

⁵¹Cr - Comments on evaluation of decay data by E. Schönfeld and R. G. Helmer

1 Decay scheme

The decay scheme is complete since there is only one excited level in ⁵¹V below the decay energy and it is populated in this decay.

The J^π and half-life of the excited level are from the 1997Zh09 evaluation.
See 1973De60 for a very complete evaluation of the nuclear and atomic data related to this decay.

2 Nuclear Data

Q value is from Audi and Wapstra (1995Au04).

The half-life data, in days, are as follows:

| | | | |
|---------------|------------|----------------------|------------------------|
| 26.0 | (10) | 1940Wa02 | |
| 26.5 | (10) | 1940Wa02 | |
| 26 | | 1948Ho04 | |
| 27 | | 1948Mi12 | |
| 27.75 | (30) | 1952Ly17 | |
| | | | |
| 27.9 | (2) | 1956Ka33 | |
| 27.8 | (1) | 1956Sc87 | |
| 27.85 | (2) | 1957Ka65 | |
| 28.04 | (16) | 1957Ka65 | |
| 27.75 | (30) | 1957Wr37 | |
| | | | |
| 27.82 | (20) | 1963Ho17 | |
| 27.701 | (6) | 1964Ma56 | |
| 27.5 | | 1965Sa09 | |
| 27.7 | (2) | 1967LaZZ | superseded by 1975La16 |
| 27.80 | (51) | 1968Bo25 | |
| | | | |
| 27.704 | (3) | 1969MeZV | superseded by 1982RuZV |
| 27.679 | (17) | 1970WaAA | superseded by 1983Wa26 |
| 27.76 | (15) | 1972Em01 | |
| 28.1 | (17) | 1973ArZI | |
| 27.721 | (26) | 1973LaAA | superseded by 1975La16 |
| | | | |
| 27.750 | (9) | 1973Vi13 | |
| 27.703 | (8) | 1974Ts01 | |
| 27.72 | (3) | 1975La16 | |
| 27.690 | (5) | 1980Ho17 | |
| 27.71 | (1) | 1982ChZF | |
| | | | |
| 27.705 | (12) | 1982DeYX | superseded by 1983Wa26 |
| 27.73 | (1) | 1982HoZJ | superseded by 1992Un01 |
| 27.704 | (3) | 1982RuZV | |
| 27.71 | (3) | 1983Wa26 | |
| 27.7010 | (12) | 1992Un01 | |
| | | | |
| 27.703 | (3) | Adopted value | |

Comments on evaluation

Three sets of half-life values were analyzed with the Limitation of Relative Statistical Weight, LRSW, method (1985ZiZY,1992Ra08) ; these sets had 21, 20, and 9 values. In all three cases the LRWS analysis increases the uncertainty of the 1992Un01 value from 0.0012 to 0.0021 in order to reduce its relative weight from 76% to 50%.

For all 21 values with uncertainties and not superseded, the LRSW weighted average is 27.7034 with an internal uncertainty of 0.0015, a reduced- $\chi^2 = 5.06$, and an external uncertainty of 0.0034. The largest contribution to this reduced- χ^2 is 2.7 from the first value from 1957Ka65. If this value is removed from the data, the remaining 20 values give an LRSW weighted average is 27.7026 with an internal uncertainty of 0.0015, a reduced- $\chi^2 = 2.49$, and an external uncertainty of 0.0024.

The third analysis was done with the nine values from the set of twenty which have uncertainties of ≤ 0.03 (namely, 1964Ma56, 1973Vi13, 1974Ts01, 1975La16, 1980Ho17, 1982ChZF, 1982RuZV, 1983Wa26, and 1992Un01). In this case the LRSW analysis gives a weighted average of 27.7025, an internal uncertainty of 0.0015, a reduced- χ^2 of 4.48, and an external uncertainty of 0.0032.

The adopted value of 27.703 (3) is consistent with all three of these results.

2.1 Electron Capture Transitions

The capture branching is determined from the $P_\gamma(320)$ value (see sec. 4.2).

