LETTERS TO PROGRESS IN PHYSICS

On the Upper Limit (Heaviest Element) in the Periodic Table of Elements, and the Periodic Table of Anti-Substances

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On the basis of the method involving equilateral hyperbolas developed by us with reference to the Periodic Table, its Top Limit has been established. It is the last element with atomic mass 411.66 and serial number 155. The great value, according to our calculation, has adjacent hyperbolas whose center is the point (0; 1). With the method, it has been possible to find just one element in the Periodic Table — Rhodium, which does not demand additional calculations involving the definition of the valid axes. Calculations towards updating the charge of a nucleus and the quantity of neutrons in end N-Z part of the diagram by means of the serial number 155 are herein executed. The variant of the Periodic Table of Elements with the eighth period is recommended. On the basis of symmetry, with the application of the Hyperbolic Law in the Periodic Table of Elements, the existence of Anti-Substances is herein indirectly proved.

In the Periodic Table, elements are in a static condition, which until now has not allowed us to reveal the dynamics of their contents in various chemical compounds. The regularity established by us represents equilateral hyperbolas $Y = K/X$, where Y is the content of any element K and X is the molecular mass of compounds taken according to one gram-atom of the defined element. The extreme conditions of the equation are attained when $Y \leqslant 1$, $K \leqslant X$. Mathematically speaking, if, for such hyperbolas, the peak is defined as $\sqrt{K}$, according to the theorem of Lagrange, on the basis of which the calculated factor of scaling ($M = 20.2895$) is applied, it shall allow us to pass from one system of coordinates to another. The square of this number (411.66) is equal to the maximal atomic mass of the last element, which is the crossing point of the valid axis of all hyperbolas whose ordinate is given by $Y = 1$. Its serial number is 155 [1].

Calculations of adjacent hyperbolas of the kind $Y = (X - K)/X$ whose center is the point 0; 1 have a simultaneous effect. Both versions of hyperbolas serve as additions with respect to each other. When in one curve Y decreases, in the second it increases. Each pair of hyperbolas of one element is crossed at the point ($X = 2K$, $Y = 0.5$) through which passes the axis of symmetry. Direct and adjacent hyperbolas of all elements are crossed among themselves. The hyperbolas of the last element are the right boundaries of existence for the compounds, and, at the left, they are bounded by the coordinate axes [2].

As a result of graphical constructions and voluminous calculations, it has been found that in the Periodic Table there is the element rhodium (Rh) to which it is not required to apply theorem Lagrange and the factor of scaling. On the basis of direct tabular data and adjacent hyperbolas, at a point of their crossing (205.811; 0.5), the valid axes which, on the X axis and along the line $Y = 1$, cut apiece with abscissa 411.622, are under construction. The divergence from the data described above is a few thousandths of percent. This fact manifests the validity of our theory [3].

It is thereby proved that the Top Limit of the Periodic Table is the element no. 155 with atomic mass 411.66. At present it is known that no. 118-th has been synthesized — last element of the seventh period (no. 117 does not exist yet). And, the above the serial number suggests that it is somehow difficult for the Table to receive a new element. So, accordingly, in nuclear reactions involving the synthesis of elements nos. 114, 115, 116, and 118, events 60, 24, 9 and 3 have been registered. In the known neutron-proton diagram of the nucleus (nearby 2500) which finishes with the element no. 114, it is seen that, in the end, its quantity of artificial isotopes sharply decreases [4]. To the number of the element with atomic mass 298, scientists have assigned special hopes as here isotopes should possess raised stability [5]. However, with the addition of the nucleus no. 155 to the diagram, a general line of new trends shows that the predicted element no. 114 should have 179 neutrons, instead of 175. Also expected by scientists are the twice-magic nucleus with a charge number 114 and atomic mass 298, which, according to our data, has a lack of 2 protons or, in other words, a surplus of 5 neutrons. The existing disorder in the parameters of the elements is caused by the fact that there enters a more long-living isotope into the table. Therefore the element no. 155 should be a reference point in nuclear reactions. It is necessary to consider it in new quantum theory calculations for the sake of filling the Periodic Table. There are different points of view on the quantity of elements in it: from 120 up to 218 and more. For example, G. Seaborg and V. Goldanskii have suggested adding 8-th and 9-th periods to 50 elements [6, 7]. But in constructing the total dependence of isotopes (more than 2500) on the charge of a nucleus, it is possible to

see that it has the parabolic form, and, in the end, its account goes by the units of the seventh period. It is also necessary to acknowledge that elements with numbers 94–103 have been discovered over the last 20 years, and 104–113–for 40.

In the world, hundreds of variants of the Periodic Table have been created, but no one never has been able to answer the question, whether it has a limit [8, 9]. We, for the first time, have given the parameters of the last element as belonging to the eighth period, the first group, having no. 155 and atomic mass 411.66 [10].

It is necessary to note that while our theory has been considered with reference to the first quadrant, the position of the second branches of equilateral hyperbolas in the third quadrant (where $K > 0$) has not been analyzed. However, it has appeared that they possess similar properties (similar to those in the first quadrant). Here too it is necessary to enter the factor for reduction of coordinate axes by one scale. If now around an imaginary axis we allow the overlapping of the third and the first quadrants, it is possible to see practically the full concurrence of curves, coordinates, and valid axes. However, it concerns only the central part of the hyperbolas, and their edges, observing a direction, fall outside the limits. Hence, here the principle of symmetry does not work. At $K < 0$ it is established, in the second and the fourth quadrants of the hyperbolas, that there is similar regularity which has been established by us for the first and the third quadrants. It is caused by equilateral hyperbolas having equal parameters with respect to the module, but with an opposite sign; namely, being mutually interfaced, they possess identical properties. Therefore, proceeding from the chemical concepts, they can be symmetric only after the change of scale of the X and Y axes. As in the third and fourth quadrants a negative ordinate (a degree of transformation of substance) is not allowable in Nature, we shall analyze only quadrants 1 and 2, in which $K > 0$ and $K < 0$. Here there is a full symmetry: the hyperbolas are congruent and all axes coincide. Hence, the Hyperbolic Law in the Periodic Table shall be applied to the second quadrant. At a positive value of Y, a negative value X, and $K < 0$, it is possible to assert that in it there are substances with a minus sign, i.e., Anti-Substances. Furnished with the analysis above, there arises the opportunity of constructing the Periodic Table of Anti-Substances similar to the one considered above.

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