Electron Configuration, and Element No.155 of the Periodic Table of Elements

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Blocks of the Electron Configuration in the atom are considered with taking into account that the electron configuration should cover also element No.155. It is shown that the electron configuration formula of element No.155, in its graphical representation, completely satisfies Gaussian curve.

1 Introduction

As is known, even the simpliests atoms are very complicate systems. In the centre of such a system, a massive nucleus is located. It consists of protons, the positively charged particles, and neutrons, which are charge-free. Masses of protons and neutrons are almost the same. Such a particle is almost two thousand times heavier than the electron. Charges of the proton and the electron are opposite, but the same in the absolute value. The proton and the neutron differ from the viewpoint on electromagnetic interactions. However in the scale of atomic nuclei they does not differ. The electron, the proton, and the neutron are subatomic articles. The theoretical physicists still cannot solve Schrödinger's equation for the atoms containing two and more electrons. Therefore, they process the calculations for only the single-electron atom of hydrogen, with use of the dualistic property of the electron, according to which it can be respresented, equally, as a particle and a wave. At the same time, the conclusions provided after the quantum theory cannot be considered as the finally true result.

To make the further text simpler, we assume the following brief notations: the Periodic Table of Elements containing 118, 168, and 218 elements will be referred to as T.118, T.168, and T.218 respectively.

2 Calculation of the electron shell for element No.155

Electron shells of the atoms (known also as the *levels*) are regularly denoted as K, L, M, N, O, or as plain numbers from 1 to 5. Each level consists of numerous sub-levels, which are split into atomic orbitales. For instance, the 1st level K consists of a single sub-level 1s. The second level L consists of two sub-levels 2s and 2p. The third level M consists of the 3s, 3p, and 3d sub-levels. The fourth level N consists of the 4s, 4p, 4d, and 4f sub-levels. At the same distance from the atomic nucleus, only the following orbitales can exist: one -s-, three -p-, five -d-, seven -f-, while no more than two electrons can be located in each single orbital (according to Pauli's principle). Hence, the number of electrons in each level can be calculated according to the formula $2N^2$. Results of the calculation are given in Table 1.

As is seen from this Table, the complete external electron level is the configuration s2+p6, known as octet.

	K	L	M	N	O	Sum	Content in the shells
s	2					2	in each shell
p	2	6				8	in each, commencing in the 2nd shell
d	2	6	10			18	in each, commencing in the 3rd shell
f	2	6	10	14		32	in each, commencing in the 4th shell
g	2	6	10	14	18	50	in each, commencing in the 5th shell

Table 1: Number of electrons in each level.

The elements, whose electrons occupy the respective sublevels, have one of the denotations: s-, p-, d-, f-, or g-elements (in analogy to electrons).

2.1 Electron Configuration in the other elements

In the regular form of the Periodic Table of Elements, each cell of the Table bears a large information about the element, including the electron constitution of the atom. The cells containing the same sub-levels are often the same-coloured in the Table, and are joined into the following blocks (T.118):

s-elements, the 1st and the 2nd groups, 7 periods;

p-elements, 6 groups × 6 periods (periods 5–10, 13–18, 31–36, 49–54, 81–86, 113–118);

d-elements, 10 groups × 4 periods, between s- and p-elements;

f-elements, 2 lines of 14 elements each (lantanides and actinides).

Fig. 1 shows distribution of the blocks of T.118, with the assumption of that all last elements are known (the lower arc) [1]. The tabular data of the blocks are easy-to-convert into a graph, if using the known number of the elements. It should be noted that the abscissa axis means number of the blocks (not number of the periods). The form of this arc is close to parabola, and is easy-to-describe by the cubic equation with the value of true approximation $R^2 = 1$.

One can find, in the scientific press, suggestions about the possibility of introducing, into the version T.118 of the Periodic Table, two additional periods of 50 elements in each thus

making it T.218. Therefore, we checked this variant as well (the upper arc), for clarity of the experiments [2, 3]. According to the reference data [4], we assumed five blocks which join all elements of the Periodic Table as follows:

s-elements = 18,
p-elements = 48,
d-elements = 60,
f-elements = 56,
g-elements = 36.

