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Erratum

Erratum to "Alpha-decay half-lives, alpha-capture and alpha-nucleus potential" [Atomic Data and Nuclear Data Tables 95 (2009) 815–835]

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We have found an error in our code related to evaluation of the Q-value correction induced by the atomic bound electrons, see Eq. (12) of the original paper:

$$Q_\alpha = \Delta\mathscr{M}_\mathrm{p} - (\Delta\mathscr{M}_\mathrm{d} + \Delta M_\alpha) + k(Z_\mathrm{p}^\epsilon - Z_\mathrm{d}^\epsilon).$$

Typical magnitudes of α-transition Q-values are several MeVs and the errors of the previously calculated Q-values are less than 10 keV. As the result, the relative errors of the previously calculated Q-values are less than 0.75%. However these Q-value differences lead to some variations in the values of the parameters of the UMADAC model. Therefore we made a new parameter search for the model.

The new parameters presented in Table 1 keep the same character of the nuclear potential, especially in the vicinity of the barrier. The major part of the parameters is slightly varied, but the values of the parameters related to the depth of the potential well (v_2, v_3, v_4), radius (r_4), diffuseness (d_1, d_2) and the parameter v_5 are changed noticeably. The new parametrization of the α-nucleus potential can be applied for nuclei with the number of nucleons in nucleus $A > 2$ due to the A-dependence of the diffuseness.

The values of parameter S for even–even, even–odd, odd–even and odd–odd nuclei are 4.5125, 3.9419, 4.1970 and 4.0382, respectively.

It should be emphasized that a deeper minimum is found now, therefore the quality of description of the data for both α-decay half lives and α-capture cross-sections has been improved slightly. Thus various root-mean-square (RMS) errors related to the decimal logarithm of the α-decay half-lives were discussed in Tables 2 and 3 of the original article in detail. The new values of the RMS errors presented in Tables 2 and 3 of the original article are given in Table 2. The new parameters of the model lead to the lower values of the corresponding RMS errors.

The values of the α-decay half-lives evaluated by using the new parameter set are close to the old ones for most nuclei. For example, the relative differences between corresponding α-decay half-lives evaluated for the new and old values of the parameters are less then 10% for 804 nuclei. The differences between the new and old (presented in Table 1 of the original article) values of the logarithms of the alpha-decay half-lives are less then 0.1 for 1114 nuclei, less then 0.26 for 130 nuclei and only for nuclei ^{146}Ho and ^{150}Tm the differences are 0.64 and 0.81 correspondingly.

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Table 1
The parameters of the UMADAC model.

v_1 (MeV)	−40.1498
v_2 (MeV)	−0.2608
v_3 (MeV)	−12.1068
v_4	0.3136
v_5 (MeV)	6.6134×10^{-2}
r_1 (fm)	1.4004
r_2 (fm)	1.1944
r_3	1.4802
r_4	0.0057
d_1 (fm)	0.8721
d_2 (fm)	−1.0944
v_0 (s)	−0.1361
v_1	0.8840
v_2 (MeV$^{-1/2}$)	-4.7681×10^{-2}
v_3	0.6295
v_4	−1.3412
v_5	−1.3638
v_6	6.2081×10^{-2}

Table 2
The RMS errors of the decimal logarithm of the α-decay half-lives calculated for the various datasets. The last column contains the Refs. related to various approaches, see original paper for details.

tot	e–e	e–o	o–e	o–o	
The total range of nuclei					
0.6199	0.2980	0.7805	0.7613	0.7405	UMADAC
1.0245	0.5205	1.1661	1.3453	1.2617	[5]
1.1209	0.3922	1.4850	1.3783	1.3426	[23]
1.1344	0.3652	1.5510	1.3635	1.3390	[27]
1.3926	1.3067	1.4389	1.5728	1.2828	[35]
The range of heavy nuclei					
0.7094	0.3001	0.9542	0.9110	0.7753	UMADAC
1.2408	0.2970	1.8106	1.4845	1.4833	[35]
1.2591	0.3894	1.6645	1.5171	1.7708	[5]
1.3500	0.3188	2.0332	1.6298	1.4300	[37]
1.4484	0.2250	2.1482	1.6657	1.8440	[23]
1.5002	0.3579	2.2642	1.6775	1.8392	[27]
1.7017	0.2271	2.5168	1.9323	2.2389	[10]

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