The P_K etc. values from LOGFT and EC-CAPTURE codes agree quite well, namely

| Level | P_K | LOGFT | | EC-CAPTURE | | |
|-------|-------|--------|-----------|-------------|-------------|------------|
| | | P_L | P_{M+N} | P_K | P_L | P_M |
| 0 | 0.892 | 0.0927 | 0.0154 | 0.8919 (17) | 0.0934 (14) | 0.0144 (6) |
| 320 | 0.891 | 0.0935 | 0.0156 | 0.8910 (17) | 0.0941 (14) | 0.0145 (6) |

The EC-CAPTURE values have been adopted.

2.3 Gamma Transitions

The internal-conversion coefficient of $\alpha = 0.00169$ (5) and $\alpha_K = 0.00154$ (3) are from the analysis of experimental data in 1985HaZA. These results are based on $\alpha = 0.00169$ (5) (1973Wi10) and α_K values of 0.00157 (8) (1969KaAA, as quoted in 1985HaZA), 0.00156 (8) (1970Ca17), 0.00146 (13) (1970Ri11), and 0.00153 (4) (1973Wi10). From $K/L = 11.3$ (6) and $L/M = 5.1$ (6) from 1969Dr01, one obtains $\alpha_L = 0.000136$ (8) and $\alpha_M = 0.000027$ (4). [An earlier evaluation by 1973De60 had available the latter three α_K values and deduced $\alpha_K = 0.00153$ (4) and from the above K/L and L/M ratios, $\alpha = 0.00169$ (5).] Other measured values of α are 0.00162 (16) (1955Bu01), 0.0031 (2) (1955Es15), 0.0015 (2) (1956Of03), and 0.0016 (2) (1962Gu09) and those of α_K are 0.0029 (2) (1955Es15), 0.00138 (13) (1955Of01), 0.00146 (10) (1968Ri17, superseded by 1970Ri11), and 0.001527 (36) (1969WiAA, as quoted in 1985HaZA, superseded by 1973Wi10).

The mixing ratio, δ , deduced from these α_K and α_L and the conversion coefficients interpolated from the tables of 1976Ba63 is 0.40 (4). This compares reasonable well with the value of +0.465 (20) from the evaluation of 1997Zh09 which is based on the measured values of +0.43 (3) from (γ,γ') , +0.52 (7) from Coulomb excitation, and 0.49 (3) calculated from the adopted $B(E2)$ and half-life values.

3, 3.1, and 3.2 X Radiations and Auger Electrons

Data are from 1996Sc06.

4.1 Electron Emissions

The data are from the γ -ray and atomic data in sec. 2.1, 2.2, and 3. A comparison of these intensities (in %) and those from RADLST gives :

| | EMISSION | RADLST |
|---------|-------------|-------------|
| L Auger | 147.6 (10) | 146.17 (16) |
| K Auger | 66.4 (6) | 66.32 (5) |
| K-320 | 0.0152 (3) | 0.0166 (13) |
| L-320 | 0.00134 (8) | 0.0016 (10) |

The adopted values are from Emission.

4.2 Photon Emissions

The energy is from 2000He14.

The LRSW analysis of 9 P_γ values gives the weighted average of 9.87% (5) with a reduced- $\chi^2 = 0.96$. The input values are: 9.8 6 (1955Bu01), 9 1 (1955Co56), 9.72 15 (1963MeZZ), 10.20 63 (1965Dh01), 9.75 20 (average of 2 values of 1965Le24), 10.2 10 (1970Ri11), 9.85 9 (1980Sc07), 10.30 19 (1984Fi10), and 9.86 8 (1991Ba11). Others: \approx 2 (1940Wa02), 3 (1945Br02), 8 (1952Ly17), 21 (1952Ma49), 9.8 (1955Bi29), 7 (1955Co56), and 10.1 3 (1970ScAA, replaced by 1980Sc07). [From a set of five values, the evaluation of 1973De60 gives a result of 9.83% (14).]

The number of X rays was calculated, by the Emission program, from the γ -ray probabilities and atomic data in sec. 2.1, 2.2, and 3.

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