As is seen, the upper arc in Fig. 1 is absolutely similar to that of T.118 (the lower arc). The larger size of the upper arc (T.218) are due to the larger number of elements.

Having these two examples considered, we clearly understand that the aforeapplied method we suggested can as well be applied to the version of the Periodic Table which ends at element No.155.

In order to check this supposition, we created Table 2 wherein we present the respective data for Fig. 1 and Fig. 2.

The upper arc of Fig. 2 shows distribution of the blocks of the electron configuration, calculated according to the reference data of T.168. Lower, another arc is presented. It is created according to our calculation for T.155 (i.e. for the Table of Elements, whose upper limit if element No.155). As is seen, the left branches of the arcs differ from each other for a little, while the right branches actually met each other. The absence of any bends or breaks, and also smooth form of both arcs, and their complete satisfying the approximation equation $R^2 = \sim 1$, manifests the presence of the same law in the basis of these data.

Therefore, we now can claim that element No.155 is included into the blocks of the electron configuration as the last element of the Periodic Table of Elements.

2.2 Electron shells of the atoms

Because our method of comparing the electron configuration of the elements was successful for element No.155, we are going to apply it to theoretical constructing the electron shells. Here we should take into account that: the electrons of the external shells bear more powerful energy, they are more distantly located from the nucleus, and determine the chemical properties of reactions due to the fact that their connexion with the nucleus is weaker thus easier to break. All data, we collected in order to check the aforementioned suggestion, are presented in Table 3. Line 4 of the Table contains the data for the version of element No.155 as that continuing the Table of Elements, while Line 5 contains the respective data suggested by me according to [5].

As is seen, from Fig. 3, all the arcs have the form which is very close to parabola, with a clearly observed maximum and the joined left branches. The difference in their ordinates is due to the difference in the number of the electrons (column 5 of Table 3). The right branches are parallel to each other, and are shifted with respect to each other for the shell number. The main result means here the presence of a qualitative connexion between the electron shells and their graphical representation. For only this reason, we had the possibility to compare the data of the last lines of Table 3.

Fig. 4 manifests that the upper arc is similar to the previous of Fig. 3, while the lower arc (T.155 Author) very differs from all them. According to its form, this is a differential function of normal distribution (the Gauss arc). The difference between the ends of the left and right branches is 0.645%. The branches are very symmetric to each other with respect to the vertical axis coming through the top with coordinates (5, 36). Hence, here is also a strong dependency between the regular method of description of the electron shells and its graphical representation.

This fact is most illustrative manifested in Fig. 5. The left straight covers four electron shells (2, 8, 18, 32), which are the same for all versions of Table 3 (as follows from the equation of the straight line $Y = 2X + 0.6931$. As is seen, once the arcs reach their maximum, they come down very fast (this is because the number of electrons decreases very fast in the shells).

3 Conclusion

Thus, element No.155 has really lawful to be positioned in the Periodic Table of Elements. This element points out not only the upper limit of the Table, found in my earlier study on the basis of the hyperbolic law [6, 7], but also can be presented as a graphical sequel of the calculations produced according to Quantum Mechanics (they have a high precision).

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References

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Number of the elements	Number of the blocks				
	s	p	d	f	g
T.218	18	48	60	56	36
T.168	16	42	50	42	18
T.118	14	36	40	28	—
T.155	16	36	46	42	15

Table 2: Blocks of the electron configuration.

Number of the elements	Number of the electrons in the shells								
T.218	2	8	18	32	50	50	32	18	8
T.168	2	8	18	32	50	32	18	8	—
T.118	2	8	18	32	32	18	8	—	—
T.155 Table	2	8	18	32	50	32	11	2	—
T.155 Author	2	8	18	32	36	32	18	8	1

Table 3: Electron shells of the atoms.

