Albert Khazan

2nd expanded edition 2010

Upper Limit
in Mendeleev's Periodic Table
Element No.155

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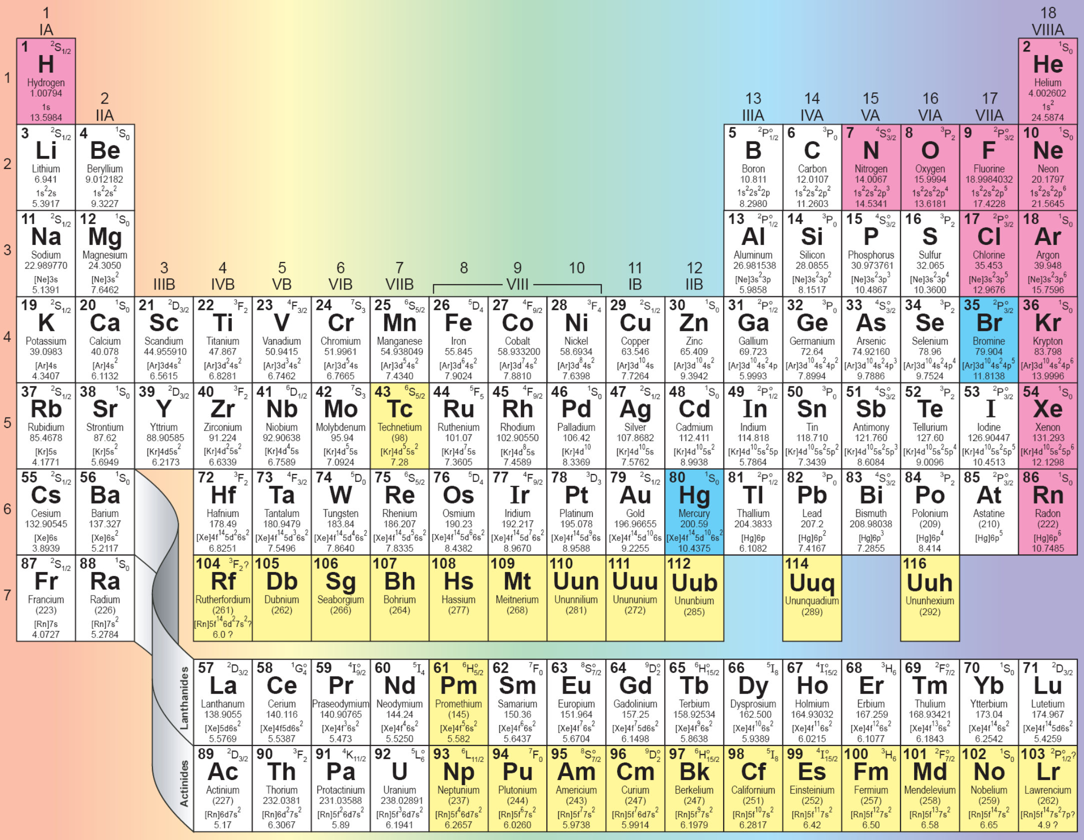

Albert Khazan

Upper Limit in Mendeleev's Periodic Table — Element No. 155

Second edition, revised and expanded

Andra upplagan, reviderad och utvidgad

Den over gränsen i Mendelejevs periodiska systemet — element No. 155

2010

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Preface

The main idea behind this book is that Mendeleev's Periodic Table of Elements is not infinitely continuous when it comes to super-heavy elements, but it has an upper limit (a heaviest element). This upper limit has theoretically been discovered during my many years of research, produced on the basis of a hyperbolic law found in the Periodic Table. According to the hyperbolic law, the content of an element in different chemical compounds (per one gram-atom of the element) can be described by the equation of an equilateral hyperbola. This statement is true throughout the Periodic Table, for both known chemical elements and still unknown ones (their molecular masses are, so far, only theoretical). This statement is very certain, because the hyperbola can be created for any set of numbers connected by the equation.

Proceeding from this statement, and on the basis of the common properties of equilateral hyperbolas, I have obtained a single real line which connects the peaks of the hyperbolas. This line intersects with $Y = 1$ in a point, whose coordinate meets the peak of the atomic mass allowed for the hyperbolas, is an actual upper limit of the Periodic Table (with atomic mass 411.66). While looking at this upper point, Lagrange's theorem has been used. Also, auxiliary research on the calculation of the scale coefficients has been made. All these have led to the aforementioned result.

While doing this research, I kept in mind that a subjective element might be present. Therefore, I was also looking for other data, in verification of the upper limit. Such data were found. As a result of my auxiliary research, the element Rhodium has been analyzed in the Periodic Table: for this element, the hyperbola's peak draws atomic mass twice, and meets the $Y = 1$ line which crosses the real axis at a point wherein $X = 411.622$. This result deviates from the aforementioned calculation of the upper limit in only several thousandth of the share of the percent. Hence, all previous theoretical considerations about the upper limit have become verified, and the heaviest element with atomic mass 411.622 has number 155 in the Periodic Table. Besides, this fact allows for the use of the heaviest element as a reference point in nuclear reactions during the synthesis of super-heavy elements.

Because these studies have been made in the first quadrant, for the positive branches of hyperbolas, I have turned my attention to a possibility to check all these in the remaining quadrants. As a result, the hyperbolic law has been successfully verified in only the second quadrant, which is absolutely symmetric with respect to the first one. This result has led me to a conclusion that, given negative atomic and molecular masses, and positive values of Y, the second quadrant is inhabited by anti-elements consisting of anti-substance.

All the aforementioned results have originated during my 40 years of research on chlorides of several refractory metals, e.g. Wolfram, which, being multivalent compounds, needed special equipment and technology for separation in their condensation. The obtained sublimants contained, in part, a mix of chlorides which were a source for extraction of the elements of the metal under study. Then, the obtained elements of the metal were compared to a calculated curve. As I discovered later, this research method is true along all the elements of the Periodic Table.

In 1971, I obtained a PhD degree on the chloride compounds of Wolfram and those of the other rare refractory metals. Further development of the theory, which involved finding proofs, required many years of research. Meanwhile, it was successful. My first report on the upper limit of the Periodic Table of Elements appeared in 2005 on the internet. Then numerous publications were subsequently made in newspapers, by interested reporters who specialized in the science news column. In 2007–2009, the American scientific journal *Progress in Physics* published a series of my scientific papers wherein I gave the presentation of my results on the hyperbolic law in the Periodic Table, and the upper limit (heaviest element) in it, in all necessary detail. Besides, many presentations have been given by me at meetings of the American Physical Society (see Appendix A).

I should emphasize the rôle of Dmitri Rabounski, the Editor-in-Chief of *Progress in Physics*, who invited me for publication. I am thankful to him for his editorial and friendly assistance, and also for the enlightening discussions.

At the end of this Preface, I would like to express my heartfelt gratitude to my wife Ludmila, my son Leonid, and his wife Oxana, who continuously supported me while undertaking the research, and who are still taking care of me. I will keep all enthusiasts of this book, and their friendly participation in the discussion of the obtained results, in my hearth.

My hope is that this book, which is a result of many sleepless nights, will pave a new road for the future of fundamental science.

New York, February, 2009 *Albert Khazan*

Preface to the 2nd Edition

Despite much success and achievements of the synthesis for super-heavy elements (10 new elements were obtained during the last 25 years), neither the physicists nor the chemists, the experts in Mendeleev's Periodic Table of Elements, answered the most important fundamental question: is the Table of Elements bounded and, if yes, where it ends?

The complicate calculations produced, by the most theorists, on the basis of Quantum Mechanics, have not answered this question till now. The mathematical methods of Quantum Mechanics are based on the physical conditions which regulate substance in micro-scales. Therefore, I turned my attention to the physical conditions observed in macro-scales, which are the subjects of study of the regular physics and chemistry. Thus, after the decades of my studying the physics and chemistry of chemical reactions, produced on many chemical compounds, the Law of Hyperboles was discovered in the Periodic Table of Elements. The essence of the hyperbolic law is as follows. Given any chemical compound, the contents of any element in it (per 1 gram-atom), including the contents of even unknown elements, whose atomic masses can be set up arbitrarily, is described by the equation of a equilateral hyperbola $Y = K/X$. The tops of all the arcs are distributed along a real axis crossing the line $Y = 1$ in the point of abscissa 411.66, which manifests the actual atomic mass of the last (heaviest) element of the Periodic Table. Thus, the number of the last element, 155, was calculated. To get the result, in the first stage, Lagrange's theorem was used, and the scaling coefficient for matching different coordinate systems was calculated.

Because the aim to get a truly scientific result, verified by independent data, I produced some additional studies of the discovered hyperbolic law. Thus, the adjacent hyperbolas of the fraction-linear functions in the Periodic Table, which play an important rôle in the hyperbolic law, were studied. Proceeding from the additional studies, it was found that only the element Rhodium has atomic mass connected to the last element's atomic mass. The found dependencies allowed to be sure in the independent verification of the hyperbolic law, with deviations from it to within only several thousandth of the share of one percent. I also showed that the hyperbolic law and the last element play an important rôle in physics and chemistry. In particular, they are useful in the synthesis of new super-heavy elements, in the determination of the numbers of isotopes in the periods of the Periodic Table, and also in the foundations of the existence of anti-elements and anti-substances in general.

Thus, on the basis of that has been found in the studies, and first commencing in the moment when the Periodic Table of Elements was invented in 1869, I was able to give a clear answer to the question about the upper limit of the Periodic Table: there is the last (heaviest) element, whose location is Period 8, Group 1; its atomic mass is 411.66, its number is 155.

As a result, the Periodic Table has reached a complete form, where all elements of Period 8 occupy their seats, according to their numbers and atomic masses.

Already 40 years ago some scientists claimed that elements whose numbers are higher than 110 are impossible. The experimental technics got much progress during the decades, so element 118 was registered. Now, with the results presented here, the theoretical physicists can make new developments in the theory of atomic nuclei and electronic shells proceeding from the common number of elements, which is 155.

New York, January, 2010 *Albert Khazan*

Chapter 1

Upper Limit in the Periodic Table of Elements

§ 1.1 Introduction. Mathematical basis

The periodic dependence of the properties of the elements on their atomic mass, as discovered by D. I. Mendeleev in 1869, predicted new elements in appropriate locations in the Periodic Table of Elements.

Progress in synthesis and in the study of the properties of the far transuranium elements has increased interest in the question of the upper limits of the Periodic Table. G. T. Seaborg, J. L. Bloom and V. I. Goldanskii emphasized that the charge of the atomic nucleus and the position occupied by the element "define unambiguously the structure of electron jackets of its atoms and characterize the whole set of its chemical properties". They suggested the existence of nuclei containing 114, 126 and 164 protons, 184, and 258 neutrons and the Table arrangement of the relevant elements [1, 2].

The objective of this study is to determine the possible number of chemical elements, along with atomic masses and atomic numbers up to the final entry in the Periodic Table.

The calculations were performed on the basis of IUPAC [3] table data for all known elements. The basic principle resides in the idea that the proportion of the defined element Y in any chemical compound of molecular mass X should be related to its single gram-atom. In this case, if K is the atomic mass, the equation $Y = K/X$ would represent a rectangular hyperbola in the first quadrant ($K > 0$). Its asymptotes conform to the axis coordinates, and semi-axis $a = b = \sqrt{2\,|K|}$. The peak of the curve should occur on the virtual axis inclined at an angle of 45° to the positive direction of the abscissa axis. The necessary conditions associated with this chemical conception are: $Y \leqslant 1$ and $K \leqslant X$.

The foregoing equation differs only in the atomic mass for each element of the Periodic Table and allows calculation of the proportion of the element in any compound. Accuracy plotting the curve and the associated straight line in the logarithmic coordinates depends on the size of the steps in the denominator values, which can be entirely random but must be on the relevant hyperbola in terms of X. Consequently, it can be computed without difficulty by prescribing any value of the numerator and denominator. In Table 1.1a are given both known Oxygen containing compounds and random data on X arranged in the order of increasing molecular mass. Fig. 1.1 depicts the hyperbola (the value of the approximation certainty $R^2 = 1$), calculated for 1 gram-atom of Oxygen.

Estimation of the unobserved content in the chemical compound as determined by the formula is expressed on the plot by the polygonal line (Table 1.1b, Fig. 1.1). It is obvious from the Fig. 1.2 that the hyperbolic function of the elemental proportion in chemical compounds plotted against molecular mass, by the example of the 2nd Group, is true ($R^2 = 1$). In the logarithmic coordinates (Fig. 1.3) it is represented as the straight lines arranged in the fourth quadrant (to the right of Hydrogen) all with slope 1. With the view to expansion of the basis of the arguments, this example is given for the 1st Group including "Roentgenium" No. 111, a more recently identified element, and the predicted No. 119 and No. 155. The real axis is shown here, on which the peaks of all hyperbolas of the Periodic Table are arranged (see below).

§ 1.2 Using the theorem of Lagrange

It is clear from the Fig. 1.2 that with the rise of the atomic mass the curvature of the hyperbola decreases (the radius of curvature increases), and the possibility to define its peak, for example, by means of graphical differentiation, becomes a problem due to errors of both subjective and objective character (instrument, vision and so on). Therefore, to estimate the curve peak of the hyperbola the mathematical method of the theorem of Lagrange was used [4].

For example, the coordinates of the peak for Beryllium are as follows: $X = 60.9097$, $Y = 0.14796$, the normal equation is $Y = 0.0024292\,X$. Taking into consideration that the semiaxis of the rectangular hyperbola $a = b = \sqrt{2\,|K|}$, the coordinates of the point $X_0 = Y_0 = \sqrt{K}$.

Let us examine this fact in relation to elements with the following atomic masses (K): Beryllium Be (9.0122), random Z (20), Chromium Cr (51.9961), Mercury Hg (200.59), No. 126 (310), random ZZ (380), No. 164 (422), random ZZZ (484). In this case $X_0 = Y_0 = \sqrt{K}$, and correspondingly, 3.00203, 4.472136, 7.210825, 14.16298, 17.606817, 19.493589, 20.54264, 22.

The obtained values are the coordinates of the rectangular hyperbola peaks ($X_0 = Y_0$), arranged along the virtual axis, the equation of which is $Y = X$ (because $\tan\alpha = 1$).

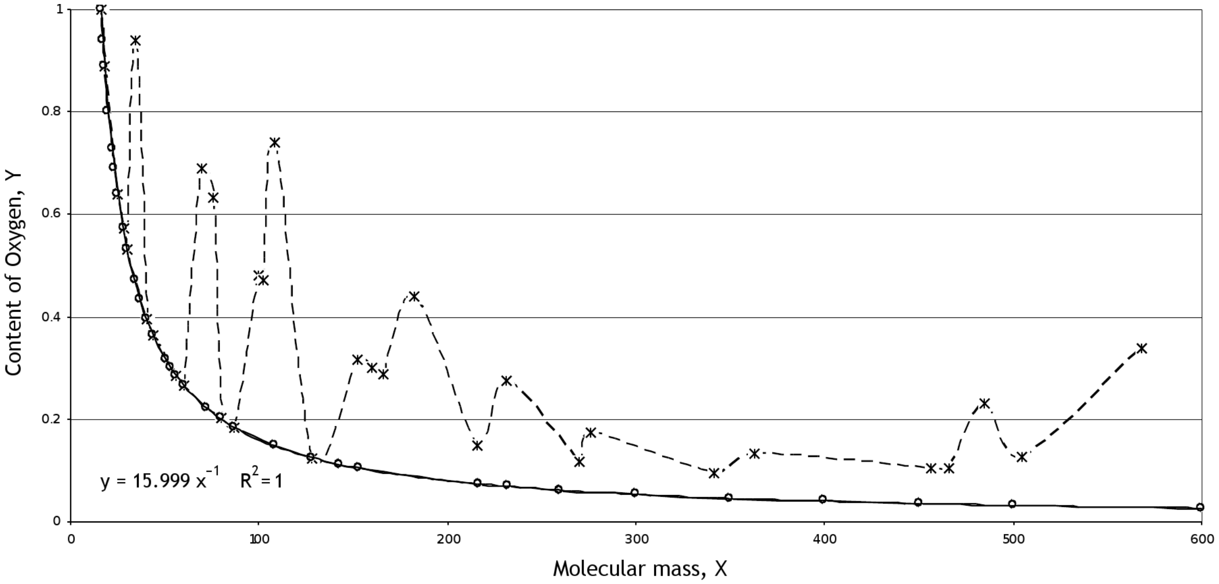

Fig. 1.1: Oxygen content versus the molecular mass of compounds on estimation to 1 gram-atom (hyperbola $y = k/x$) and the total amount of O (maxima, leaders). The molecular mass in the table is given according to its increase.

