^{218}At - Comments on evaluation of decay data by V. Chisté and M. M. Bé

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

1 Decay Scheme

^{218}At disintegrates by alpha emission (99.9 (1) %) to ^{214}Bi mainly. The γ transitions between the ^{214}Bi levels have not been observed. However, a Q value of 6811 (12) keV is calculated in the disintegration of ^{218}At to ^{214}Bi from the decay scheme data compared to a value of 6867 (3) keV from the Audi's tables. This deficiency in the calculated Q value suggests the possible existence of a weak gamma transition from the 62-keV to the ground state levels.
A weak beta minus emission (0.1 (1) %) to Rn-218 has been pointed out (1948Wa20). Spins and parities are from the mass-chain evaluation of Y. A. Akovali (1987El12, 1995El08 for A = 218 and 1995El07 for A = 214) and A. K. Jain (2006Ja03 for A = 218).

2 Nuclear Data

The Q values (α and β^-) are from the atomic mass evaluation of Audi *et al.* (2003Au03).

Experimental ^{218}At half-life values (in seconds) are given in Table 1:

Table 1: Experimental values of ^{218}At half-life.

Reference	Experimental value (s)	Comments
R. J. Walen (1949Wa05)	1.3 (2)	Uncertainty increased to take into account systematic uncertainty.
D. G. Burke (1989Bu09)	1.5 (3)	
Recommended value	**1.4 (2)**	$\chi^2 = 0.31$

The original uncertainty value given by R. J. Walen (1949Wa05) was multiplied by 2, in order to take into account the systematic uncertainties which were not considered by 1949Wa05. A weighted average has been calculated using Lweight computer program (version 3).

The recommended value of ^{218}At half-life is the weighted average of **1.4** second with an internal uncertainty of 0.2 second. The reduced-χ^2 value is 0.31.

2.1 a Transitions and Emissions

The energies of the α-particle transitions given in Section 2.1 were calculated from Q_α (2003Au03) and level energies.

The energy of $\alpha_{0,0}$, $\alpha_{0,1}$ and $\alpha_{0,2}$ emissions given in section 3 were measured by R.J. Walen (1963Wa29 (see 1964Hy02) and 1958Wa16), the adopted values are those recommended by A. Rytz (1991Ry01) where the original energy was decreased by 1 keV, due to a change in calibration energy (1995El07).

The $\alpha_{0,0}$, $\alpha_{0,1}$ and $\alpha_{0,2}$ emission probabilities are the measured values of R. J. Walen (1958Wa16), 3.6, 90.0 and 6.4 respectively, without uncertainties. From R. J. Walen, the total α decay is 99.9 (1) %. Since, there is no precision in the Walen's paper, the uncertainty of 0.1 % from propagation of the β^- transition probability (1948Wa20) has been assigned to each α line.

2.2 b$^-$ Transitions and Emissions

The maximum energy of the β^- transition in the decay of ^{218}At $\rightarrow$ ^{218}Rn is given by Audi (2003Au03) and, without any other information available, is affected to a ground state to ground state transition.

The adopted β^- transition probability was measured by R. J. Walen (1948Wa20) to be 0.1 (1) %

3 References

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