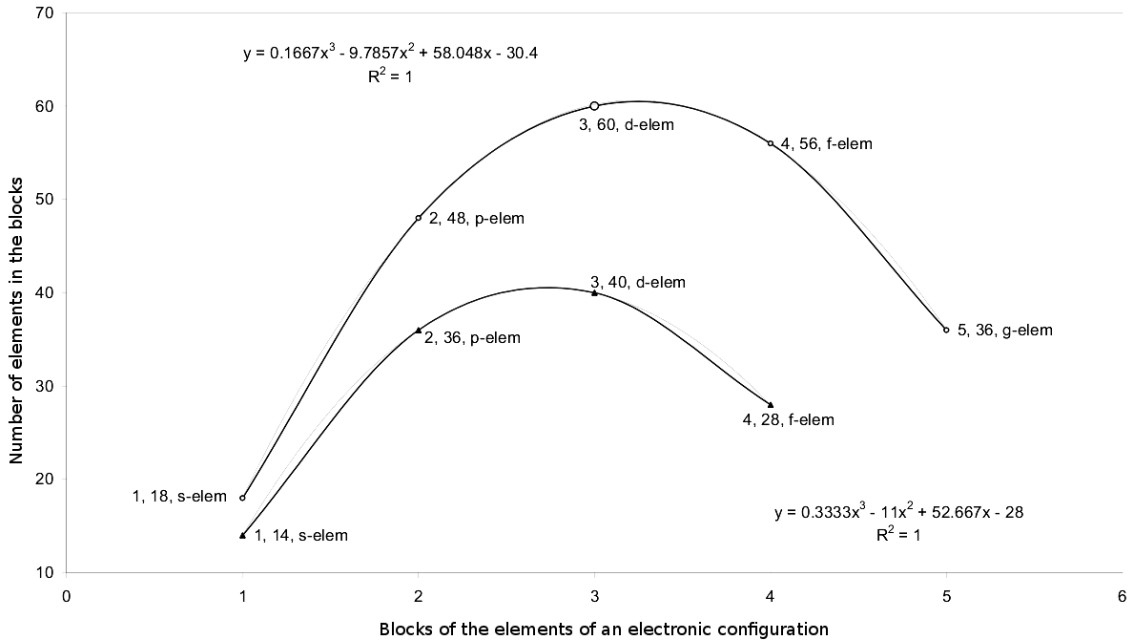

Fig. 1: Location of the blocks of the electron configuration in the Periodic Table of Elements, containing different number of the elements. The upper arc — the Table of 218 elements. The lower arc — the Table of 118 elements.

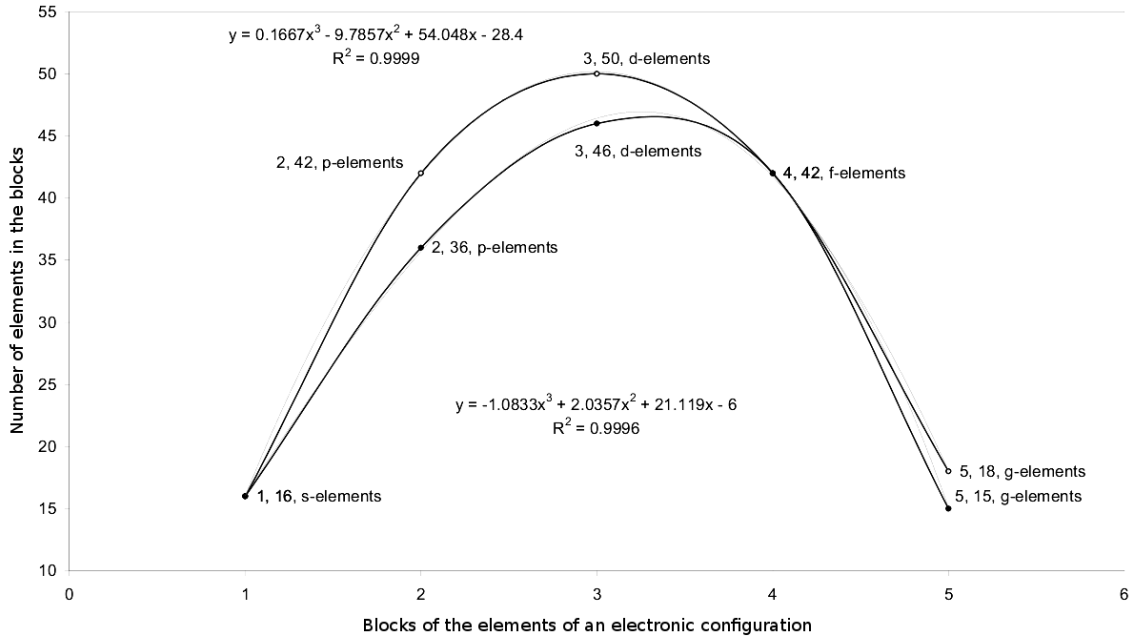

Fig. 2: Dependency, in the blocks, between the number of the elements and the electron configuration. The upper arc — the Table of 168 elements. The lower arc — the Table of 155 elements.