K	X	$Y=\frac{K}{X}$	$\ln X$	$\ln Y$	Compound		Compound	X	$Y=n\,\frac{K}{X}$
15.9994	15.999	1	2.77255	0	O		O	15.9994	1
15.9994	17.007	0.9408	2.83363	−0.0611	$\frac{1}{2}H_2O_2$		H_2O	18.015	0.88811546
15.9994	18.015	0.8881	2.8912	−0.1187	H_2O		BeO	25.01	0.63972011
15.9994	20	0.8	2.99573	−0.2232	—		CO	28.01	0.57120314
15.9994	22	0.7272	3.09104	−0.3185	—		NO	30.006	0.53320669
15.9994	23.206	0.6895	3.14441	−0.3719	$\frac{1}{3}B_2O_3$		H_2O_2	34.01	0.94089974
15.9994	25.01	0.6397	3.21928	−0.4467	BeO		MgO	40.304	0.39698293
15.9994	28.01	0.5712	3.33256	−0.56	CO		N_2O	44.012	0.36353722
15.9994	30.006	0.5332	3.4014	−0.6288	NO		CaO	56.077	0.28532197
15.9994	33.987	0.4708	3.52598	−0.7534	$\frac{1}{3}Al_2O_3$		COS	60.075	0.26633375
15.9994	37	0.4324	3.61092	−0.8384	—		B_2O_3	69.618	0.68947686
15.9994	40.304	0.397	3.69645	−0.9239	MgO		N_2O_3	76.01	0.63149586
15.9994	44.012	0.3635	3.78446	−1.0119	N_2O		CuO	79.545	0.20114401
15.9994	50.663	0.3158	3.9252	−1.1526	$\frac{1}{3}Cr_2O_3$		Cl_2O	86.905	0.18410908
15.9994	53.229	0.3006	3.9746	−1.2021	$\frac{1}{3}Fe_2O_3$		CrO_3	99.993	0.4800336
15.9994	56.077	0.2853	4.02673	−1.2542	CaO		Al_2O_3	101.96	0.47077285
15.9994	60.075	0.2663	4.09559	−1.323	COS		N_2O_5	108.008	0.74068588

K	X	$Y=\frac{K}{X}$	$\ln X$	$\ln Y$	Compound		Compound	X	$Y=n\,\frac{K}{X}$
15.9994	71.844	0.2227	4.2745	−1.5019	FeO		CdO	128.41	0.12460089
15.9994	79.545	0.2011	4.37632	−1.6038	CuO		Cr_2O_3	151.99	0.31581025
15.9994	86.905	0.1841	4.46482	−1.6923	Cl_2O		Fe_2O_3	159.687	0.30058803
15.9994	108.6	0.1473	4.6877	−1.9151	$\frac{1}{3}La_2O_3$		Co_2O_3	165.86	0.2894007
15.9994	128.41	0.1246	4.85523	−2.0827	CdO		V_2O_5	181.88	0.43985045
15.9994	143.09	0.1118	4.96348	−2.1909	Cu_2O		WO_2	215.84	0.14825797
15.9994	153.33	0.1043	5.03257	−2.26	BaO		Fe_3O_4	231.53	0.27642206
15.9994	216.59	0.0739	5.37801	−2.6055	HgO		UO_2	270.027	0.11850667
15.9994	231.74	0.069	5.44562	−2.6731	Ag_2O		Ag_2CO_3	275.75	0.174064
15.9994	260	0.0615	5.56068	−2.7881	—		UO_2Cl_2	340.94	0.0938546
15.9994	300	0.0533	5.70378	−2.9312	—		Gd_2O_3	362.5	0.132409
15.9994	350	0.0457	5.85793	−3.0854	—		Tl_2O_3	456.764	0.10508709
15.9994	400	0.04	5.99146	−3.2189	—		Bi_2O_3	465.96	0.103009
15.9994	450	0.0356	6.10925	−3.3367	—		Re_2O_7	484.4	0.231205
15.9994	500	0.032	6.21461	−3.4421	—		Tl_2SO_4	504.8	0.1267781
15.9994	600	0.0267	6.39693	−3.6244	—		$Ce_2(SO_4)_3$	568.43	0.33776

Table 1.1: Content of Oxygen Y in compounds X per gram-atom (Table 1.1a) left and summarized O (Table 1.1b) on the right.

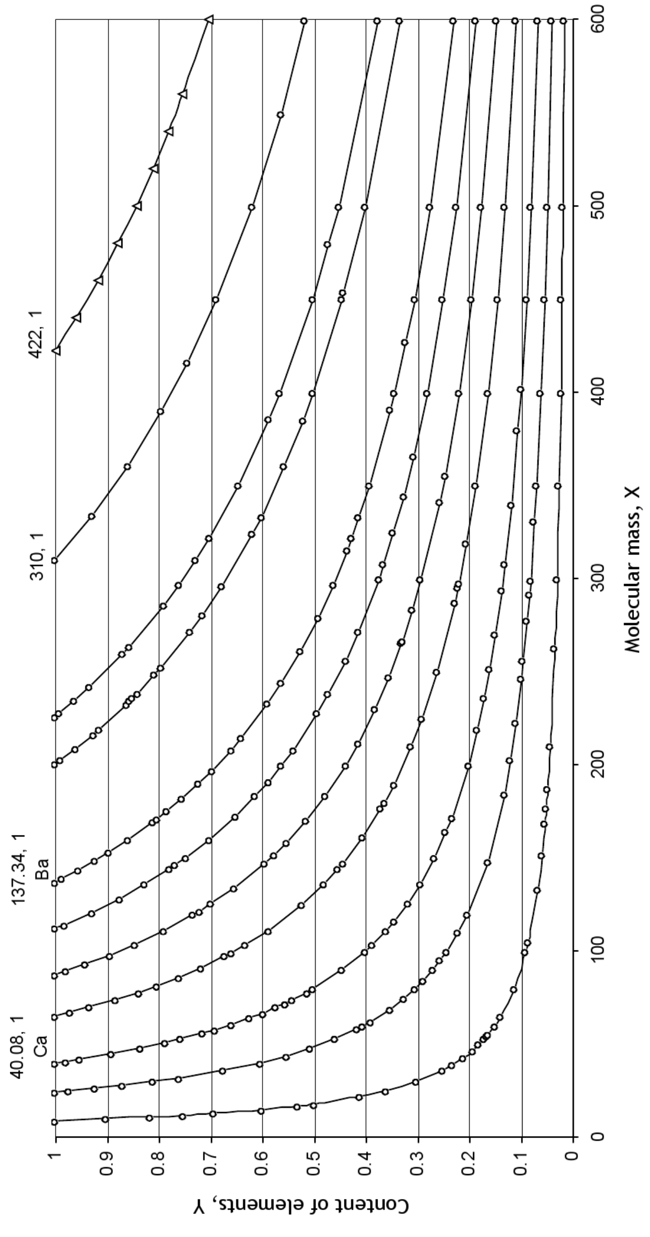

Fig. 1.2: Element proportion in chemical compounds against molecular mass ($y = k/x$) on the example of the 2nd Group of the Periodic Table, plus No. 126 and No. 164.

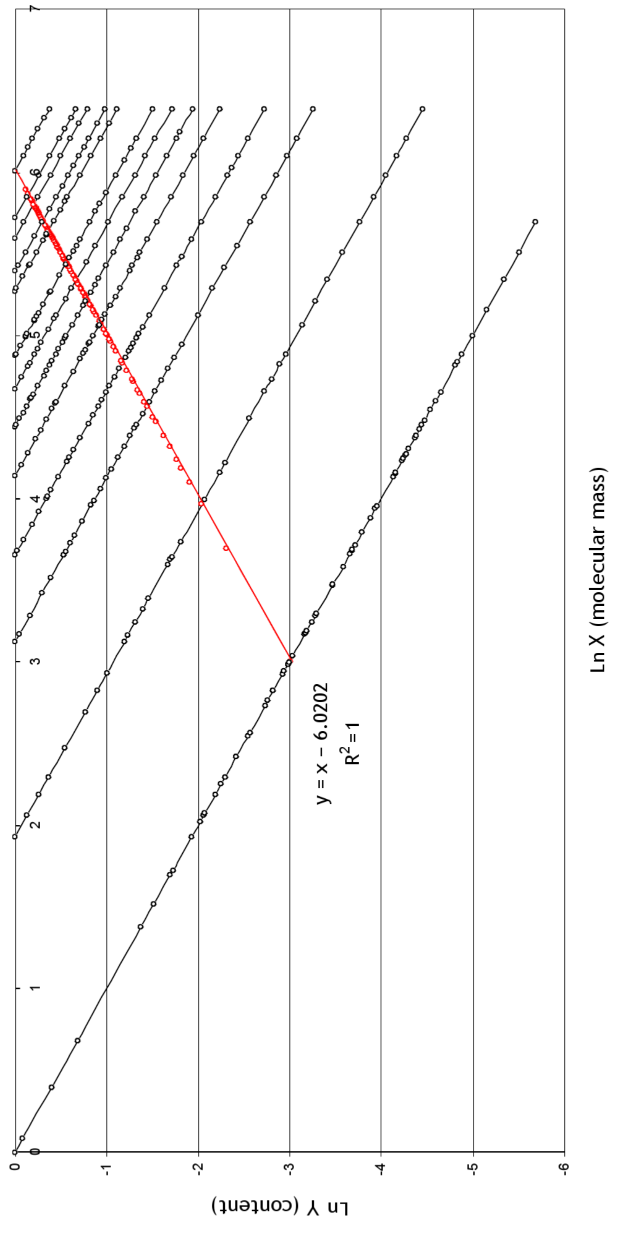

Fig. 1.3: Element content versus the molecular mass in chemical compounds of the 1st Group and No. 111, calculated No. 119, No. 155; + virtual axis.

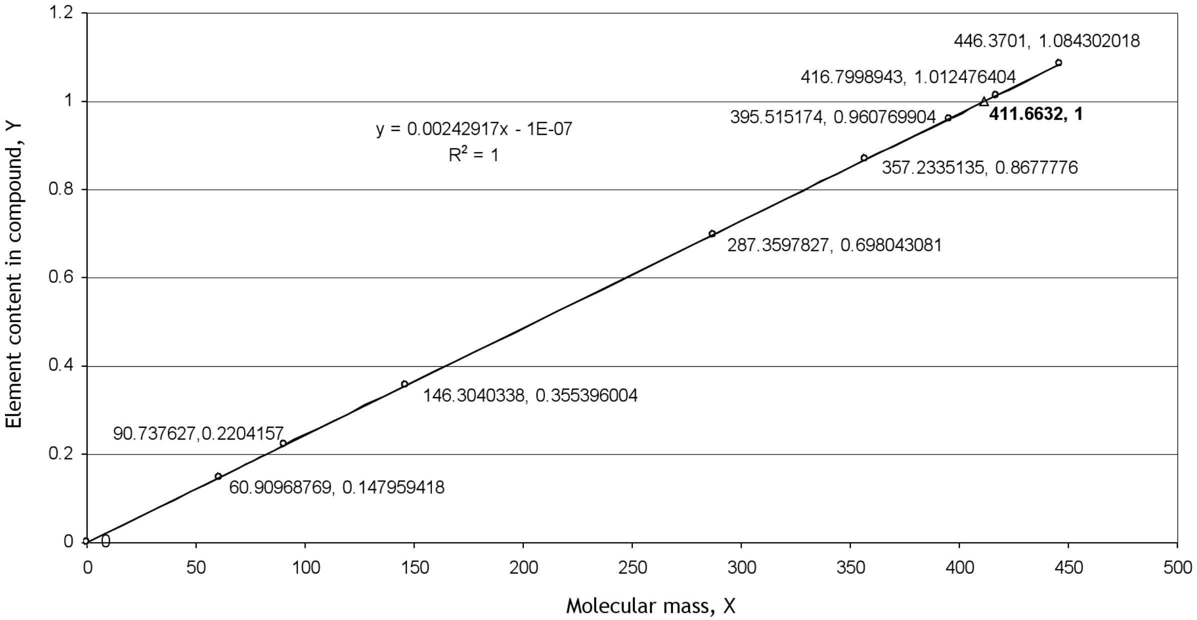

Fig. 1.4: The virtual axis of the hyperbolas $y = k/x$, after transformation of the data with application of the scaling coefficient.

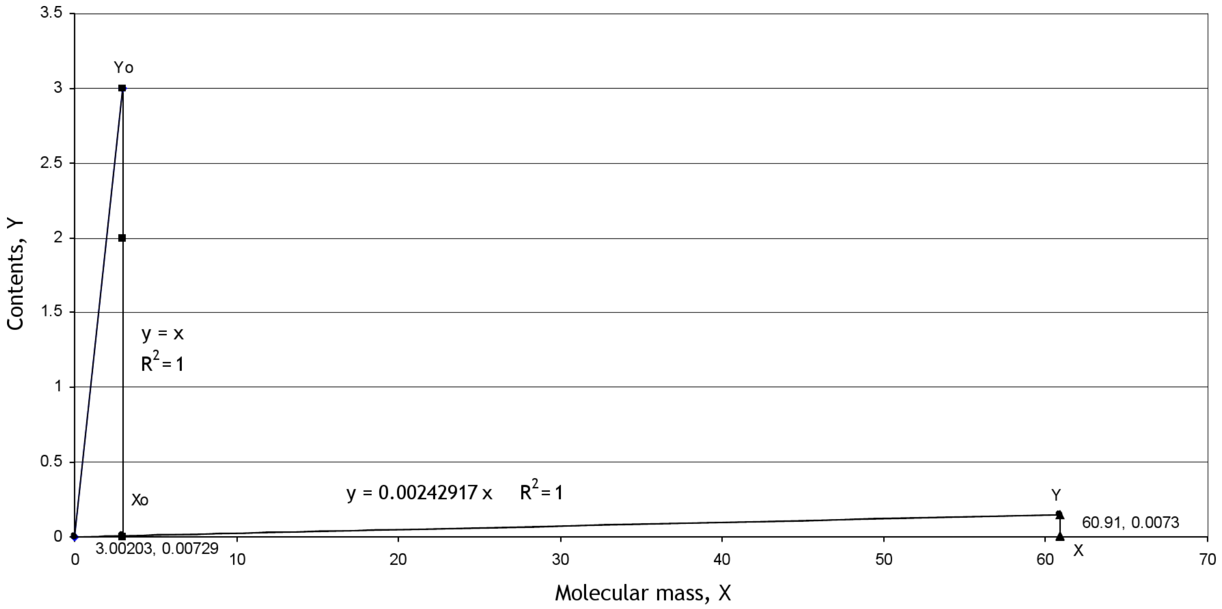

Fig. 1.5: Inversely proportional dependency in coordinates at calculation of the scaling coefficient.

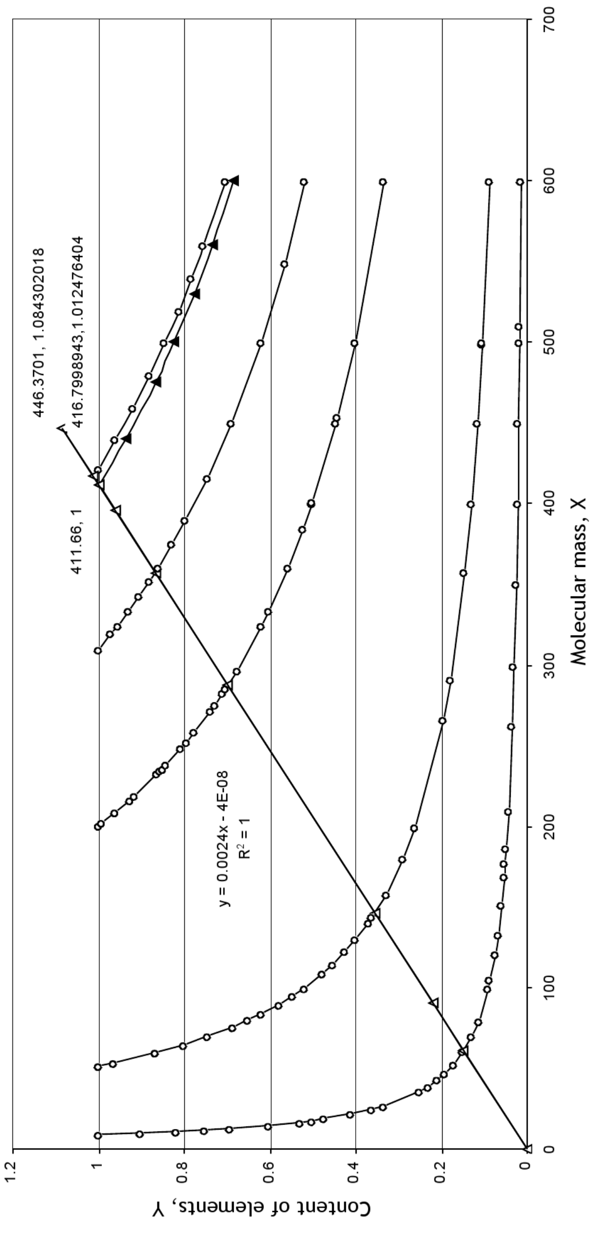

Fig. 1.6: Element content versus the compound's molecular mass and the hyperbola virtual axes of type $y = k/x$ for the entire Periodical Table. Additionally No. 126, No. 164 and that rated on (ZZZZ) are introduced.

§ 1.3 The point of crossing and the scaling coefficient

Our attention is focused on the point of crossing of the virtual axis with the line $Y = 1$ in Fig. 1.4 when the atomic mass and the molecular mass are equal, i.e. $K = X$. It is possible only in the case when the origin of the hyperbola and its peak coincide in the point with the maximum content Y according to the equation $Y = K/X$.

The atomic mass of this element was calculated with application of the scaling coefficient and the value of the slope of the virtual axis (the most precise mean is 0.00242917): $\tan\alpha = Y/X = 0.00242917$, from which $X = Y/\tan\alpha$. Due to the fact that at this point $K = X$ we have: $Y/\tan\alpha = 1/\tan\alpha = 411.663243$. This value is equal to the square of the scaling coefficient too: $20.2895^2 = 411.6638$, $\Delta = 0.0006$.

The coefficient was calculated from matching of the coordinates of the peak hyperbola for Beryllium: $X_0 = Y_0 = \sqrt{K}$ and $X = 60.9097$, $Y = 0.14796$. Using this data to construct two triangles (Fig. 1.5), one easily sees an inversely proportional relationship: $X/X_0 = Y_0/Y$, whence $X/X_0 = 60.9097/3.00203 = 20.2895041$ and $Y_0/Y = 3.00203/0.14796 = 20.28947013$, $\Delta = 0.000034$.

The calculated value $M = 20.2895$ is the scaling coefficient. With its help the scale of system coordinates can be reorganised.

