Yo02). These relative emission probabilities were normalised to the 228.327-keV gamma ray (100 %). The 49.72-keV gamma ray has only been quantified by 1966Fr02, and therefore the relative emission probability of this low-energy gamma ray was calculated from the population-depopulation balance of the 49.72-keV nuclear level (with no populating beta transition). A value of 2.1 (2) % was adopted for the relative emission probability of the 111.80-keV gamma ray on the basis of the population-depopulation balance of the 161.52-keV nuclear level (with no populating beta transition) and the measurement of Fransson and Bemis. Finally, the possible existence of a low-intensity 161.5-keV gamma transition from the 161.52-keV nuclear level to the ground state of I-132 was discarded on consideration of the population-depopulation of the 161.52-keV nuclear level.

Relative gamma-ray emission probabilities (%).

transition	E_γ (keV)	P_γ^{rel}		
		1966Fr02	1981Yo02	Recommended
$\gamma_{2,0}$ (I)	49.72 (1)	16.3 (11)	17.02 (34)*	17.14 (4)*
$\gamma_{4,2}$ (I)	111.80 (8)	2.1 (2)	1.98 (5)	2.1 (2)‡
$\gamma_{5,4}$ (I)	116.34 (13)	2.2 (2)	2.23 (6)	2.23 (6)
$\gamma_{5,2}$ (I)	228.327 (3)	100 (6)	100 (2)	100 (2)

* deduced from decay scheme and calculated branching ratio (not measured directly).

‡ adopted from 1966Fr02 and on the basis of the population-depopulation balance of the 161.52-keV nuclear level.

Gamma-ray emissions: recommended energies, relative emission probabilities, multipolarities and theoretical internal conversion coefficients (frozen orbital approximation).

E_γ (keV)	P_γ^{rel}	Multipolarity	α_K	α_L	α_{M+}	α_{tot}
49.72 (1)	17.14 (4)	M1	4.83 (7)	0.64 (1)	0.15 (1)	5.62 (8)
111.80 (8)	2.1 (2)	M1 + E2 δ = 0.58 (6)	0.562 (17)	0.115 (9)	0.033 (4)	0.71 (3)
116.34 (13)	2.23 (6)	M1 + E2 δ = 0.53 (5)	0.489 (13)	0.093 (6)	0.024 (1)	0.606 (20)
228.327 (3)	100 (2)	E2	0.0802 (12)	0.0151 (2)	0.0037 (1)	0.0990 (14)

Multipolarities and Internal Conversion Coefficients

The nuclear level scheme specified by Khazov *et al*. (2005Kh07) has been used to define the multipolarities of the gamma transitions on the basis of known spins and parities. Somewhat disparate mixing ratios were obtained by Fransson and Bemis (1966Fr02) and Yousif *et al.* (1981Yo02). All of the multipolarities recommended by Yousif *et al.* were adopted with improved uncertainties introduced for the (M1 + E2) transitions. These data were used to determine the internal conversion coefficients of the 49.7-, 111.8-, 116.3- and 228.327-keV gamma rays from the theoretical tabulations of Band *et al.* (2002Ba85, 2002Ra45) by means of the methodology of Kibédi *et al.* (2008Ki07) in which the frozen orbital approximation was adopted.

A normalisation factor of 0.8812 (13) was calculated from the internal conversion coefficients and relative emission probabilities of the gamma-ray transitions depopulating the 277.86-keV nuclear level of ^{132}I, assuming that there is no direct beta feeding to other levels as implied from the various spins and parities:

$$\sum P_{\gamma+ce}^{rel} = 100\%$$

$$P_\gamma(116.34 \text{ keV}) + P_\gamma(228.327 \text{ keV})\, F = 100$$

$$[3.58(10) + 109.90(14)]\, F = 100$$

$$F = 0.8812 \pm 0.0013$$

Beta-particle Emission

Energy and emission probability

The single beta-particle energy was calculated from the structural detail of the proposed decay scheme. A nuclear level energy of 277.86(6) keV adopted from Khazov *et al*. (2005Kh07) and a Q_{β^-} value of 518 ± 4 keV from Audi *et al.* (2003Au03) were used to determine the energy and uncertainty of this beta-particle transition.

Beta-particle Emission Probability per 100 Disintegrations of ^{132}Te.

Transition	E_β (keV)	P_β	Transition type	log*ft*
$\beta^-_{0,5}$	240 ± 4	100	allowed	4.85

Atomic Data

The x-ray and Auger electron data have been calculated using the evaluated gamma-ray data, and the atomic data from 1977La19, 1996Sc06, 1998ScZM and 1999ScZX.

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