

**<sup>141</sup>Ce - Comments on evaluation of decay data  
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This evaluation was completed in 1998; it has been updated in February 2012. The literature available by this latter date has been included.

### 1. Decay Scheme and Decay Energy

<sup>141</sup>Ce decay scheme is complete as there are no other excited levels of <sup>141</sup>Pr below the decay energy  $Q^-$ , except for the 7/2<sup>+</sup> single level with an energy of 145.443 keV (2001Tu02).

$Q^-$  value has been taken from the atomic mass adjustment by Audi and Meng (2011AuZZ).

### 2. Half-Life

The following values of the <sup>141</sup>Ce half-life presented in Table 1 were considered here:

**Table 1.** Results of <sup>141</sup>Ce half-life measurements (in days)

Reference	Author(s)	Value	Comments
1949Wa23	Walker	32.11 (23)	Omitted; uncertainty strongly underestimated in an unknown amount
1950Fr58	Freedman and Engelkemeir	<b>32.50 (20)</b>	
1957Ke26	Ketelle and Brozi	32.51 (2)	Omitted; uncertainty strongly underestimated in an unknown amount
1965An07	Anspach <i>et al.</i>	32.550 (7)	Omitted; superseded in 1992Un01
1967Ob01	O'Brien and Eldridge	32.38 (2)	Omitted; uncertainty strongly underestimated in an unknown amount
1971Ba28	S. Baba and H. Baba	<b>32.60 (20)</b>	
1971De11	Debertin	32.51 (6)	Omitted; superseded in 1983Wa26
1972Em01	Emery <i>et al.</i>	<b>32.45 (13)</b>	
1973MeYE	Merritt and Taylor	32.51 (6)	Omitted; superseded in 1980RuZY
1976Va30	Vaninbroukx and Grosse	<b>32.501 (13)</b>	
1980RuZY	Rutledge <i>et al.</i>	<b>32.50 (3)</b>	
1983Wa26	Walz <i>et al.</i>	<b>32.51 (10)</b>	
1992Un01	Unterweger <i>et al.</i>	32.510 (24)	Omitted; superseded in 2002Un02
2002Un02	Unterweger	<b>32.510 (24)</b>	

From the seven values (in boldface) used in the data analysis, the LWEIGHT computer program has consistently identified two outliers (1971Ba28 and 1972Em01), and deduced a weighted mean (32.503) and

an internal uncertainty (0.011) with  $\chi^2/\nu = 0.03$ . This result suggests that the uncertainties had been overestimated.

The recommended value for the <sup>141</sup>Ce half-life is **32.503 (11) days**.

### 3. $\beta^-$ Transitions

The energy of the  $\beta^-_{0,1}$  - transition has been deduced from the  $Q^-$  value and the 145 keV <sup>141</sup>Pr level energy. The emission probability of the  $\beta^-_{0,1}$  - transition is equal to  $P_{\gamma+ce}$  for the 145 keV gamma-ray transition. The probability of feeding the ground state was deduced from the relation  $1-P(\beta^-_{0,1})$ .

### 4. Gamma-Ray Transition

The energy was taken from the recommended data by Helmer and van der Leun (2000He14). The emission probability  $P_{\gamma+ce}$  was deduced using the relation  $P_{\gamma+ce} = P_{\gamma} (1 + \alpha_T)$ . (For  $P_{\gamma}$  see Section 7.2). The multipolarity (M1+E2) is based on the measurements of conversion electrons of 1961Co04, 1961Ne12, 1965Ge04, 1966Di02, 1966Pa09, 1968Ge02, 1972Ca07, 1975Le09, 1979Ha09, 1992Sc24. The E2/M1 mixing ratio  $\delta = 0.068$  (5) is a weighted average of measurements from 1962Sc11 (0.068 (8)), 1963Ha07 (0.066 (22)) and 1979Ha21 (0.069 (7)). The internal conversion coefficients (ICC)  $\alpha_T, \alpha_K, \alpha_L, \alpha_{L'}, \alpha_M, \alpha_N, \alpha_O, \alpha_P$  and their associated uncertainties were interpolated from theoretical values of Band *et al.* (2002Ba85) using the BrIcc computer program (2008Ki07) for the “frozen orbital” approximation, version 2.3S.