Now if one rectangular hyperbola peak is known, $X_0 = Y_0 = \sqrt{K}$, then the new coordinates will be: $X = X_0\, M$ or $X = M\sqrt{K}$, $Y = \sqrt{K}/M$. Furthermore, $\tan\alpha_0 = Y_0/X_0 = 1$, so $\tan\alpha = Y/X = 1/M^2$. At the same time at $Y = 1$ and $K = X$, we obtain $X = Y/\tan\alpha$ or $K = Y/\tan\alpha = 1/\tan\alpha = M^2$.

The results obtained are plotted in Fig. 1.6 in comparison with the hyperbolas of such elements as Be, Cr, Hg and the hypothetical No. 126 (atomic mass = 310), No. 164 (atomic mass = 422), ZZZZ (atomic mass = 411.66). It is obvious that it is practically impossible to choose and calculate precisely the curve peak for an atomic mass exceeding the value 250 without the use of the mathematical method adduced herein.

The rated element ZZZZ is the last in the Periodic Table because the hyperbola No. 164 after it crosses the virtual axis at the point which coordinates are: $X_0 = Y_0 = \sqrt{422} = 20.5426386$.

After scaling we have $X = 20.2895 \times 20.5426386 = 416.8$ and $Y = 20.5426386/20.2895 = 1.0125$, but this makes no sense because Y cannot exceed the value 1. In addition, the hypothetical atomic mass 422 occurred higher than the molecular mass 416.8, i.e. $X < K$, but that is absurd. Similarly, it is obvious from Fig. 1.3 how the virtual axis (the equation $Y = X - 6.0202$ where $Y = \ln y$, $X = \ln x$) crossing all the logarithmic straight lines at the points corresponding to the hyperbola peaks, takes the value $\ln X = 6.0202$ at $\ln Y = 0$, or after taking logarithms, $X = 411.66$, $Y = 1$.

§ 1.4 The atomic (ordinal) number

To determine important characteristics of the atomic number some variants of graphical functions of the atomic mass versus the nucleus of all the elements were studied, including No. 126. One of them is exponential, with the equation $Y = 1.6091\, e^{1.0992x}$ (where Y is the atomic mass, x is ln No) at $R^2 = 0.9967$. After taking the logarithm of the both sides and inserting the atomic mass of 411.66 we have No. 155. The calculations also demonstrated that the ordinal No. 126 should have the atomic mass 327.2 but not 310.

Finally, the following atomic masses were obtained: No. 116 — 298.7, No. 118 — 304.4, No. 119 — 307.2, No. 120 — 310, No. 126 — 327.3, No. 155 — 411.66.

§ 1.5 The new law

Based on the foregoing, the heretofore unknown hyperbolic law of the Periodic Table of Elements is established. This law is due to the fact that the element content Y when estimated in relation to 1 gram-atom, in any chemical combination with molecular mass X, may be described by the adduced equations for the positive branches of the rectangular hyperbolas of the type $Y = K/X$ (where $Y \leqslant 1$, $K \leqslant X$), arranged in the order of increasing nuclear charge, and having the common virtual axis with their peaks tending to the state $Y = 1$ or $K = X$ as they become further removed from the origin of coordinates, reaching a maximum atomic mass designating the last element.

Chapter 2

Effect from Hyperbolic Law in Periodic Table of Elements

§ 2.1 Introduction. Mathematical basis

In Chapter 1 we showed that the Y content of any element K in a chemical compound is decreasing in case molecular mass X is increasing in the range from 1 up to any desired value in compliance with rectangular hyperbolic law $Y = K/X$ [5]. Simultaneously, fraction $(1 - Y)$ is increasing in inverse proportion in compliance with formula $1 - Y = K/X$ or

$$Y = \frac{X - K}{X} \,. \tag{2.1}$$

It is known that the function

$$y = \frac{ax + b}{cx + d} \tag{2.2}$$

is called a linear-fractional function [6, p. 991]. If $c = 0$ and $d \neq 0$, then we get linear dependence $y = \frac{a}{d}\,x + \frac{b}{d}$. If $c \neq 0$, then

$$y = \frac{a}{c} + \frac{\frac{bc - ad}{c^2}}{x + \frac{d}{c}} \,. \tag{2.3}$$

Supposing that $X = x + \frac{d}{c}$, $\frac{bc-ad}{c^2} = k \neq 0$, $Y = y - \frac{a}{c}$, we get $Y = K/X$, i.e. rectangular hyperbolic formula which center is shifted from coordinates origin to point $C\left(-\frac{d}{c}; \frac{a}{c}\right)$.

As we can see, formula (2.1) is a special case of the function (2.2), cause coefficient $d = 0$. Then, determinant $D\,(ad - bc)$ degenerates into $-bc$. There exists a rule: when $D < 0$, $K > 0$, real axis together with X axis (abscissa axis) makes an angle $+45°$; and if $D > 0$, then the angle is $-45°$. In our case $D = a \times 0 - (-K) \times 1 = K$. Therefore, real axis, on which tops of all new hyperbolas will be located, shall be in perpendicular position to the axis $Y = K/X$. At that, the center is shifted from the coordinates origin $C\,(0; 0)$ to the point $C\,(0; 1)$. That means, in our case, semi-axes

$$a = b = \sqrt{\frac{2|D|}{c^2}} = \sqrt{2K}\,. \tag{2.4}$$

Then the coordinates of the top of the other hyperbola Beryllium will be: $X_0 = Y_0 = \sqrt{K} = \sqrt{9.0122} = 3.00203$ and $X' = 60.9097$, $Y' = 1 - Y = 1 - 0.14796 = 0.85204$.

In order to avoid possible mistakes let us use the following terminology: hyperbola of $Y = K/X$ kind is called straight, and linear-fractional — an adjoining one.

Fig. 2.1 demonstrates these curves which represent five elements from different groups: Chlorine (No. 17), Zirconium (No. 40), Wolfram (No. 74), Mendelevium (No. 101), and the last one (No. 155). Peculiarity of the diagrams is symmetry axis at content of elements equal to 0.5. It is clear that both hyperbolas of the last element and ordinate axis limit the existence area of all chemical compounds related to one gram-atom.

Previously, we proved that all the elements of Periodic System can be described by means of rectangular hyperbole formulas. That is why, it is quite enough to present several diagrams in order to illustrate this or that dependence. The same is valid for linear-fractional functions which curves are directed bottom-up. If we put the picture up by symmetry axis, we shall see that they fully coincide with straight hyperbolas. At the cross point of straight and adjoining hyperbolas on this line, abscissa is equal to doubled atomic mass of the element. Coordinates of another cross points for each pair of hyperbolas have the following parameters: X is equal to the sum of atomic mass of two elements $(K_1 + K_2)$, and Y has two values $\frac{K_1}{K_1+K_2}$ and $\frac{K_2}{K_1+K_2}$. Mentioned above is valid up to the upper bound of the Periodic Table inclusive.

As we can see on Fig. 2.2, (A00) and (B01) are real axes of straight and adjoining hyperbolas accordingly; and, AC and BD, (00E) and (01E) are tangents to them. Real axes are perpendicular to each other and to tangents. And all of them are equal to each other. Diagonals (00D) and (01C) divide straights AE and BE in halves.

There are formulas of mentioned lines. Cross points of these lines are also calculated. Abscissa of cross sections are values divisible by atomic mass of the last element: 0; 205.83; 274.44; 329.328; 411.66; 548.88; 617.49; 823.32 (0; 0.5; 0.667; 0.8; 1.0; 1.333; 1.5; 2.0).

For reference, Fig. 2.3 demonstrates graphical construction for Wolfram.

We can see, that knowing real axes (normal to the top of hyperbolas), it is very easy to build up tangents to any element, if required, in order

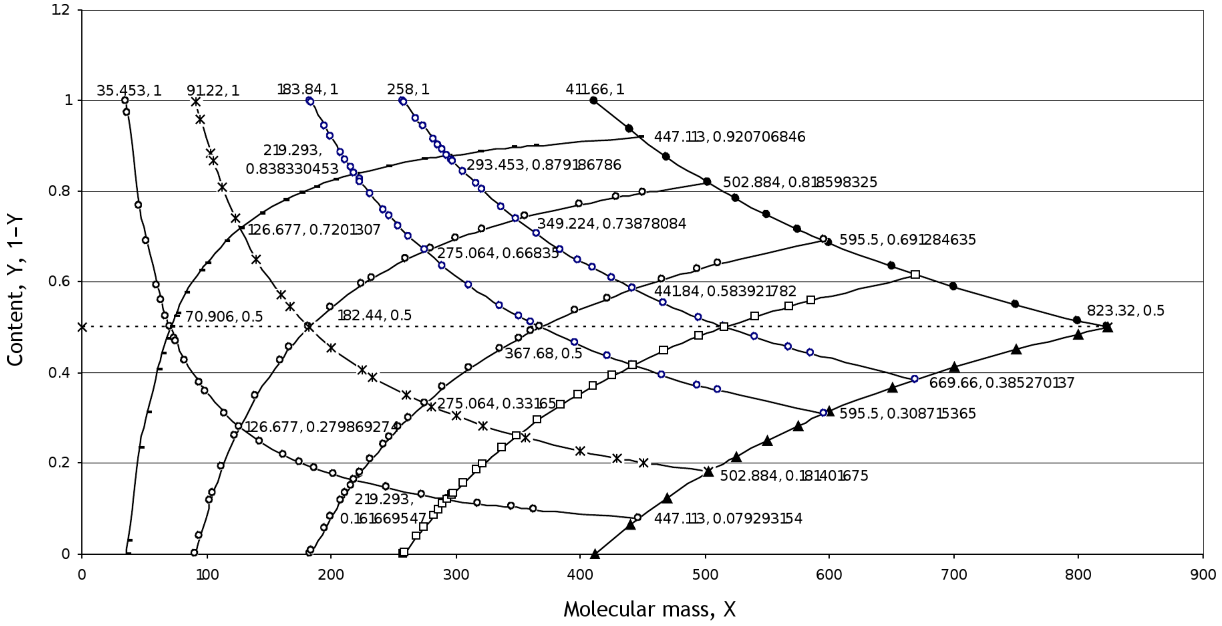

Fig. 2.1: Dependence of Y and $1 - Y$ content from molecular mass in straight and adjoining hyperbolas accordingly.

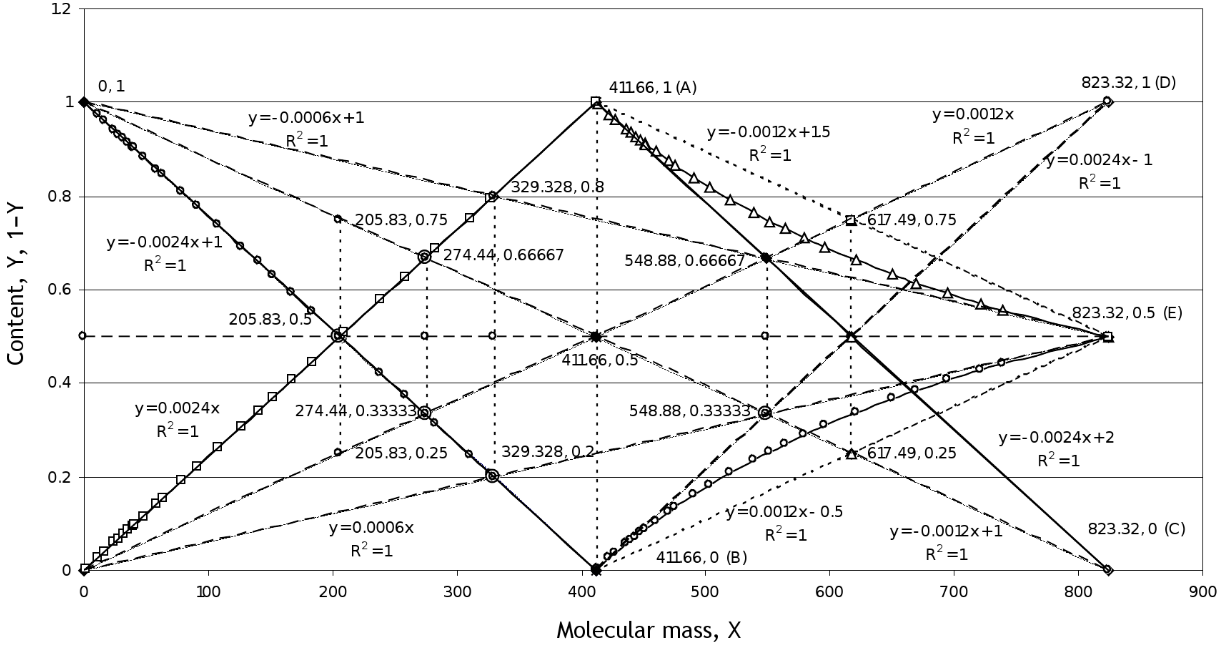

Fig. 2.2: Main lines of straight and adjoining hyperbolas of the last element: real axes, tangents, diagonals etc.

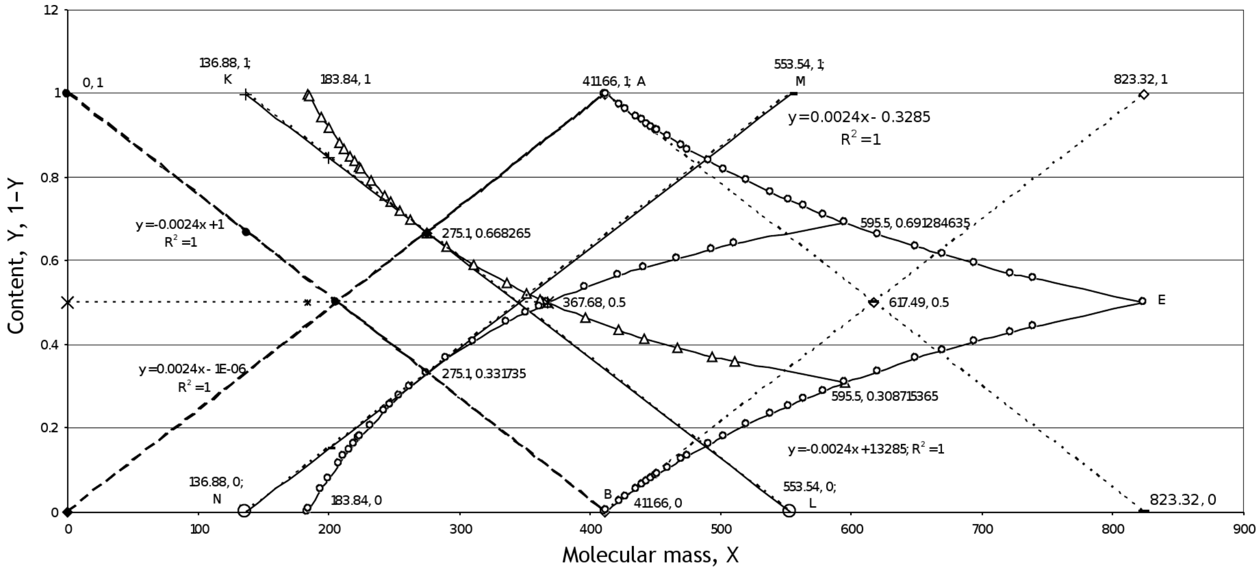

Fig. 2.3: Hyperboles of the last element and Wolfram, their cross points and tangents.

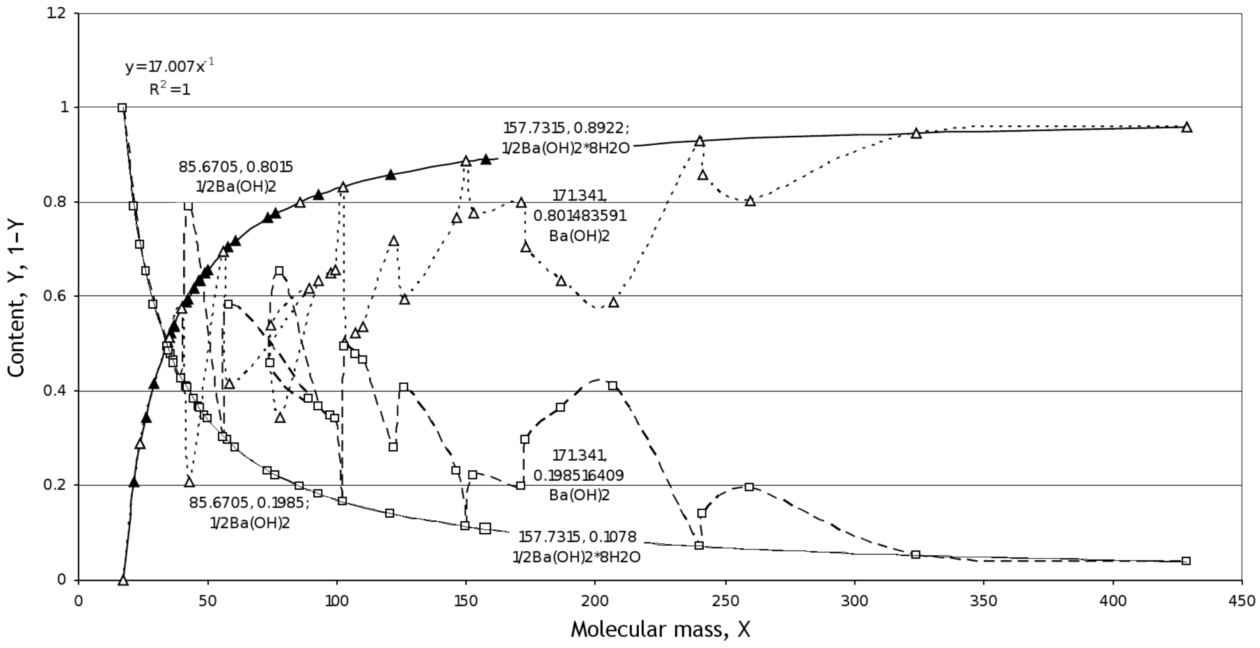

Fig. 2.4: Dependence of content of Y (OH) and $1-Y$ in hydroxides from their molecular mass counting on 1 gram-mole OH (of hyperbola). Broken curves are overall (summarized) content of OH in a chemical compound.

