^{215}At -Comments on evaluation of decay data
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This evaluation was done in December 2010 with a literature cut-off by the same date.

1. DECAY SCHEME

^{215}At decays 100 % to levels of ^{211}Bi by emission of α particles. The adopted ^{211}Bi levels populated in the ^{215}At decay are based on the experiment of 1966Gr07 and the evaluation by Browne (2004Br45).

The decay scheme of ^{215}At seems to be incomplete as the alpha decays to higher levels in daughter ^{211}Bi, which are known from the β^- decay of ^{211}Pb (see ^{211}Bi Adopted Levels, Gammas of 2004Br45), are not observed yet.

The current evaluated data are supported by the agreement between Q(calculated) = 8178 (5) keV, deduced from the calculated average energies of all emissions, and Q(α) = 8178 (4) keV, adopted from 2003Au03.

2. NUCLEAR DATA

Q(α) is from 2003Au03 where this value has been deduced from the measurement of α-particle energy E($\alpha_{0,0}$) = 8026 (4) keV by 1982Bo04 recommended in 1991Ry01.

The ^{215}At half-life of 0.10 (2) ms is from the single measurement of 1951Me10.

2.1. Alpha Transitions

The alpha transition energies have been obtained from the Q(α) value and ^{211}Bi level energies given in Table 1 from ^{211}Bi Adopted Levels, Gammas of 2004Br45.

Table 1. ^{211}Bi levels populated in ^{215}At α-decay

Level	Energy (keV)	Spin and parity	Half-life	Probability of α-transition (%)
0	0.0	9/2–	2.14 (2) min	99.95 (2)
1	404.854 (9)	7/2–	0.317 (11) ns	0.05 (2)

The alpha transition probability P ($\alpha_{0,1}$) is from the measurement of 1966Gr07 by means of α–γ coincidence technique with surface-barrier semi-conductor and NaI(Tl) detectors. The accurate P($\alpha_{0,0}$) value has been deduced from the expression of P($\alpha_{0,0}$) + P($\alpha_{0,1}$) = 100 %.

The α decay hindrance factors have been calculated using the ALPHAD computer program from the ENSDF evaluation package with r_0 (^{211}Pb) = 1.5443 fm (2004Br45).

2.2. Gamma Transitions and Internal Conversion Coefficients

The 405-keV gamma-ray transition probability has been deduced from the intensity balance at the 405-keV level using the adopted alpha transition probability P($\alpha_{0,1}$) and total internal conversion coefficient (ICC) α_T for $\gamma_{1,0}$ (405 keV). The multipolarity (M1+E2) and E2/M1 mixing ratio (δ) of -1.1 (1) have been taken from 2004Br45. These are based on the measurements of conversion electrons in ^{211}Pb β^- decay and γ(θ) measurements with polarized ^{211}Bi nuclei. ICCs α_T, α_K, α_L, α_M have been interpolated using the BrIcc computer program, version v2.2a, data set BrIccFO (2008Ki07).

3. ATOMIC DATA

The fluorescence yields, X-ray energies and relative probabilities, and Auger electrons energies and relative probabilities are from the SAISINUC software.

4. ALPHA EMISSIONS

The energy of alpha-particle group $\alpha_{0,0}$ that populates the ^{211}Bi ground state is the measured value from 1982Bo04 recommended in 1991Ry01. In 1966Gr07 the measured value of 8.00 (1) MeV was reported.

The energy of alpha-particle group $\alpha_{0,1}$ of 7628 (4) keV has been deduced from the Q(α) value taking into account the level energy of 404.854 (9) keV and the recoil energy for ^{211}Bi. The above value of E($\alpha_{0,1}$) can be compared to the value of 7626 (15) keV as measured by 1966Gr07 and adjusted by the evaluator to the adopted E($\alpha_{0,0}$) = 8026 (4) keV (the original value of 1966Gr07 is 7.60 (1) MeV).

The earlier measured energy of α–emission in the decay of ^{215}At is 8.00 (2) MeV (1951Me10).

5. ELECTRON EMISSIONS

The energies of the conversion electrons for $\gamma_{1,0}$ (405 keV) have been obtained from the gamma-ray transition energy and the atomic electron binding energies.

The emission probabilities of the conversion electrons have been deduced using the P_γ and ICC values.

The absolute emission probabilities of K and L Auger electrons have been calculated using the EMISSION computer program.

6. PHOTON EMISSIONS

6.1 X - Ray emissions

The absolute emission probabilities of Pb KX- and LX-rays were calculated using the EMISSION computer program.

6.2. Gamma emissions

6.2.1. Gamma ray energies

The 405-keV gamma-ray energy has been adopted from the 405-keV level energy. In 1966Gr07 this energy was obtained from the ^{215}At α decay as $\approx$ 404 keV.

6.2.2. Gamma ray emission probabilities

The 405-keV gamma-ray emission probability has been deduced from the alpha transition probability P($\alpha_{0,1}$) = 0.05 (2) % and total internal conversion coefficient α_T = 0.122 (8).

7. REFERENCES

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