The values of the total conversion coefficient  $\alpha_T$ , measured and deduced (1966 - 1992); are presented below. A value for the total conversion coefficient of the 145 keV gamma transition was obtained from special coincidence measurements by Hansen *et al.* (1979Ha09) and Schönfeld *et al.* (1992Sc24). Another useful quantity used by them was the measured ratio of the emission probabilities of KX rays and the 145-keV gamma ray.

Total conversion coefficient  $\alpha_T$

1966Di02	0.440 (11)	Dingus <i>et al.</i>	deduced from $\alpha_K$
1966Pa09	0.441 (9)	Pancholi	deduced from $\alpha_K$
1975Le09	0.421 (21)	Legrand <i>et al.</i>	measured
1979Ha09	0.439 (13)	Hansen <i>et al.</i>	measured
1979Ha09	0.448 (7)	Hansen <i>et al.</i>	deduced from $X_K/\gamma$ ratio
1979Ha09	0.436 (17)	Hansen <i>et al.</i>	coinc. meas., extrapol. technique
1992Sc24	0.452 (8)	Schönfeld <i>et al.</i>	coinc. meas., special technique
1992Sc24	0.435 (7)	Schönfeld <i>et al.</i>	deduced from $X_K/\gamma$ ratio
	<b>0.449 (7)</b>	<b>Present evaluation (BrIcc)</b>	

## 5. Atomic Data

The fluorescence yields, X-ray energies and relative emission probabilities, and Auger electron energies and relative emission probabilities based on data in 1996Sc06 and 1977La19 are from the SAISINUC computer program.

## 6. Electron Emissions

The energies of the conversion electrons were obtained from the gamma-ray transition energy and the atomic electron binding energies in 1977La19.

The emission probabilities of the conversion electrons were deduced using the evaluated  $P(\gamma)$  and internal conversion coefficient values for the various atomic shells.

The total absolute emission probabilities of K and L Auger electrons were calculated using the EMISSION computer program (1996Sc06, 2000Sc47).

## 7. Photon Emissions

### 7.1 X - Ray emissions

The Pr KX- and LX- absolute emission probabilities given in the Tables Section (Table 5.1) were deduced using the computer program EMISSION. Measured values of  $P_{X_k} / P_\gamma$  are compared with a value of 0.350 (6), which was deduced using the computer program EMISSION.

0.338 (5)	Nemet (1961Ne12)
0.347 (12)	Nemet (1961Ne12)
0.342 (9)	Campbell <i>et al.</i> (1971Ca49)
0.334 (9)	Campbell and Mc Nelles (1972Ca07)
0.349 (5)	Hansen <i>et al.</i> (1979Ha09)
0.339 (5)	Schönfeld <i>et al.</i> (1992Sc24)
<b>0.350 (6)</b>	<b>Present evaluation</b>

The recommended value in the present evaluation is in good agreement with the experimental results, especially with the value from 1979Ha09.

### 7.2 Gamma-Ray Emission

The recommended 145 keV gamma-ray absolute emission probability is the weighted mean of 4 values (2,3,4,6). The following values (based on absolute activity determinations) were considered:

1	0.493 (6)	Eldridge	1966E109
2	0.4844 (41)	Legrand <i>et al.</i>	1975Le09
3	0.482 (3)	Hansen <i>et al.</i>	1979Ha09
4	0.485 (4)	Rutledge <i>et al.</i>	1980RuZY
5	0.489 (4)	Schötzig <i>et al.</i>	1980Sc07
6	0.480 (5)	Schönfeld <i>et al.</i>	1992Sc24
	<b>0.4829 (19)</b>	LWM (2, 3, 4, 6) recommended value. $\chi^2/\nu = 0.28$ .	

Value 1 was not used when calculating the average because the uncertainty seems to be underestimated by an unknown amount. Value 5 was also not used because it is considered to be superseded by value 6. The remaining 4 values were used to calculate a weighted mean. (The uncertainty of value 2 is stated to be 3  $\sigma$  but is has been assumed here to be 1  $\sigma$  as this seems to be more realistic and comparable to the other values).

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