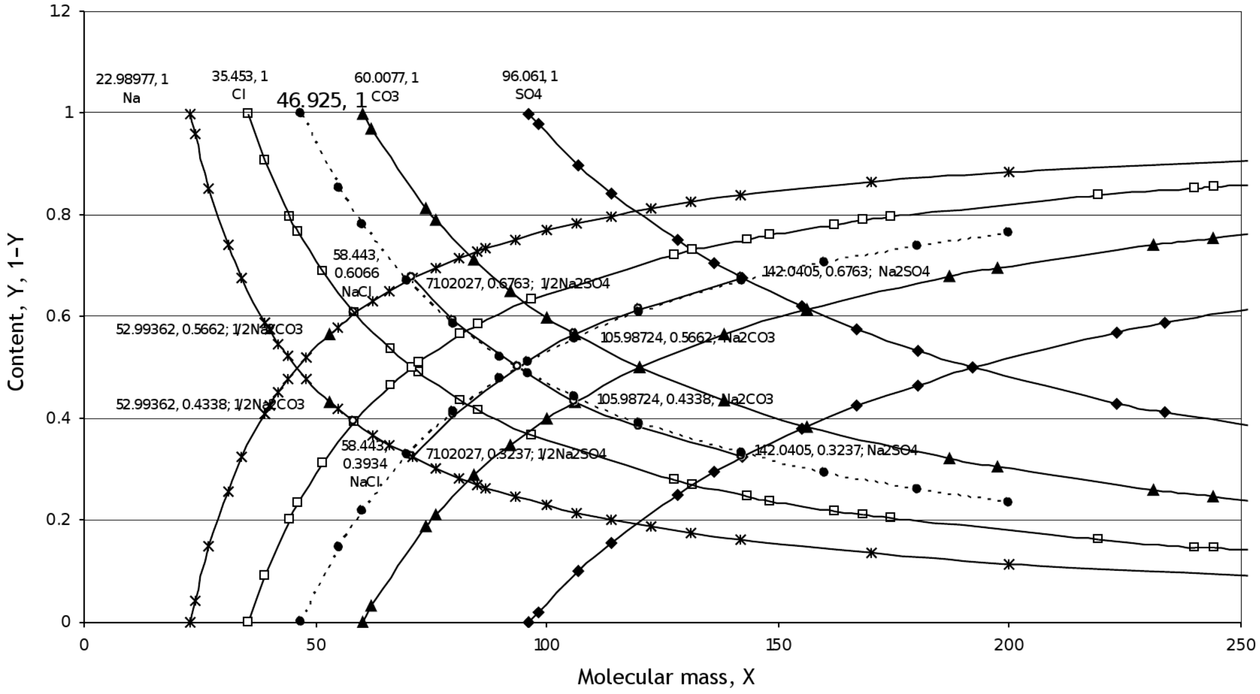

Fig. 2.5: Application of mathematic methods at calculating of the diagram containing hyperbolas of Sodium, Chlorine and groups CO_3, SO_4. Building up of a new hyperbola based on these data.

to check accuracy of chosen tops. For that, it is necessary to calculate formula of the straight which passes through the point $M_1\,(X_1; Y_1)$ and parallel $Y = aX + b$, i.e.

$$Y - Y_1 = a\,(X - X_1)\;. \tag{2.5}$$

§ 2.2 Application of the law of hyperbolas for chemical compounds

As it has already been mentioned above, the law is based on the following: the content of the element we are determining in the chemical compound should be referred to its gram-atom. It was shown in detail by the example of Oxygen. In compliance with the formula $Y = K/X$ element is a numerator, and any compound is a denominator. For example, in order to determine content of Sodium (Na) in compounds with molecular mass NaOH (39.9967), Na_2CO_3 (105.9872), Na_3PO_4 (163.941), NaCl (58.443), Na_2SO_4 (142.0406) it is necessary, before the formula, to put coefficients, reducing amount of Sodium in it to a unit: 1, $\frac{1}{2}$, $\frac{1}{3}$, 1, $\frac{1}{2}$, accordingly. Then, numerically, part of element (Y) will be 0.5748, 0.4338, 0.4207, 0.3934, and 0.3237. I.e., it is in one range with decreasing, and value $(1-Y)$ with increasing. Both these curves (in pairs) which are built based on these data are referred to one element.

Method of rectangular hyperbolas is worked out in order to determine the last element of Mendeleev's Periodic Table. But its capabilities are much bigger.

Let us build straight and adjoining hyperbolas for Sodium, Chlorine and also for groups CO_3 and SO_4, which form, accordingly, carbonates and sulphates. As we can see in the formula $Y = K/X$ they replace elements in a numerator. We already said that hyperbolas can by formed by any numbers within location of their tops on a real axis. However, there is a rule for groups, similar to that of 1 gram-atom of the element: their quantity in calculated compounds should not exceed a unit. Otherwise we get a situation shown on Fig. 2.4.

As we can see, it is necessary to put coefficient $\frac{1}{2}$ before the formula of hydroxide at bivalent Barium. Then, his compounds will be on hyperbolas. In case of non-observance of this rule, their points will be on broken line (circle).

Now we can start to solve a problem of building up new hyperbolas, based on existing ones (Fig. 2.5).

Let's mark on them several general points related to the known compounds. On Sodium curves there are two points (on each curve)

$\frac{1}{2}\,Na_2CO_3$ and $\frac{1}{2}\,Na_2SO_4$, which are also located on respective hyperbolas but without the coefficient $\frac{1}{2}$ (Na_2CO_3 and Na_2SO_4). Thus, the point $\frac{1}{2}\,Na_2SO_4$, located on the straight hyperbola of Sodium, and its cross points with hyperbolas CO_3 and SO_4 form imaginary broken line located between Chlorine and CO_3.

In a similar manner it works with adjoining hyperbolas. Let's build a formula (by three points) $Y = 63.257\,X^{-1.0658}$ of a power function (or $\ln Y = 4.1472 - 1.0658 \ln X$). With the help of mentioned formula we will find some more coordinates, including (obligatory) their crossing center (93.85; 0.5). Then we divide the abscissa of this point by 2 (straight and adjoining hyperbolas cross at doubled value of atomic mass) we get X, equal to 46.925, and that is a numerator in a formula of new hyperbolas ($Y = 46.925/X$).

§ 2.3 Conclusions

Method of rectangular hyperbolas makes it possible to do the following:

- Create mathematical basis for using hyperbolas of the kind $Y = 1 - \frac{K}{X}$ in chemistry;
- Determine existence area of the chemical compounds;
- Calculate formulas of the main lines and cross points of all the hyperbolas, including the last element;
- Show the possibility of building up hyperbolas whose numerator is a group of elements, including the rule of 1 gram-atom (in this case it is 1 gram-mole);
- Calculate and to build unknown in advance hyperboles by several data of known chemical compounds located on respective curves;
- Control (with high accuracy) the content of synthesized substances;
- Design chemical compounds.

Due to the fact that it is inconvenient to call each time the element 155 the "last element" and by the right of the discoverer we decided to call it **KHAZANIUM** (**Kh**).

Chapter 3

The Rôle of the Element Rhodium in the Hyperbolic Law of the Periodic Table of Elements

§ 3.1 Introduction

The method of rectangular hyperbolas assumes that their peaks (i.e. vertices) should be determine with high accuracy. For this purpose the theorem of Lagrange and the coefficient of scaling calculated by the Author for transition from the system of coordinates of the image of a hyperbola, standard practice of the mathematician, and used in chemistry, are utilized. Such an approach provides a means for calculating the parameters of the heaviest element in Mendeleev's Periodic Table.

In the first effect of the hyperbolic law it is shown that to each direct hyperbola corresponds an adjacent hyberbola: they intersect on the line $Y = 0.5$ at a point the abscissa of which is twice the atomic mass of an element [7]. This fact is clearly illustrated for Be, Ca, Cd in Fig. 3.1.

Upon close examination of the figure deeper relationships become apparent:

- From the centre of adjacent hyperbolas ($X = 0$, $Y = 1$) the secants have some points of crossing, the principal of which lie on the line $Y = 0.5$ and on the virtual axes (peaks);
- The secants intersect a direct hyperbola in two points, with gradual reduction of a segment with the increase in molecular mass;
- Behind the virtual axis of adjacent hyperbolas the secants cut a direct hyperbola in only one point;
- In conformity therewith, the magnitude of the abscissa, between a secant and a point of intersection of hyperbolas on the line $Y = 0.5$, also changes;
- For the element Rhodium the secant becomes a tangent and also becomes the virtual axis of adjacent hyperbolas.

§ 3.2 Mathematical motivation

On the basis of the presented facts, we have been led to calculations for 35 elements to establish the laws for the behavior of secants. The results are presented in Table 3.2 for the following parameters:

- Atomic numbers of elements and their masses;
- Calculated coordinates of peaks of elements (the square root of the atomic mass and coefficient of scaling 20.2895 are used);
- Abscissas of secants on the line $Y = 0.5$ are deduced from the equation of a straight lines by two points
$$\frac{(X - X_1)}{(X_2 - X_1)} = \frac{(Y - Y_1)}{(Y_2 - Y_1)} \quad \text{(column 6)}; \tag{3.1}$$
- Points of intersection of direct and adjacent hyperbolas (see column 7);
- Difference between the abscissas in columns 6 and 7 (column 8);
- Tangent of an inclination of a secant from calculations for column 6.

According to columns 6 and 7 of Table 3.2, Fig. 3.2 manifests dependences which essentially differ from each other are obtained. Abscissas of secants form a curve of complex form which can describe with high reliability (size of reliability of approximation $R^2 = 1$) only a polynomial of the fifth degree. The second dependency has a strictly linear nature ($Y = 2X$), and its straight line is a tangent to a curve at the point (102.9055, 205.811). For clarity the representation of a curve has been broken into two parts: increases in molecular mass (Fig. 3.3) and in return — up to Hydrogen, inclusive (Fig. 3.4). The strongly pronounced maximum for elements B, C, N, O, F, Ne is observed.

At the end of this curve there is a very important point at which the ordinate is equal to zero, where (the line of Rhodium in the table) the data of columns 6 and 7 coincide.

Thus it is unequivocally established that for Rhodium the secant, tangent and the virtual axis for an adjacent hyperbola are represented by just one line, providing for the first time a means to the necessary geometrical constructions on the basis of only its atomic mass (**the only one in the Periodic Table**), for the proof of the hyperbolic law.

Graphical representation of all reasoning is reflected in Fig. 3.5 from which it is plain that the point with coordinates (205.811, 0.5) is the peak of both hyperbolas, and the peaks of Ca and Ta are on both sides of it. Below are the detailed calculations for the basic lines of Rhodium on these data (see Page 41).

1	2	3	4	5	6	7	8	9
El.	**No.**	**At. mass**	**X_0 peak**	**Y_0 peak**	**Abs. secant**	**Cross. hyperb.**	**$\Delta = 6 - 7$**	**tan a, secant**
H	1	1.0079	20.3695	0.04948	10.715	2.0158	8.6992	−0.046664
He	2	4.0026	40.5992	0.0986	22.5163	8.0052	14.5111	−0.0222
Li	3	6.941	53.4543	0.12985	30.7155	13.882	16.8335	−0.01628
Be	4	9.0122	60.9097	0.14796	35.7434	18.0244	17.719	−0.014
B	5	10.811	66.712	0.162055	39.80692	21.622	18.18492	−0.01256
C	6	12.0107	70.3162	0.1708	42.4	24.0214	18.3786	−0.0117923
N	7	14.0067	75.9345	0.184458	46.5546	28.0134	18.5412	−0.01074
O	8	15.9994	81.1565	0.197143	50.5423	31.9988	18.5435	−0.009893
F	9	18.9984	88.4362	0.21483	56.3163	37.9968	18.3195	−0.008878
Ne	10	20.1797	91.1441	0.2214	58.5311	40.3594	18.1717	−0.0085425
Mg	12	24.305	100.0274	0.242983	66.0669	48.61	17.4569	−0.007568
S	16	32.065	114.89125	0.27909	79.6849	64.13	15.5549	−0.006273
Ca	20	40.078	128.4471	0.31202	93.3508	80.156	13.1948	−0.005356
Cr	24	51.9961	146.3042	0.3554	113.484	103.9922	9.4918	−0.004406
Zn	30	65.409	164.093	0.3986	136.428	130.818	5.61	−0.003665
Br	35	79.904	181.366	0.44057	162.0982	159.808	2.29	−0.003085
Zr	40	91.224	193.7876	0.47074	183.075	182.448	0.627	−0.002731
Mo	42	95.94	198.7336	0.482757	192.1085	191.88	0.2285	−0.002603
Rh	**45**	**102.906**	**205.82145**	**0.4999746**	**205.811**	**205.811**	**0**	**−0.00242941**
Cd	48	112.411	215.1175	0.52256	225.26	224.822	0.458	−0.00221946
Ba	56	137.327	237.7658	0.577573	281.428	274.654	6.774	−0.001777
Nd	60	144.242	243.6785	0.591936	298.5785	288.484	10.09455	−0.0016746
Sm	62	150.36	248.7926	0.60436	314.417	300.72	13.7	−0.00159

1	2	3	4	5	6	7	8	9
El.	**No.**	**At. mass**	**X_0 peak**	**Y_0 peak**	**Abs. secant**	**Cross. hyperb.**	**$\Delta = 6 - 7$**	**tan a, secant**
Dy	66	162.5	258.6414	0.628283	347.9	325	22.9	−0.001437
Yb	70	173.04	266.8976	0.64834	379.48	346.08	33.4	−0.0013176
Hf	72	178.49	271.068	0.65847	396.843	356.98	39.863	−0.00126
Ta	73	180.948	272.928	0.663	404.923	361.896	43.027	−0.0012348
Re	75	186.207	276.8658	0.67255	422.7646	372.414	50.35	−0.0011827
Ir	77	192.217	281.2984	0.68332	444.1376	384.434	59.704	−0.0011258
Hg	80	200.59	287.3598	0.698	475.8318	401.18	74.6518	−0.00105
At	85	210	294.0228	0.71423	514.44	420	94.44	−0.000972
Fr	87	223	302.9868	0.736	573.85	446	127.85	−0.00087
Th	90	232.038	309.0658	0.75077	620.0472	464.07612	155.971	−0.000806
Am	95	243	316.282	0.7683	682.53	486	196.53	−0.0007326
Es	99	252	322.0858	0.7824	740.0874	504	236.0874	−0.0006756

a) Column 4 contains the square root of the respective atomic mass (column 3) multiplied by the scaling coefficient ($M = 20.2895$). Column 5 contains the square root divided by the scaling coefficient M;

b) Column 6. We draw a straight line from the centre (0;1) to the point of crossing with the real axis at $(X_0; Y_0)$. With equation 3.1 we have, for example, for Mg: $(X - 0)/(100.0274 - 0) = (Y - 1)/(0.242983 - 1)$, so the equation of the straight line is $Y = 1 - 0.007568\,X$. Thus, abscissa of the point of crossing of the line by the line $Y = 0.5$ is 66.0669 (column 6);

c) Column 7. These are abscissas of the points of crossing of the direct and adjacent hyperbolas, created for each element, by the straight line $Y = 0.5$. Abscissas of the crossing points decrease with the increase of atomic mass of elements, and reach zero at the meeting of the crossing line and the real axis of the adjanced hyperbolas.

d) In column 9, the tangent of the corner of inclination of the secants is resulted; at the element Rhodium this line crosses the axis X in a point with abscissa 411.622, and its position meets the tangent at peak; $411.66 - 411.62 = 0.04$ or nearly so 0.01% from atomic mass.

Table 3.1: Results of calculations for some elements of the Periodic Table.

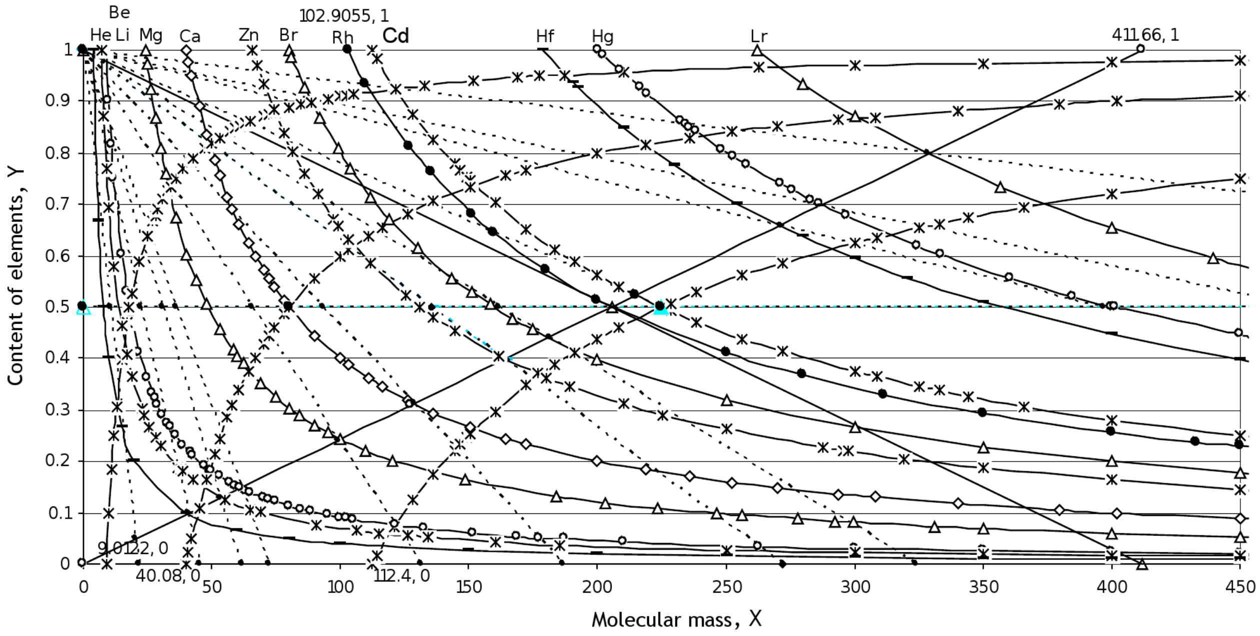

Fig. 3.1: Hyperboles created for some elements of the Periodic Table, and their peaks located in virtual axis. Position secants, dependent on molecular mass, are shown.

