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International Chart Of The Nuclides – 2003

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The International Chart of Nuclides – 2003 has been developed taking into account the data obtained in 1998 -2003. Unlike widespread nuclide charts the present Chart of Nuclides contains EVALUATED values of the main characteristics. These values are supplied with the standard deviations. The presented data are applicable in medicine, agriculture, environmental protection etc.

The new Chart of Nuclides has been developed as the updated International Chart of Nuclides-1998[1)]. It contains brief information on characteristics of all isotopes of 118 chemical elements known by 2003. This Chart of Nuclides is a peculiar "wall guide" on nuclides and intended for being used by wide circle of experts of different level (students, graduate students, engineers, scientific researchers), who would like to have primary true information on stable and radioactive nuclides.

Unlike widespread nuclide charts[2,3,4)] that also bring brief information on nuclides, the present Chart of Nuclides contains EVALUATED values of the main characteristics such as mass excess, nuclide percent abundance, cross sections of thermal neutron induced activation for stable and natural long-lived nuclides; mass excess, half-life, decay energy for radioactive nuclides. These values are supplied with the standard deviations. They have been obtained on the basis of the information from database of Head Scientific Data Centre (Atominform, Moscow) and the Radionuclide Data Centre (RDC) at the V.G.Khlopin Radium Institute (St.-Petersburg) including the evaluated data, presented in the *ENSDF-2000* international file[5)], *Table of Isotopes*[6)] and *Table of Radioactive Isotopes*[7)], as well as their own evaluated data obtained by RDC experts.

The uncertainties of the recommended values are parenthetical and provided with the number of units of the last significant digit of the value: for instance, 40.1(22) means 40.1±2.2.

Nuclide mass excesses, Δ, are expressed in MeV with $\Delta(^{12}C)=0$ and corresponded to data of reference[8)].

Half-life evaluated values (with uncertainties) are presented for radioactive nuclides. Nuclide percentage in natural mixture of isotopes for a given chemical element is mentioned for stable nuclides instead of half-life. Both values, i.e. half-life and abundance of isotopes in natural mixture, are presented for natural long-lived radioactive nuclides.
Basic decay types with percentage of branching, and evaluated values (with uncertainties) of decay energies (Q-values, in keV) obtained on the basis of data[5,8)] are presented.

Basic types of radiation (particles and photons) and mean values of radiation energy per decay (keV/decay) obtained on the basis of data[7)] and RDC evaluations are presented. Mean radiation energy per decay <R> is a quantitative characteristic indicating the contribution of the given radiation type to the energy (Q) released in the decay.
Radiation capture cross sections (in barns) induced by thermal neutrons (activation cross section) are presented for the stable and natural long lived nuclides in accordance with reference[10)]. Also the energies of the most intensive gamma-rays (in keV) are presented.

Nuclides in the chart are arranged as Z-N diagram, where Z is the number of protons in a nucleus, N is the number of neutrons. Z grows on along the vertical from bottom to top; N grows on along the

horizontal from left to right. The following information for each radioactive nuclide is contained in the information boxes arranged along the lines:

1. Nuclide symbol with mass number;
2. Mass excess;
3. Spin of ground state of nucleus;
4. Half-life;
5. Decay modes;
6. Decay energy;
7. Average radiation energies;
8. Energies of the most intensive radiation components;
9. Thermal neutron activation cross section.

All the values in the first five lines are arranged in such a way that information on the same characteristic for different nuclides is put along the same horizontal line.

Figures 1 and 2 below present the examples of the information boxes for ^{57}Co, ^{155}Eu and ^{241}Am.

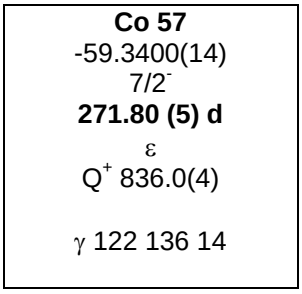

Figure 1. Information box for ^{57}Co.

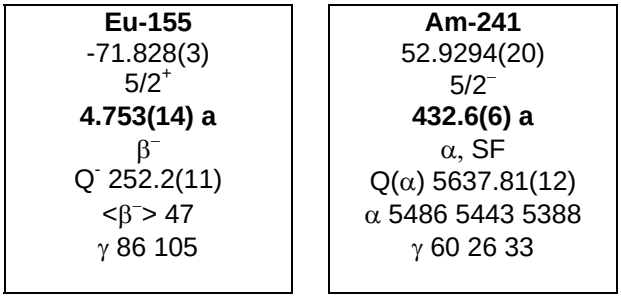

Figure 2. Information boxes for ^{155}Eu and ^{241}Am.

As for the stable nuclides, the abundance of nuclide in natural mixture of isotopes (percentage) is indicated in the forth line and the thermal neutron activation cross section is indicated in the last line. Figure 3 below presents the examples of the stable and natural unstable nuclide information boxes for ^{59}Co and ^{40}K.

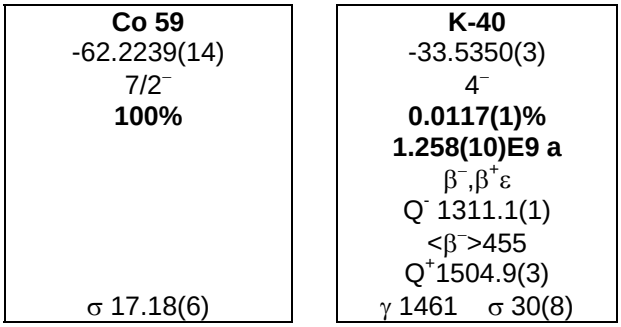

Figure 3. Information boxes for ^{59}Co and ^{40}K.

As to history, the necessity to develop the international charts of nuclides was discussed in 1994 at International Conference on Nuclear Data for Science and Technology, Gatlinburg, the USA. IAEA international working group had confirmed that there is a necessity to develop the international charts of nuclides. Opinion of more than 200 respondents from national and international organizations as a result of 1994 – 1996 attitude survey was the reason for developing the international charts of nuclides.

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