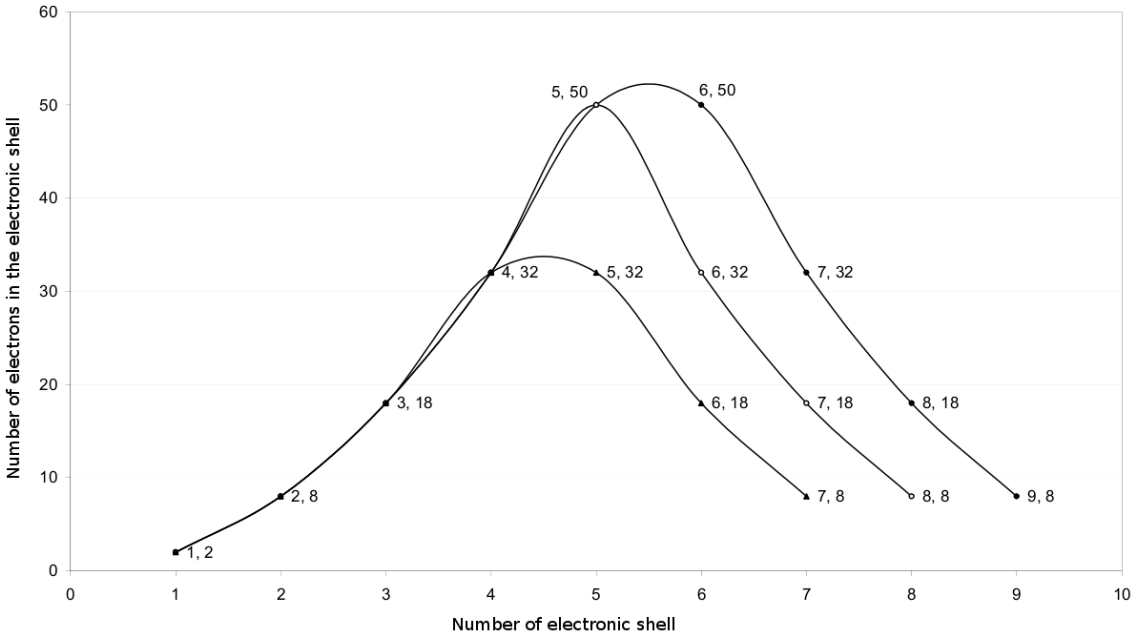

Fig. 3: Dependency of the number of electrons in the electron shells from the shell number, for three versions of the Periodic Table of Elements — T.118, T.168, T.218 (from up to down).