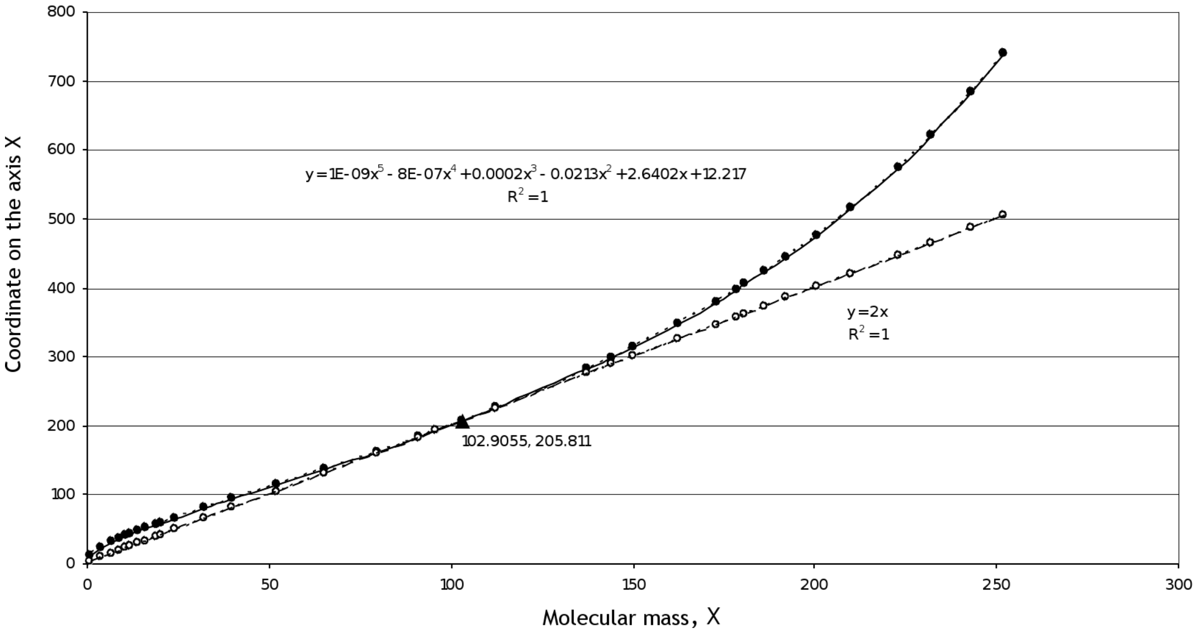

Fig. 3.2: Dependency of the coordinates of the axis X from molecular mass: secant (column 6) and cross-point of the hyperbolas (column 7) in line $y = 0.5$.

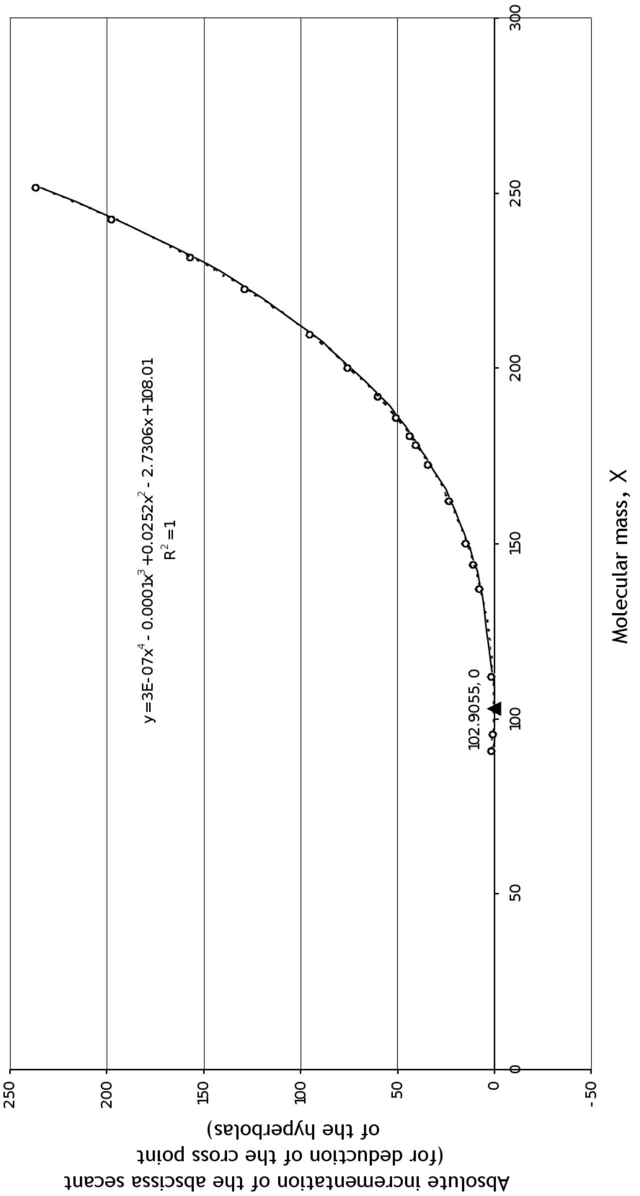

Fig. 3.3: Dependency of the absolute increment of the abscissa secant from the change of molecular mass (for calculation of the coordinate X of the cross-point of the hyperbolas.

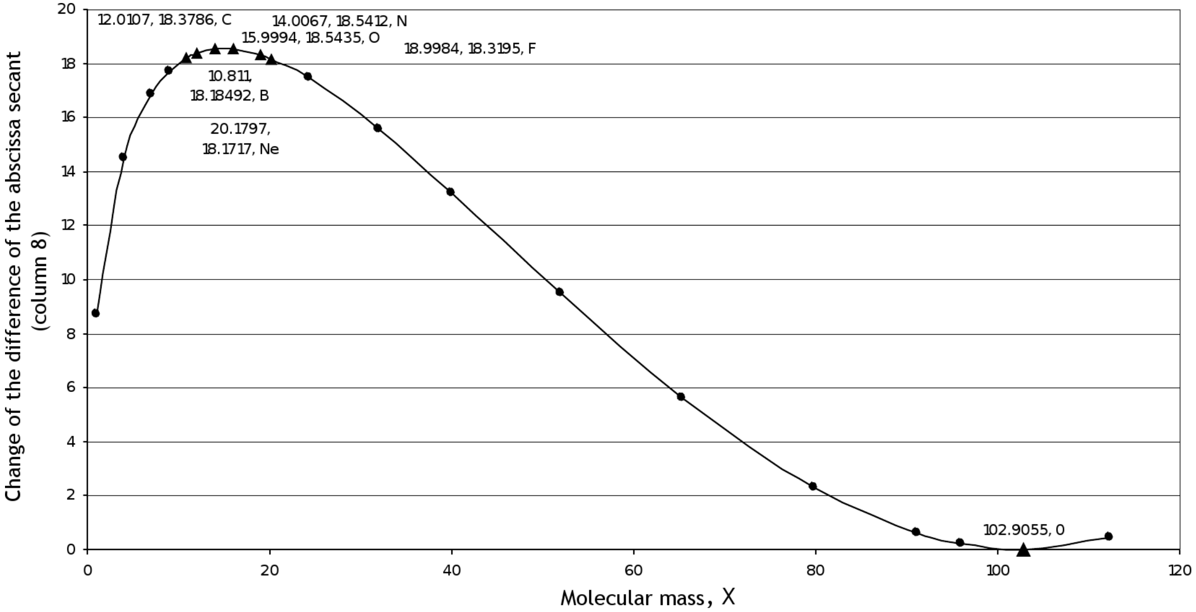

Fig. 3.4: Dependency of the abscissa secants from molecular mass (column 8) when crossing the hyperbolas in two points.

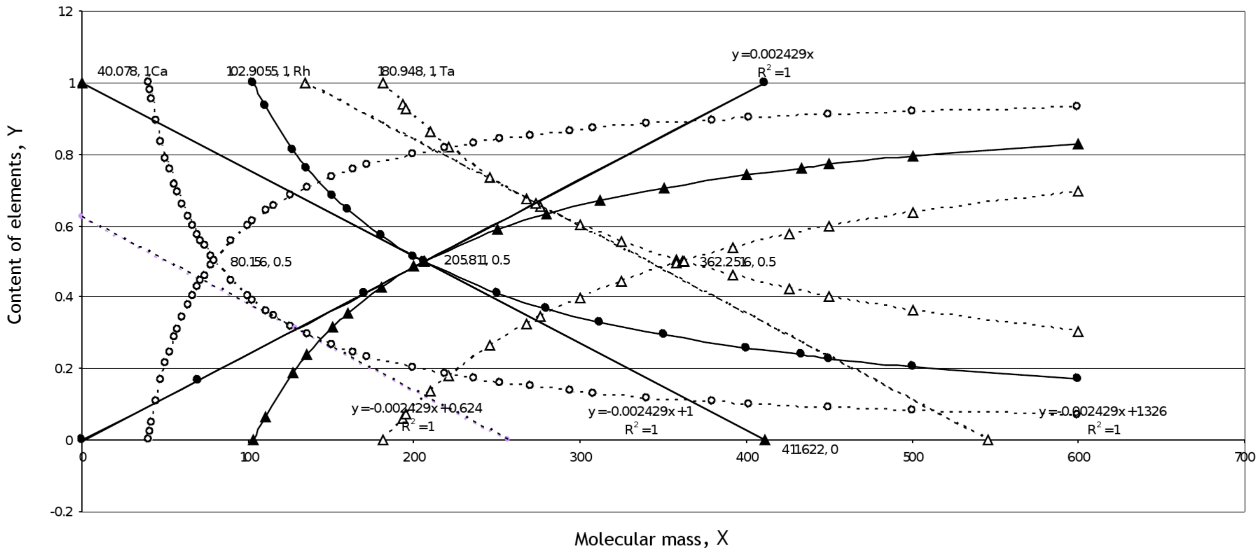

Fig. 3.5: Geometric composition for determination of the peaks of the hyperbolas in the virtual axis. The base of the calculation is the hyperbola of Rhodium (shown at the centre).

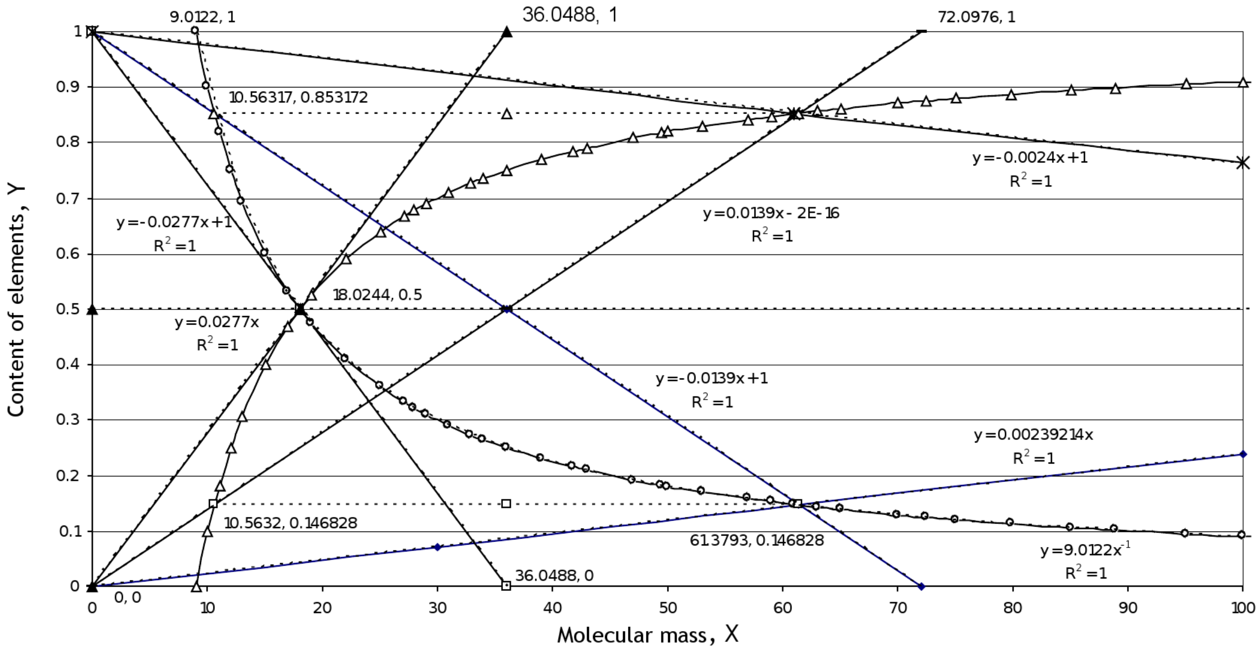

Fig. 3.6: Geometric composition for determination of the peak of the rectangular hyperbola of Beryllium. Secant passes arbitrarily through the point ($x = 36.0488$, $y = 0.5$). Intersection of it with the hyperbola gives a wrong peak.

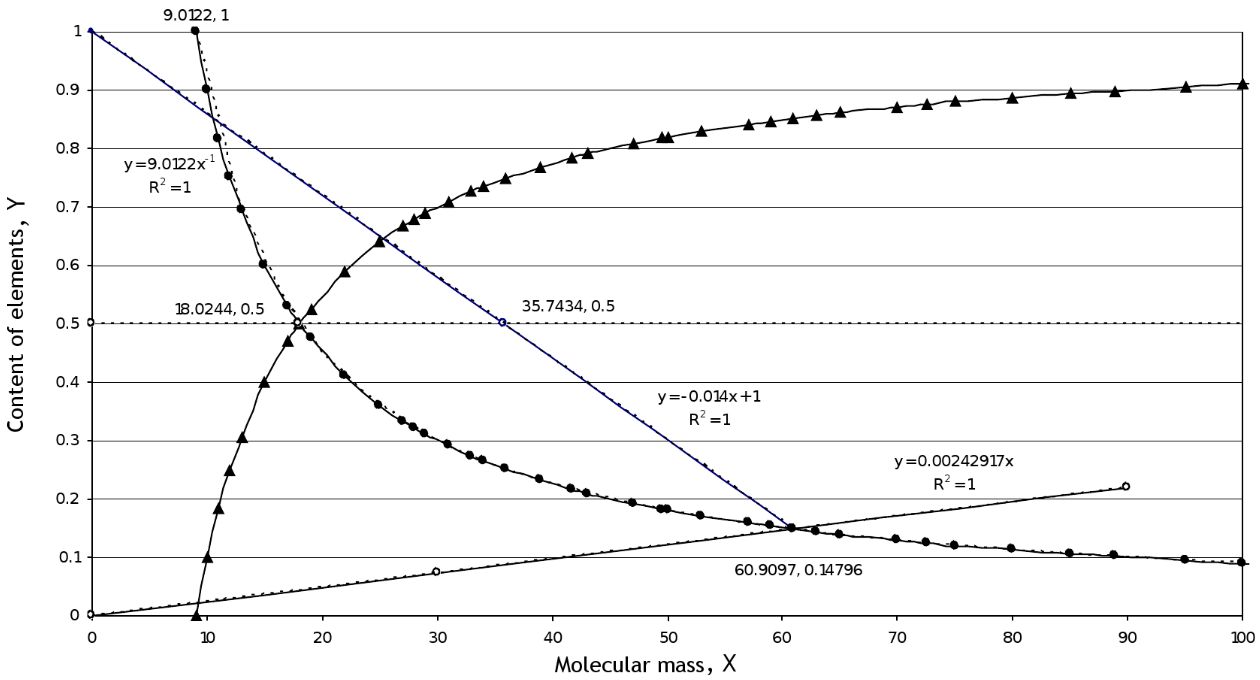

Fig. 3.7: Geometric composition for determination of the peak of the hyperbola of Beryllium. Scale of the hyperbola is $x = 100$. Abscissa of the secant is 35.7434.

1) A secant: —

$$\frac{(X-0)}{(205.811-0)} = \frac{(Y-1)}{(0.5-1)}\,, \tag{3.2}$$

whence

$$Y = -0.0024294134X + 1\,. \tag{3.3}$$

At $Y=0$, $X=411.622$, in this case coordinates of peak will be: $X=205.811$, $Y=0.5$.

2) A tangent: — the equation of a direct hyperbola,

$$Y = \frac{102.9055}{X}\,, \tag{3.4}$$

its derivative at $X=205.811$, so

$$Y' = -\frac{102.9055}{205.811^2} = -0.0024294134\,, \tag{3.5}$$

$$Y - 0.5 = -0.0024294134X + 0.5\,. \tag{3.6}$$

Finally,

$$Y = -0.0024294134X + 1 \tag{3.7}$$

at $Y=0$, $X=411.622$.

3) A normal: — (the virtual axis),

$$Y = 0.0024294134X \tag{3.8}$$

at $Y=1$, $X=411.622$.

