^{218}Po - 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. The half-life value was re-evaluated in Dec. 2010 in order to include the Martz's result.

1 Decay Scheme

^{218}Po disintegrates by alpha emission mainly (99.978 (3) %) to the ground state level of ^{214}Pb. A weak beta minus emission (0.022 (3) %) to At-218 has been pointed out. Spin and parity are from the mass-chain evaluation of Y. A. Akovali (1987El12, 1995El08, 1998Ak04 for A = 218 and 1995El07 for A = 214) and A. K. Jain (2006Ja03 for A = 218).
A good agreement was found between the recommended Q value of Audi and the effective Q value of 6113.33 (22) keV for the α branch, calculated from the decay scheme data.

2 Nuclear Data

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

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

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

Reference	Experimental value (min)	Comments
M. Curie (1931Cu01)	3.05	Not used.
M. Blau (1924Bl02)	3.050 (18)	Uncertainty increased to take into account systematic uncertainty.
J. R. Van Hise (1982Va09)	3.11 (2)	Uncertainty increased to take into account systematic uncertainty.
G. V. Potapov (1986Po17)	3.093 (6)	Original uncertainty corresponds to two standard deviations.
D. E. Martz (1989Ma**)	3.040 (8)	Uncertainty increased to take into account systematic uncertainty.
Recommended value	**3.071 (22)**	χ^2 = 10.1

The recommended value was deduced from the four values of ^{218}Po half-life (1924Bl02, 1982Va09, 1986Po17 and 1989Ma**). The original uncertainty values given by M. Blau (1924Bl02) and D. E. Martz (1989Ma**) were multiplied by 2, in order to take into account the systematic uncertainties which were not considered by the authors. The original uncertainty value given by Van Hise (1982Va09) is for 2σ, but it seems that they did not take into account the systematic uncertainties so the original uncertainty has been maintained. The largest contribution (57 %) to the weighted average comes from the value of G. V. Potapov (1986Po17). The LWEIGHT program 3 increases the uncertainty for the 1986Po17 value from 0.006 to 0.007 in order to reduce its relative weight from 57 % to 50 %.

A weighted average of 3.071 minutes has been calculated using Lweight computer program (version 3), with an expanded uncertainty of 0.022 minute so range includes the most precise value of 1986Po17. The reduced-χ^2 value is 10.1.

2.1 α 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 $\alpha_{0,0}$ emission given in section 4 was measured by 1971Gr17, and following the recommendations given by A. Rytz (1991Ry01) was decreased by 0.20 keV. The $\alpha_{0,1}$, emission energy is from R. J. Walen (1958Wa16).

The $\alpha_{0,1}$ emission probability is the measured value of R. J. Walen (1958Wa16) (0.0011 (11) %).

For the $\alpha_{0,0}$ emission probability and associated uncertainty, the following relation was applied:
$P_{\alpha 0,0} + P_{\alpha 0,1} = 100 - P_{\beta^-}(264\ keV)$,
where $P_{\beta^-}(264\ keV)$ = 0.022 (3) % (given by 1952Hi60, see **2.2**) and $P_{\alpha 0,1}$ = 0.0011 (11) % (given by 1958Wa16). Taking into account these values, then $P_{\alpha 0,0}$ = 99.9769 (32) %.

2.2 β⁻ Transitions and Emissions

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

The adopted 260-keV β^- transition probability was measured by F. Hiessberger (1952Hi60), 0.022 (3) %, and is in agreement with the two values given by R. J. Walen : 0.0200 (5) % (1949Wa05) and 0.0185 % (1958Wa16), respectively.

2.3 γ Transitions and Emissions

The $\gamma_{(1,0)}$ transition probability following the α-decay of $^{218}Po \rightarrow {}^{214}Pb$ was deduced from the decay-scheme balance using the recommended experimental α-particle intensity value of 0.0011 (11) % given by R. J. Walen (1958Wa16). (see **2.1 α Transitions and Emissions**).

3 Atomic Data

Atomic values, ω_K, ϖ_L and n_{KL} and the X-ray relative probabilities are from Schönfeld and Janβen (1996Sc06).

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