^{217}At - Comments on evaluation of decay data

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This evaluation was completed in 2007. Literature available by December 2007 was included.

1 Decay Scheme

^{217}At disintegrates 99.9933 (24) % by α emission to levels in ^{213}Bi and 0.0067 (24) % by β^- emission to levels in ^{217}Rn. ^{217}At ground state has $J^\pi = 9/2^-$ (2007Ba19).

The α decay scheme of ^{217}At was built based on the measurement of 1997Ch19. The β^- decay scheme of ^{217}At has not been studied.

The adopted Q(α) value of Audi(2003Au03) is good in agreement with the Q(α) value calculated from decay scheme data.

2 Nuclear Data

The Q values are from the 2003Au03 evaluation.

Level energies, have been obtained from a least-squares fit to γ-ray energies (GTOL computer code). Spin and parities are from 2007Ba19.

The measured and evaluated ^{217}At half-life values are listed in Table 1.

Table 1 Measured half-life values of ^{217}At and evaluated value

$T_{1/2}$ (ms)	References	Measurement method
21	1947En03	
18 2	1950Ha52	Alpha pulse analyzer
32.3 4	1963Di05	
32.3 4	2007Ba19	NDS, from 1963Di05
32.3 4	Evaluated value	from 1963Di05

The adopted value is taken from the measurement of 1963Di05.

2.1 γ Transitions

The γ transition probabilities were calculated using the γ-ray emission intensities and the relevant internal conversion coefficients.

Multipolarities and mixing ratios of γ transitions are from 1997Ch19.

The internal conversion coefficients (ICC) and the associated uncertainties for the γ-transitions have been obtained using the BrIcc computer program.

2.2 α Transitions

The measured and evaluated energies of alpha particles were listed in table 2. The evaluated values are from 1997Ch19, except as noted.

Table 2 Measured and evaluated value of α-particle energy for ^{217}At

1967Dz02	1977Vy02	1982Bo04	1997Ch19	Evaluation
	6037 3[b]			6037 3[c]
			6322.0 16	6322.0 16
6422 7[a]				
6486 7			6484.7 16	6484.7 16
6541 7[a]				
6619 7[a]				
6772 7[a]				
6810 7			6813.8 16	6813.8 16
6849 7[a]				
7070 8	7062 5	7071 2	7066.9 16	7066.9 16

[a]: the α transitions reported in 1967Dz02 were not confirmed in 1997Ch19 and 1997Ch53.
[b]: 1977Vy02 assign this α transition to the ^{221}Rn decay; 1997Ch53 assign this α transition to the ^{217}At decay.
c: from 1977Vy02.

The measured and evaluated alpha particle emission probabilities were listed in table 3. The evaluated alpha particle emission probabilities were deduced from the transition probability balance. These calculated results are in good agreement with the measured emission probabilities of the main alpha transitions.

Table 3 Measured and evaluated α-particle emission probabilities for ^{217}At

E_α(keV)	P_α					
	1967Dz02	1969LeZW	1997Ch19	1997Ch53	Calc.	Evaluation
6037 3				< 0.002	< 0.002	< 0.002
6322.0 16			0.005 1	0.012 6	0.0049 4	0.0049 4
6484.7 16	0.17 3	0.02 1	0.021 2	0.022 2	0.0167 8	0.0167 8
6813.8 16	0.55 9	0.06 2	0.036 3	0.038 4	0.0384 15	0.0384 15
7066.9 16	98.5 10	99.9 1	99.9	>99.9	99.932 3	99.932 3

3. Atomic data

Atomic values(ω_K,ϖ_L, ϖ_M, η_{KL} and η_{LM}) are from Schönfeld (1996Sc06).

The X-ray and Auger electron emission probabilities have been deduced from γ-ray and conversion electron data by using the computer code RADLST.

4. Electron Emissions.

The conversion electron emission probabilities have been deduced from γ-ray transition data.

5. Photon Emissions

5.1 γ-ray energy values

The measured and evaluated γ-ray energies for ^{217}At α decay are listed in table 4. The evaluated values are from 1997Ch19. The 455 keV γ-ray is introduced by evaluators due to probabilities balance. This γ-ray was observed in 1964Va20, but not confirmed by 1997Ch19. 1997Ch53 assigned the 6037 keV α transition and introduced the 1050 keV level.

Table 4 Measured and evaluated value of γ-ray energy for ^{217}At

1981Di14	1997Ch19	Evaluation
	165.8[a]	165.8[a]
258.5 2	257.88 4	257.88 4
	335.33 10	335.33 10
		455[b]
	501.0[a]	501.0[a]
593.1 2	593.10 10	593.1 1
	758.9 1	758.9 1

[a]: not placed in level scheme.
[b]: from 1964Va20

5.2 Absolute values of the γ-ray emission probabilities

The measured and evaluated γ-ray emission probabilities for ^{217}At α decay are listed in table 5. The evaluated values are from 1997Ch19, except as noted.

Table 5 Measured and evaluated γ-ray emission probabilities for ^{217}At

E_γ (keV)	P_γ		
	1981Di14	1997Ch19	Evaluation
165.8[a]		<0.0002	<0.0002
257.88 4	0.065 5	0.0287 7	0.0287 7
335.33 10		0.0062 3	0.0062 3
455			<0.002[b]
501.0[a]		<0.0002	<0.0002
593.1 1	0.014 1	0.0115 5	0.0115 5
758.9 1		0.0049 4	0.0049 4

a: not placed in level scheme. b: from intensity balance.

6. Branching Ratio

The measured and evaluated branching ratio for ^{217}At β^- decay are listed in table 6. The evaluated β^- decay branching ratio is from 1997Ch53, that's $\%\beta^- = 0.0067\ (24)\ \%$.

So $\%\alpha = 99.9933\ (24)\ \%$.

Table 6 Measured and evaluated branching ratio for ^{217}At β^- decay.

I_{β^-} (%)	References
0.0012 6	1969LeZW
0.005	1995Ch74
0.0067 24	1997Ch53
0.0067 24	Evaluated value, from 1997Ch53

7. References

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