Here are the same calculations for the tabulated data presented:

1) A secant: —

$$\frac{X}{205.82145} = \frac{(Y-1)}{(0.4999746-1)}\,, \tag{3.9}$$

whence

$$Y = -0.0024294134X + 1\,; \tag{3.10}$$

$$Y = 1\,, \quad X = 411.622\,. \tag{3.11}$$

2) A tangent: —

$$Y = \frac{102.9055}{X}\,, \tag{3.12}$$

the fluxion at $X = 205.821454$,

$$Y' = -\frac{102.9055}{205.82145^2} = -0.0024291667\,, \tag{3.13}$$

so

$$Y - 0.4999746 = -0.0024291667(X - 205.82145)\,, \tag{3.14}$$

whence

$$Y = -0.0024291667X + 0.99994928\,, \tag{3.15}$$

$$Y = 0\,, \quad X = 411.6429\,. \tag{3.16}$$

3) A normal: —

$$Y = 0.0024291667X\,; \tag{3.17}$$

$$Y = 1\,, \quad X = 411.6638\,. \tag{3.18}$$

§ 3.3 Comparative analysis calculations

For a secant the results are identical with the first set of calculations above, whereas for a tangent and normal there are some deviations, close to last element calculated.

By the first set of calculations above its atomic mass is 411.622; hence the deviation is 411.663243 − 411.622 = 0.041243 (0.01%). By the second set the size of a tangent and a normal are close to one another (an average of 411.65335) and have a smaller deviation: 411.663243 − 411.65335 = 0.009893 (0.0024%). This is due to the tangent of inclination of the virtual axis of a direct hyperbola in the first set is a little high.

Using Rhodium (Fig. 3.5) we can check the propriety of a choice of coefficient of scaling. It is necessary to make the following calculations for this purpose:

- Take the square root of atomic mass of Rhodium (i.e. $X = Y = 10.1442348$);
- Divide X_0 by X of the peak (205.811/10.1442348 = 20.2885);
- Divide $Y = 10.1442348$ by Y_0 of the peak (0.5): also gives 20.2885;
- The difference by X and Y with the coefficient obtained, 20.2895, yielding the same size at 0.001 or 0.005%.

Formulae for transition from one system of coordinates to another have been given in the first paper of this series.

Using data for peaks, from the table, we get the following results:

Coordinates of peak

$$X_0 = 205.8215, \quad Y_0 = 0.49997, \tag{3.19}$$

$$X = Y = 10.1442348, \tag{3.20}$$

then

$$\frac{X_0}{X} = 20.2895, \quad \frac{Y}{Y_0} = 20.2897, \tag{3.21}$$

i. e. absolute concurrence (maximum difference of 0.0009%).

§ 3.4 The rôle of the element Rhodium

However, all these insignificant divergences do not belittle the most important conclusion: that the validity of the hyperbolic law is estabished because the data calculated above completely coincide with calculations for Rhodium is proved, based only on its atomic mass.

All the calculations for the table were necessary in order to find a zero point for Rhodium, for which it is possible to do so without calculating the secant, but using only its atomic mass, thereby verifying the hyperbolic law.

How to get the correct choice of abscissa of a secant is depicted in Fig. 3.6 (using Beryllium as an example) where instead of its tabulated value, 35.7434, the value equal to twice the point of intersection (36.0488) has been used. Here we tried to make a start from any fixed point not calculated (similar to the case for Rhodium). It has proved to be impossible and has led to a mistake in the definition of the peak. In Fig. 3.7 the geometrical constructions for Beryllium on the basis of correct settlement of data are given.

§ 3.5 Conclusions

Previously we marked complexity of a choice of peak of a hyperbola of an element in the coordinates, satisfying the conditions $Y \leqslant 1$, $K \leqslant X$, as on an axis of ordinates the maximum value being a unit whilst the abscissa can take values in the hundreds of units. The problem has been solved by means of the theorem of Lagrange and the coefficient of scaling deduced. On the basis thereof our further conclusions depended, so it was very important to find a method not dependent on our calculations and at the same time allowing unequivocally to estimate the results. Owing to properties of the virtual axis of an rectangular hyperbola on which peaks of all elements lie, it is enough to have one authentic point.

Analyzing the arrangement of the virtual axes of direct and adjacent hyperbolas, we have paid attention to their point of intersection (205.83, 0.5), the abscissa of which is exactly half of atomic mass of the last element. As secants from the centre $X = 0$, $Y = 1$ cut direct hyperbolas any way (Fig. 3.1), we have been led to necessary calculations and have obtained a zero point at which the secant coincides with a tangent and the real axis. The divergence with tabular data is in the order of 0.004%–0.009%.

Thus Rhodium provides an independent verification of the method of rectangular hyperbolas for Mendeleev's Periodic Table of Elements.

Chapter 4

Upper Limit of the Periodic Table and Synthesis of Superheavy Elements

§ 4.1 Shell construction of a nucleus, magic numbers

The nucleus of an atom is the central part of the atom, consisting of positively charged protons (Z) and electrically neutral neutrons (N). They interact by means of the strong interaction.

If a nucleus of an atom is consider as a particle with a certain number of protons and neutrons it is called a nuclide. A nuclide is that version of an atom defined by its mass number ($A = Z + N$), its atomic number (Z) and a power condition of its nucleus. Nuclei with identical numbers of protons but different numbers of neutrons are isotopes. The majority of isotopes are unstable. They can turn into other isotopes or elements due to radioactive disintegration of the nucleus by one of the following means: β-decay (emission of electron or positron), α-decay (emission of particles consisting of two protons and two neutrons) or spontaneous nuclear fission of an isotope. If the product of disintegration is also unstable, it too breaks up in due course, and so on, until a stable product is formed.

It has been shown experimentally that a set of these particles becomes particularly stable when the nuclei contain "magic" number of protons or neutrons. The stable structure can be considered as shells or spherical orbits which are completely filled by the particles of a nucleus, by analogy with the filled electronic shells of the noble gases. The numbers of particles forming such a shell are called "magic" numbers. Nuclei with magic number of neutrons or protons are unusually stable and in nuclei with one proton or other than a magic number, the neutron poorly binds the superfluous particle. The relevant values of these numbers are 2, 8, 20, 28, 50, 82, and 126, for which there exists more stable nuclei than for other numbers [8]. Calculations indicate existence of a nucleus with filled shell at $Z = 114$ and $N = 184$ ($^{298}114$) which would be rather stable in relation to spontaneous division. There is experimental data for the connexion of magic numbers to a nucleus with $Z = 164$. Y. Oganesyan [9, 10] has alluded to a Rutherford-model atom which assumes existence of heavy nuclei with atomic numbers within the limits of $Z \sim 170$. At the same time there is a point of view holding that superheavy elements (SHEs) cannot have $Z > 125$ [11]. In October 2006, it was reported that element 118 had been synthesized in Dubna (Russia), with atomic mass 293 [12]. (It is known however, that this atomic mass is understated, owing to technical difficulties associated with the experiments.)

§4.2 The *N-Z* diagram of nuclei, islands of stability

The search for superheavy nuclei, both in the Nature and by synthesis as products of nuclear reactions, has intensified. In the 1970's 1200 artificially produced nuclei were known [13]. Currently the number is ~ 3000, and it is estimated that this will increase to ~ 6500 [14].

In Fig. 4.1 the neutron-proton diagram of nuclei of stable and artificial isotopes [15–17] is presented.

Light stable or long-lived nuclei which arrangement can be arranged in a valley of stability as shown by small circles. The top set of border points represents a line of proton stability and bottom a line of neutron stability. Beyond these limits begins the so-called, "sea of instability". There is apparently only a narrow strip of stability for which there exists a quite definite parity, N/Z. For nuclei with atomic mass below 40, the numbers of protons and neutrons are approximately identical. With increase in the quantity of neutrons the ratio increases, and in the field of $A = (N+Z) = 250$ it reaches 1.6. The growth in the number of neutrons advances the quantity of protons in heavy nuclei, which in this case become energetically more stable. To the left of the stable nuclei are proton excess nuclei, and on the right neutron excess nuclei. These and others are called exotic nuclei.

The diagram terminates in the last element from the table IUPAC at No. 114, with mass number 289, while scientists suspect nucleus No. 114–298. Such isotopes should possess the increased stability and lifetime of superheavy elements.

This diagram is specially constructed, only on the basis of tabulated data, but augmented by the theoretical upper limit of the Periodic Table. Up to the $Z \sim 60$ the line of trend approaches the middle of a valley of stability, with $N/Z \sim 1.33$. Furthermore, N/Z increases steadily to ~ 1.5 up to $Z \sim 100$. The equation of the line of trend represents a polynomial of the fourth degree. It is noteworthy that this implies rejection of the upper magic number for neutrons heretofore theoretically supposed.

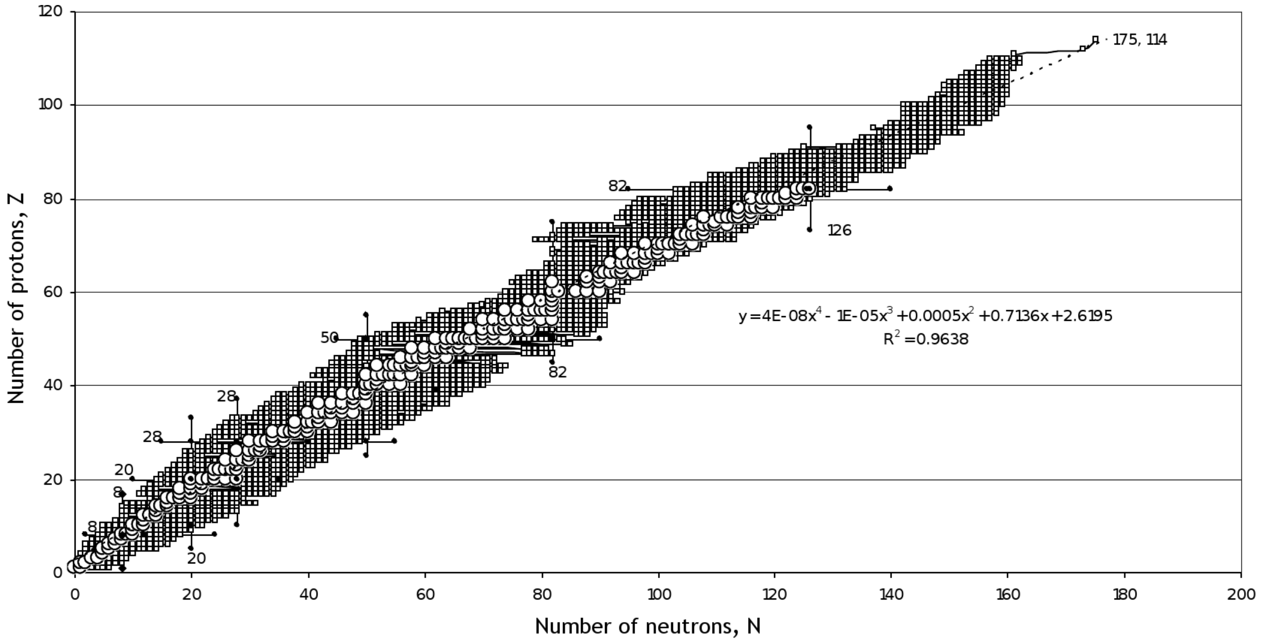

Fig. 4.1: N-Z diagram of nuclides.

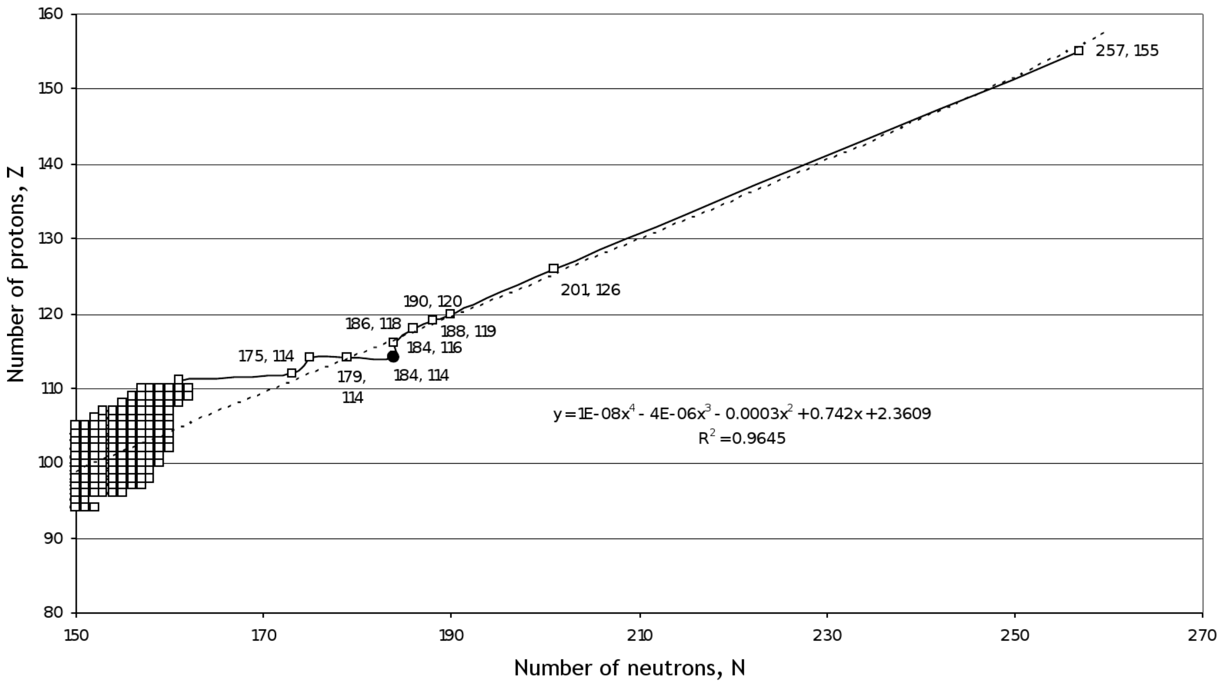

Fig. 4.2: *N*-*Z* diagram of nuclides. For increase in scale the diagram is reduced after carrying out of a line of a trend.

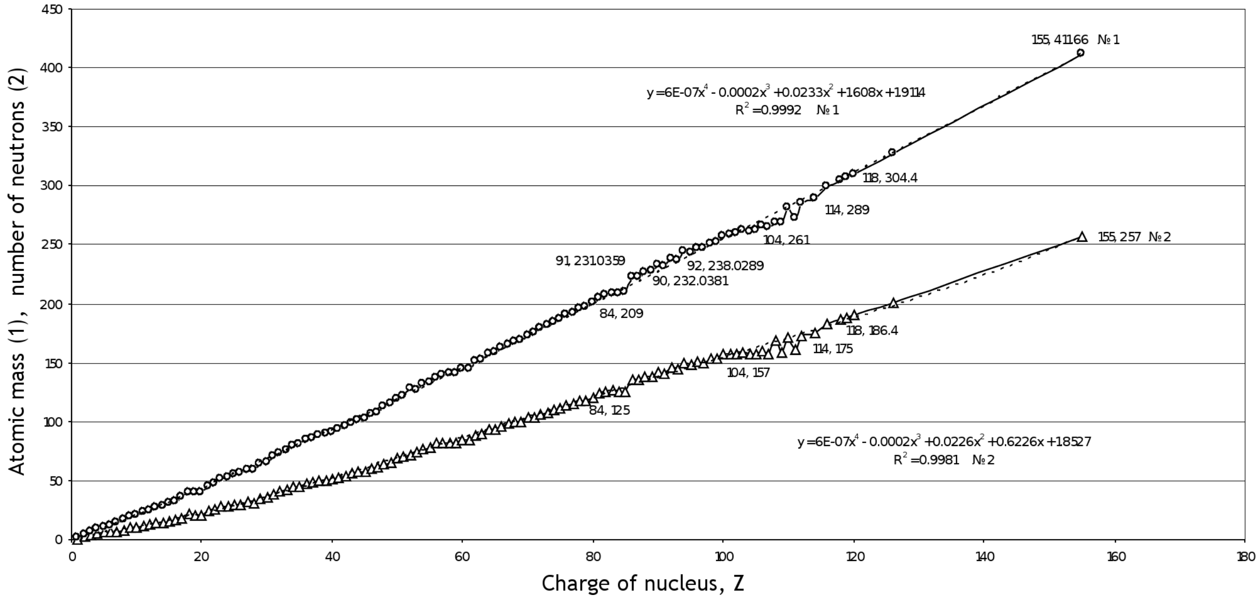

Fig. 4.3: Dependence of element mass number (1) and corresponding numbers of neutrons (2) on the atomic number in the Periodic Table.

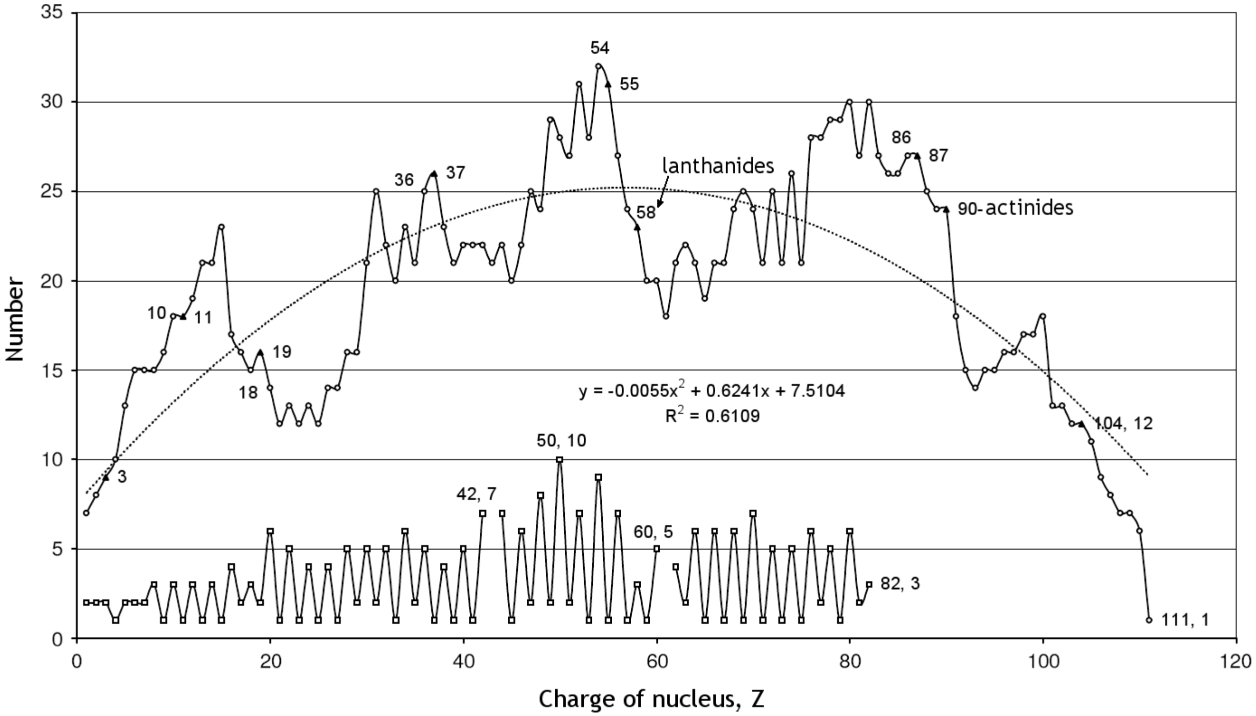

Fig. 4.4: Dependence of total isotopes (circle) and stable elements (square) on atomic number. The triangle designates the beginning of the periods.