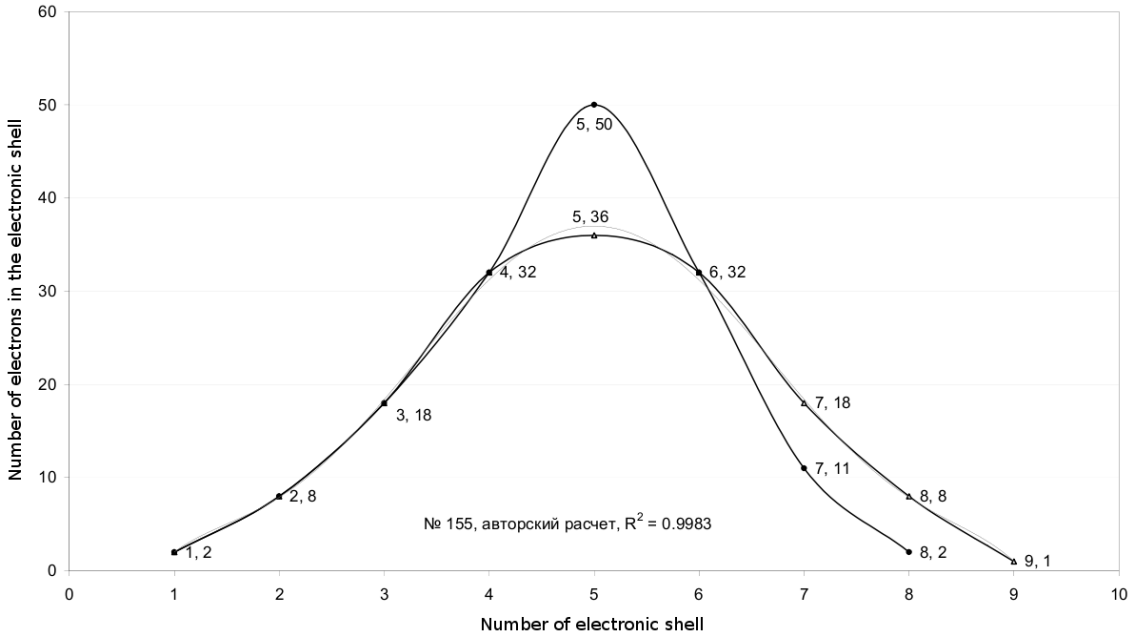

Fig. 4: Dependency of the number of electrons in the electron shells from the shell number, for element No.155 according to the tabular data (the upper arc) and the author's calculation (the lower arc).

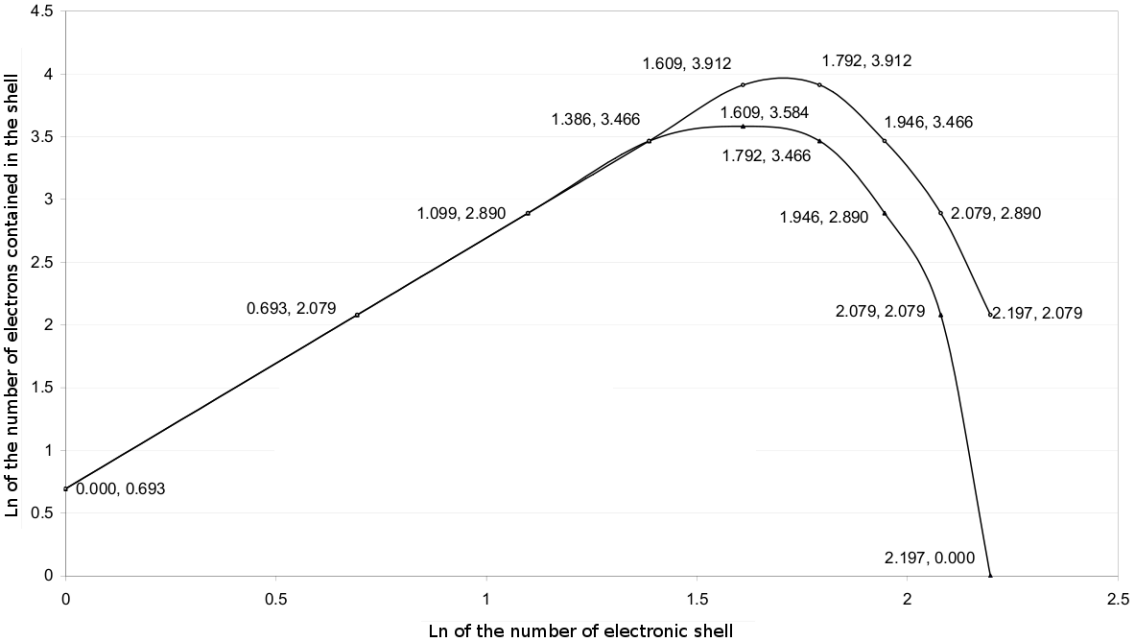

Fig. 5: Dependency of the number of electrons in the electron shells from the shell number (presented in the logarithm coordinates), for T.218 (the upper arc) and for T.155 according to the author's calculation (the lower arc).