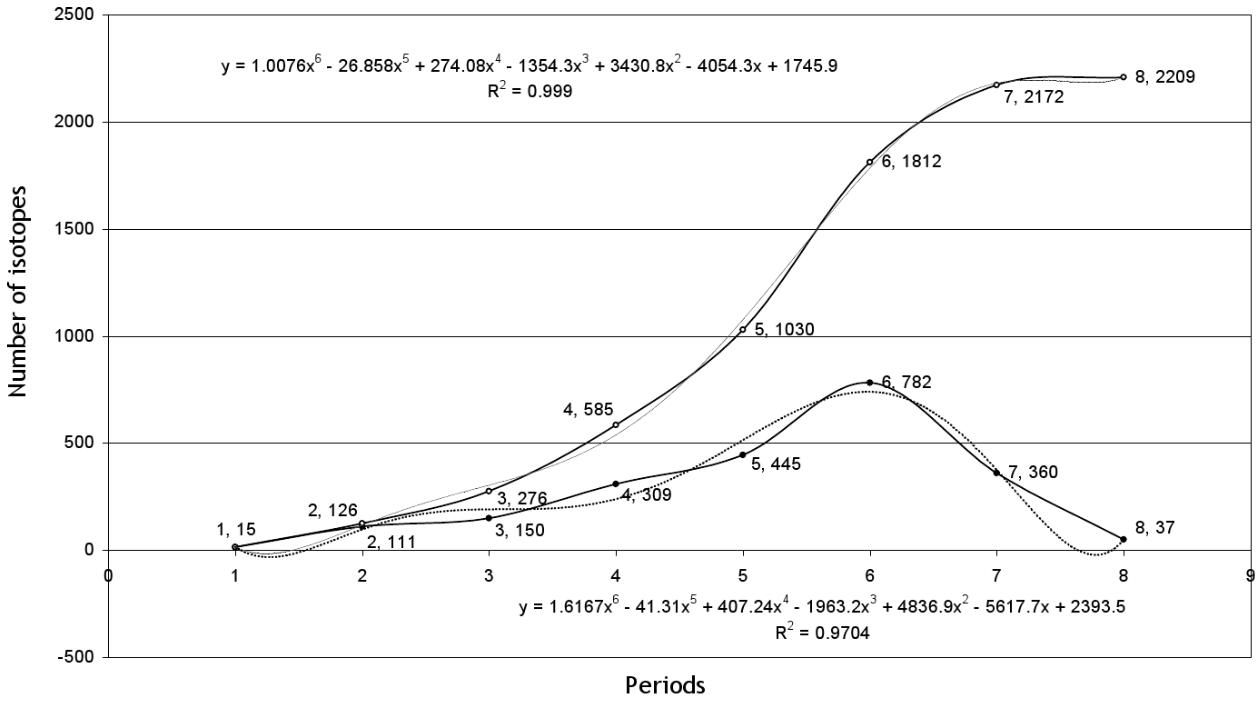

Fig. 4.5: Distribution of isotopes on the periods: an *S*-shaped summarizing curve, lower-quantity at each point.

1 H	2A 2											3A 13	4A 14	5A 15	6A 16	7A 17	2 He
3 Li	4 Be											5 B	6 C	7 N	8 O	9 F	10 Ne
11 Na	12 Mg	3B 3	4B 4	5B 5	6B 6	7B 7	—— 8	8 9	—— 10	1B 11	2B 12	13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr
37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe
55 Cs	56 Ba	57 La	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn
87 Fr	88 Ra	89 Ac	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Rg	112 Uub	113 Uut	114 Uuq	115 Uup	116	117	118

58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu
90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr

Table 4.1: The standard Table of Elements. Lanthanides and actinides are given in a segregate (lower) part of the Table, wherein the first row is inhabited by lanthanides, the second row — by actinides.

122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139
		140	141	142	143	144	145	146	147	148	149	150	151	152	153		

Table 4.2: The 8th period — a table of super-actinides (18g and 14f elements) as suggested by G. T. Seaborg and V. I. Goldanskii [1, 2].

119	120	121	154	**155** **Kh**

Table 4.3: An add-on to the 8th period suggested by the Author — s-elements (No. 119, 120), d-elements (No. 121), d-elements (No. 154, 155). Must element No. 155 (Khazanium) be analogous to Ta, as Db?

119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136
137	138	139	154	**155**													

140	141	142	143	144	145	146	147	148	149	150	151	152	153

Table 4.4: Fragments of the 8th period, according to the literature [18], with the end (No. 155) as suggested by the Author (in the literature [18] it is continuing over No. 155).

Comment: As seen from the suggested versions of the 8th period, there was no clear views on the position of the element No. 155 in the Periodic Table of Elements, before as we calculated an exact address to it. According to G. T. Seaborg and V. I. Goldanskii, the elements should be positioned in one row, in a pyramidal table: by 50 elements of the 8th and 9th periods. In this case, No. 155 would be in the 5th Group of the standard Mendeleev Table. I suggested 18 elements per row. This, in common with the principle of symmetry, which is specific to the Periodic Table of Elements, positiones the last element (No. 155) in the 1st Group of the Periodic Table.

It is particularly evident from Fig. 4.2, in which small fragment of the N-Z diagram is amplified and augmented with some theoretically determined nuclei, including the heaviest element $Z = 155$, that the equations of lines of trend and the values of R^2 are practically identical in both Figures. When the line of trend for Fig. 4.1, without element 155, is extrapolated beyond $Z = 114$, it passes through the same point in Fig. 4.2 for $Z = 155$, indicating that element 155 is correctly placed by theory.

The predicted element No. 114–184 is displaced from the line of a trend. With a nuclear charge of 114 it should have 179 neutrons ($A = 293$) whereas 184 neutrons has atomic number 116. In the first case there is a surplus 5 neutrons, in the second a deficit of 2 protons. For an element 126 (on hypothesis) the mass number should be 310, but by our data it is 327. The data for mass number 310 corresponds to $Z = 120$.

It is important to note that there is a close relation between the mass number and the atomic mass. The Author's formulation of the Periodic Law of D. I. Mendeleev stipulates that the properties of elements (and of simple compounds) depend upon periodicity in mass number. It was established in 1913, in full conformity with the hypothesis of Van den Brook, that the atomic numbers of the chemical elements directly reflect the nuclear charge of their atoms. This law now has the following formulation:

> "Properties of elements and simple substances have a periodic dependence on the nuclear charge of the atoms of elements".

In the Periodic Table the last, practically stable element is Bismuth, $Z = 83$. The six following elements (No.'s 84 to 89) are radioactive and exist in Nature in insignificant quantities, and are followed by the significant radioactive elements Thorium, Protactinium and Uranium ($Z = 90$, 91, and 92 respectively). The search for synthetic elements (No.'s 93 to 114) continues. In the IUPAC table, mass numbers for elements which do not have stable nuclides, are contained within square brackets, owing to their ambiguity.

It is clear in Fig. 4.3 that the reliability (R^2) of approximation for both lines of trend is close to 1. However, in the field of elements No. 104 to No. 114, fluctuations of mass number, and especially the number of neutrons, are apparent.

According to the table, the most long-lived isotope of an element violates the strict law of increase in mass number with increase in atomic number. To check the validity of element No. 155 in the general line of trend of elements for all known and theoretical elements, the two following schedules are adduced:

1) For element numbers 1 to 114, $Y = 1.6102\,X^{1.099}$ at $R^2 = 0.9965$;

2) For element numbers 1 to 155, $Y = 1.6103\,X^{1.099}$ at $R^2 = 0.9967$.

Upon superposition there is a full overlapping line of trend that testifies to a uniform relation of dependences. Therefore, in analyzing products of nuclear reactions and in statement of experiment it is necessary to consider an element No. 155 for clarification of results.

§4.3 The 8th period of the Periodic Table of Elements

Our theoretical determination of the heaviest element at $Z = 155$ allows for the first time in science a presentation of Mendeleev's Table with an 8th period. Without going into details, we shall note that at the transuranium elements, electrons are located in seven shells (the shells from 1 to 7 included), which in turn contain the subshells s, p, d, f. In the 8th period there is an 8th environment and a subshell g.

G. T. Seaborg and V. I. Goldanskii, on the basis of the quantum theory, have calculated in the 8th period internal transitive superactinoid a series containing 5g-subshells for elements No. 121 to No. 138 and 6f subshells for No. 139 to No. 152. By analogy with the seventh period, No. 119 should be alkaline, No. 120 should be an alkaline earth metal, No. 121 — similar to Actinium and Lanthanium, No. 153 to No. 162 contain a 7d subshell, and No. 163 to No. 168 an 8p subshell. The latter class resulted because these scientists assumed the presence not only of an 8th, but also a 9th periods, with 50 elements in each.

However, distribution of isotopes depending on a atomic number of the elements (Fig. 4.4) looks like a parabola, in which branch Y sharply decreases, reaching the value 1 at the end of the seventh period. It is therefore, hardly possible to speak about the probability of 100 additional new elements when in the seventh period there is a set of unresolved problems.

Our problem consisted not so much in development of methods for prediction of additional elements, but in an explanation as to why their number should terminate No. 155. Considering the complexities of synthesis of heavy elements, we have hypothesized that their quantity will not be more than one for each atom. Then, from Fig. 4.5 it can be seen that the S-figurative summarizing curve already in the seventh period starts to leave at a horizontal, and the 8th reaches a limit. The bottom curve shows that after a maximum in the sixth period the quantity of isotopes starts to decrease sharply. This provides even more support for our theoretical determination of the heaviest possible element at $Z = 155$.

In July 2003 at International Conference in Canada, resulting in publication [19], it was asked "Has the Periodic Table a limit?"

The head of research on synthesis of elements in Dubna (Russia), Y. Oganesyan, has remarked that the question of the number of chemical elements concerns fundamental problems of science, and therefore the question, what is the atomic number of the heaviest element?

Despite the fact that hundreds of versions of the Periodic Table have been offered of the years, none have designated the identity of the heaviest element. The heaviest element is offered in Table 4.3 shown in Page 53.

§ 4.4 Conclusions

With this Chapter in a series on the upper limit of the Periodic Table of the Elements, the following are concluded:

1. As the fact of the establishment of the upper limit in Periodic Table of Elements until now is incontestable (on October 25, 2005, appeared the first publication on the Internet), it is obviously necessary to make some correction to quantum-mechanical calculations for electronic configurations in the 8th period.
2. In modern nuclear physics and work on the synthesis of superheavy elements it is necessary to consider the existence of a heaviest element at $Z = 155$ with the certain mass number that follows from the neutron-proton diagram.
3. For discussion of the number of the periods and elements in them it is necessary to carry out further research into the seventh period.
4. From the schedules for distribution of isotopes, it is apparent that the end of the seventh period of elements is accounted for in units because of technical difficulties: No. 94 to No. 103 have been known for 20 years, and No. 104 to No. 116 for 40. Hence, to speak about construction of the Table of Elements with the 8th and ninth periods (100 elements), even for this reason, is not meaningful.
5. The variants of Mendeleev's Periodic Table constructed herein with inclusion of the heaviest element No. 155 opens a creative path for theoretical physicists and other scientists for further development of the Table.

Chapter 5

Introducing the Table of the Elements of Anti-Substance, and the Theoretical Grounds to It

§ 5.1 Introduction

As can be seen in [20, 21], our method has produced hyperbolas located in the first quadrant. At the same time, their second branches have not been investigated from the point of view of the hyperbolic law in the Periodic Table of Elements.

Its essence is reflected in the fact that in any chemical compound with molecular mass X referred to one gram-atom of a defined element K, its maintenance Y represents the equilateral hyperbola $Y = K/X$ whose top is located on the real axis located in a corner at 45° with respect to the abscissa in the positive direction.

§ 5.2 Mathematical grounds. A principle of symmetry

For any element $K > 0$ there is only one hyperbola consisting of two branches (in the first and the third quadrants). Hyperbolas with various values K cannot be imposed against each other. At each point of a hyperbola, there are coordinates according to the equation $X \cdot Y = K$ where X and Y can have not only positive values, but also negative values. If we identify the set of hyperbolas at various values K, they can wholly fill the area of the rectangular corner XOY (the first quadrant). In mathematics, the two branches of an equilateral hyperbola are symmetric with respect to each other. The real axis passes through the tops located in the first and third quadrants, and also through the center of symmetry. The normal to it is an imaginary axis, and also an axis of symmetry around which it is possible to combine both quadrants.

§ 5.3 The comparative analysis of equilateral hyperbolas in the first and third quadrants

Let's consider the hyperbolas of Beryllium, Chromium, Mercury, and the last element identified by us, which we shall call 155 and which is represented in Fig. 5.1. Apparently, the ordinate of the curves is equal to unity, while the abscissa is 600. The tops of the curves are on the real axis which is perpendicular to the imaginary axis, while their curvature decreases with the growth of molecular mass. These properties have been considered in detail, above in this book, for the first quadrant, in which $Y = K/X$ (where $X > 0$, $Y > 0$).

If these hyperbolas are constructed in the coordinates $X < 0$, $Y < 0$, (at $K > 0$), they will take the place of the second branches and settle down in the third quadrant. Hence, the properties of these equilateral hyperbolas, proceeding from mathematical concepts, except for one, can be completely found. It is impossible to combine these curves in two quadrants as the axes X and Y have different names and, accordingly, we see that the scales are caused by chemical conditions.

This discrepancy can be excluded if we take advantage of the factor of scaling $M = 20.2895$. In a graph shown in Fig. 5.2 the same hyperbolas in the coordinates transformed by means of M are shown: $X' = X/M$, $Y' = YM$. Apparently, the form and properties of the hyperbolas after transformation remain unchanged and prove the mathematical principles.

If now around an imaginary axis we make the third and the first quadrants overlap, it is possible to see that there is nearly full concurrence among the curves and real axes (Fig. 5.3). However, there is some increase in the ordinates because the abscissa in Fig. 5.2 possesses a slightly higher value than that of the ordinate, which is easy to notice from the position of circles designating the second branches. It has no basic value since the initial scales of the coordinate axes are naturally various upon their schematic construction. Therefore, the corner of the real axis seems to be less than 45° though its equation is given by the equality $Y = X$. This fact is due to the scale of coordinate axes only. At identical values of X and Y, the tangent of the corner of an inclination of the real axis of an equilateral hyperbola is equal to 1, while, at the same time, its top is defined as a root square of K and corresponds to the equality $X_0 = Y_0$.

It is necessary to note also that all the established laws apply extensively to adjacent hyperbolas of the kind given by $Y = 1 - KX$.

§ 5.4 Discussion of results

On the basis of our results, it is possible to draw a conclusion that the properties of hyperbolas described by $K = XY$, which is in first quadrant, prove to be true. The same holds for those in the third quadrant,

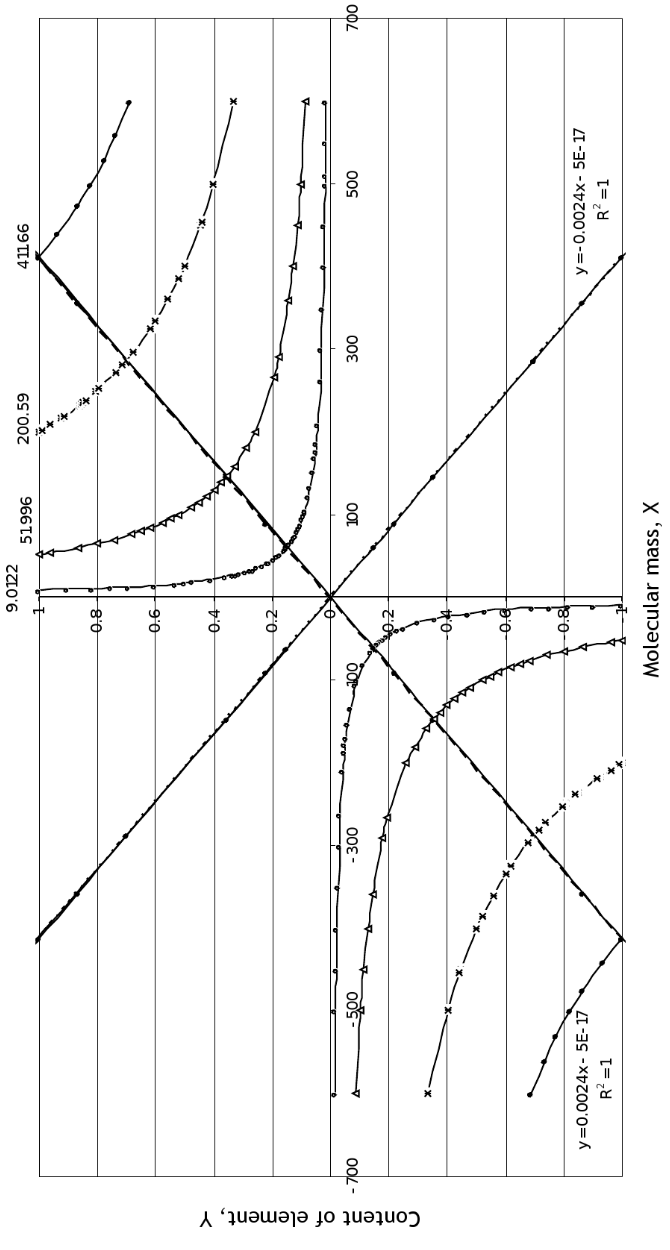

Fig. 5.1: Dependence of the contents of Be, Cr, Hg, No. 155 from molecular mass of the compounds.

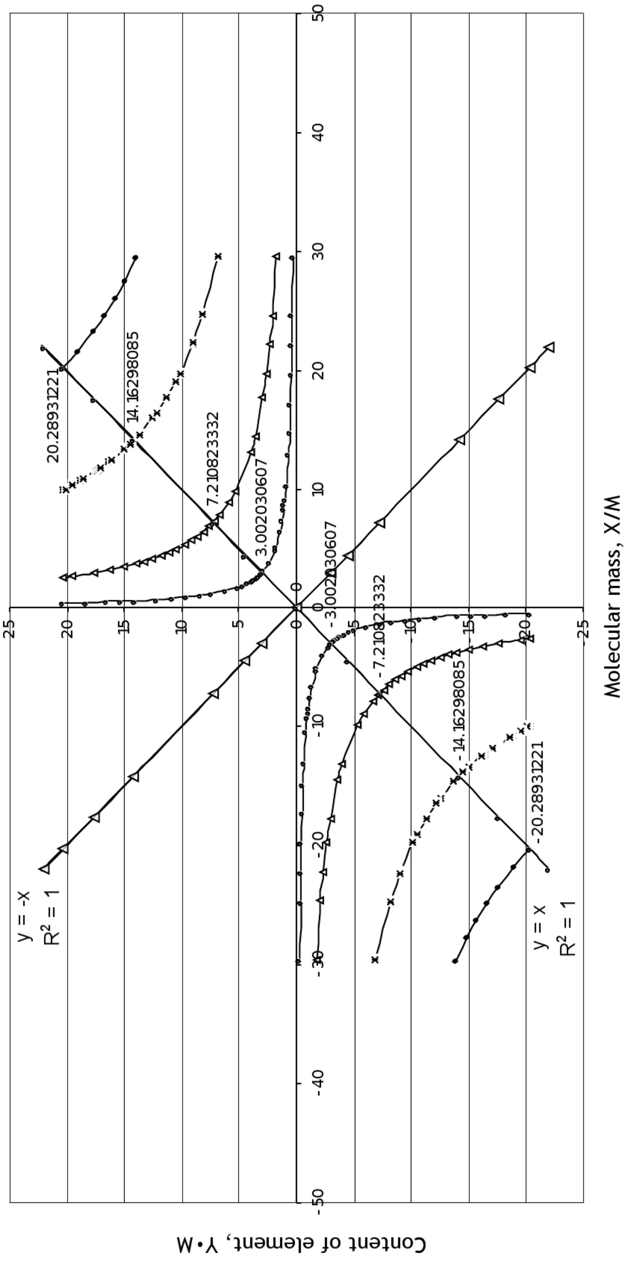

Fig. 5.2: Dependence of the contents of Be, Cr, Hg, No. 155 from molecular mass of the compounds, using the scaling coefficient M.

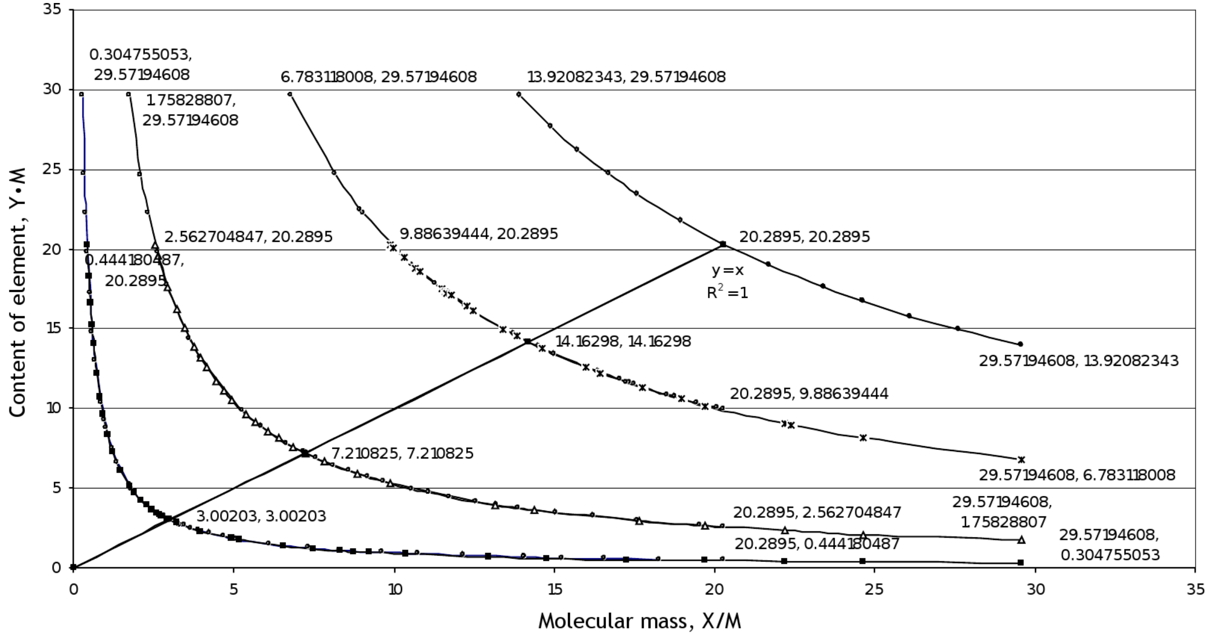

Fig. 5.3: The scale of the axes X and Y are numerically like each other, while the divisions of the scales are different. So, if a division is 3.075 in the axis X, while it is 1.75 in the axis Y. Under 60, the corner of the real axis gives 45°.

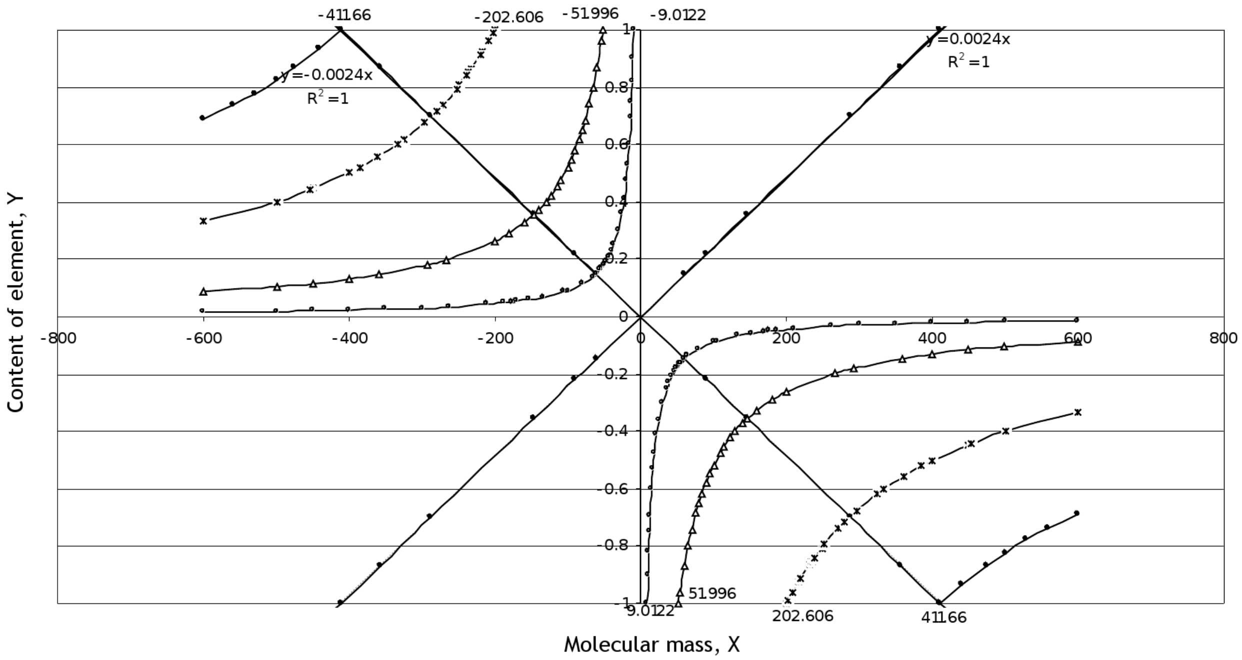

Fig. 5.4: Dependence of the contents of Be, Cr, Hg, No. 155 from molecular mass of the compounds in the 2nd and 4th quadrants.

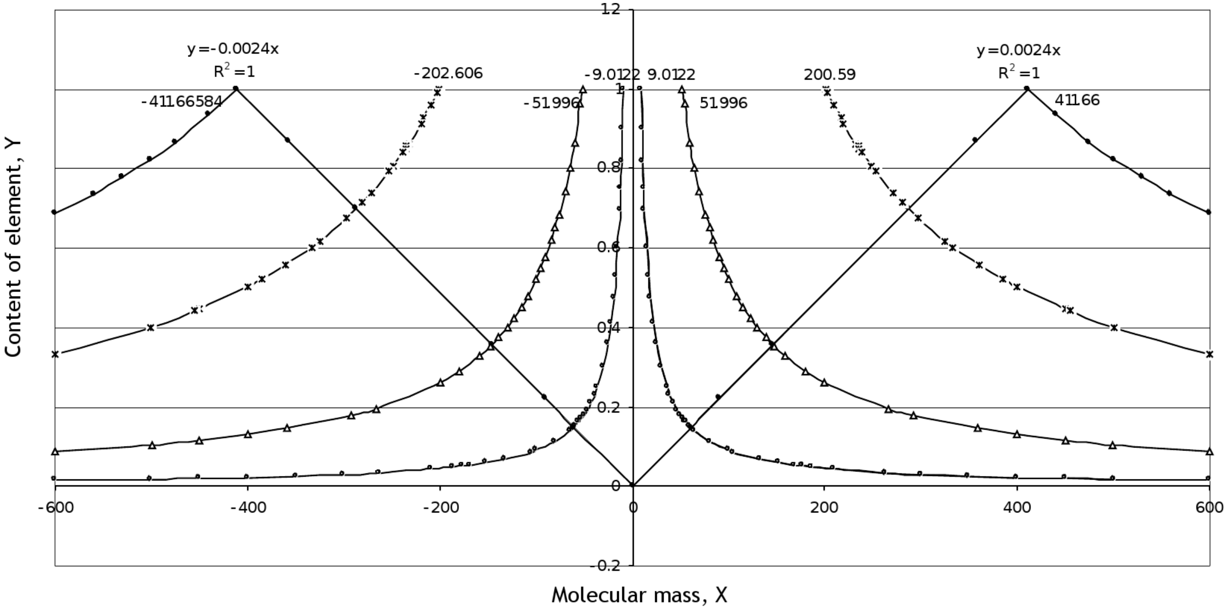

Fig. 5.5: Dependence of the contents of Be, Cr, Hg, No. 155 from molecular mass of the compounds in the 1st and 2nd quadrants.

1 H	2A 2											3A 13	4A 14	5A 15	6A 16	7A 17	2 He
3 Li	4 Be											5 B	6 C	7 N	8 O	9 F	10 Ne
11 Na	12 Mg	3B 3	4B 4	5B 5	6B 6	7B 7	8	8 9	10	1B 11	2B 12	13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr
37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe
55 Cs	56 Ba	57– 71	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn
87 Fr	88 Ra	89– 103	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Rg	112 Uub	113 Uut	114 Uuq	115 Uup	116 Uuh	117 Uus	118 Uuo

57 La —	58 Ce —	59 Pr —	60 Nd —	61 Pm —	62 Sm —	63 Eu —	64 Gd —	65 Tb —	66 Dy —	67 Ho —	68 Er —	69 Tm —	70 Yb —	71 Lu —
89 Ac —	90 Th —	91 Pa —	92 U —	93 Np —	94 Pu —	95 Am —	96 Cm —	97 Bk —	98 Cf —	99 Es —	100 Fm —	101 Md —	102 No —	103 Lr —

Lanthanides (first row) and actinides (second row).

119 —	120 —	121 —	122 —	123 —	124 —	125 —	126 —	127 —	128 —	129 —	130 —	131 —	132 —	133 —	134 —	135 —	136 —
137 —	138 —	139 —	140 —	141 —	142 —	143 —	144 —	145 —	146 —	147 —	148 —	149 —	150 —	151 —	152 —	153 —	154 —
155 —																	

The 8th period of the Periodic Table.

Table 5.1 (shown in Pages 64–65): The Periodic Table of Elements and Anti-Elements, with the 8th period. Long dash is signed for anti-elements.

where $K = (-X)\cdot(-Y)$. Hence, the action of the hyperbolic law covers also an area of negative values of coordinate axes covering 155.

We recall the construction of hyperbolas at $K < 0$ (Fig. 5.4). Therefore, it has been established that in the second and the fourth quadrants of the hyperbolas, the same laws hold, which have also been established by us for the first and the third quadrants. It is caused by the fact that the equilateral hyperbolas have equal parameters on the module, but opposite in sign, namely, they are mutually interfaced and so possess identical properties. Therefore, proceeding from the chemical concepts, they can be symmetric only after changing the scale of the axes X, Y. Thus, referring to their congruence, unlike other mathematical conditions: curves coincide in the field of action of the factor M. Outside, its one hyperbola is generated as the abscissa increases, while the second corresponds to the increase in ordinate, not changing the direction of a curve. As it has appeared, absolute symmetry is available only on the axes X and Y.

Because in the third and fourth quadrants, a negative ordinate (a degree of transformation of a substance) cannot occur in Nature, we shall consider only quadrants 1 and 2.

From Fig. 5.5 it is seen that for $K > 0$ and $K < 0$ the congruence of hyperbolas and their real axes are imposed against each other.

Corresponding to such symmetry, there is a question about the observation of chemical conditions. In the first quadrant, they have been considered in detail and do not cause doubts. In the second case (at $K < 0$) the abscissa is negative, and the ordinate is positive. Here the degree of transformation Y defined as the mass of an element (of one gram-atom), with respect to the corresponding molecular mass, is given by $Y = K/(-X)$, or, in other words, $K = (-X)Y$. From the point of view of mathematics, this result is fair. At the same time, physicists are in need of further necessary elaboration from the point of view of chemistry.

§ 5.5 Substances and anti-substances

It is known that a *substance* consists of atoms containing protons, neutrons, and electrons. An *anti-substance* differs only by the prefix "anti". In terms of chemical condition, all substances are divided into simple and complex (chemical compounds). They can be both organic and inorganic.

As the hyperbolic law in the Periodic Table has been proved for hyperbolas of the first quadrant, there arises an idea to apply it also to the second quadrant. As the basis for this purpose, the quadrants are symmetric and the maintenance of elements in connection (Y) has a positive value. The difference consists only in those abscissas with opposite signs. But it is possible only when the molecular mass of a chemical compound has a minus sign. If, in the first quadrant, we arrange all possible hyperbolas around 155 inclusively, nothing prevents us from making the same apply to the second quadrant. Hence, in it there are substances with a minus sign, i.e., anti-substances constructed of anti-particles (similar to the substances in the first quadrant). With respect to mass, they are similar to a proton, neutron and, electron, only with an opposite (minus) sign.

From this it follows that it is possible to construct a Periodic Table, which is common for the elements of substances and for the elements of anti-substances. Such a Periodic Table has been constructed by the Author [22, 23], and shown as Table 5.1 in Pages 64–65 (it is similar to Table 4.1 we suggested in Chapter 4, Page 52, for the elements of substances only). For example, the known synthesized elements (their hyperbolas are more exact): anti-Hydrogen, anti-Deuterium, and anti-Helium occupy symmetric places in both quadrants.

§ 5.6 Conclusions

On the basis of symmetry with application of the hyperbolic law in the Periodic Table of Elements, the existence of anti-substances has been indirectly proved. As well, the construction of the various hyperbolas in the second quadrant and in the Table has been shown to be similar to that of the Periodic Table of Elements. It is clear that the third and fourth quadrants cannot be (directly) applied to calculation in the field of chemistry because the negative degree of transformation of substances does not exist.

Hence, it is now possible to draw a conclusion that the hyperbolic law established by us in the Periodic Table of Elements is generally true for the characteristics of not only substances, but also those of anti-substances [22, 23]. It also allows us to calculate all nuclear masses up to the last element (anti-element).

Chapter 6

Concluding Remarks

§ 6.1 Element No. 155 — the upper limit (heaviest element) in the Periodic Table of Elements

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 real axis of all hyperbolas whose ordinate is given by $Y = 1$. Its serial number is 155.

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.

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 real 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 several thousandths shares of the percent. This fact manifests the validity of our theory.

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 is not discovered for 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. To the number of the element with atomic mass 298, scientists have assigned special hopes as here isotopes should possess raised stability. 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. T. Seaborg and V. I. Goldanskii have suggested adding 8-th and 9-th periods to 50 elements. 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. We, for the first time, have given the parameters of the last element as belonging to the 8th period, the first group, having No. 155 and atomic mass 411.66.

§ 6.2 Periodic Table of Anti-Elements

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 real 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-Elements. Furnished with the analysis above, there arises the opportunity of constructing the Periodic Table of Anti-Elements similar to the one considered above [22, 23].

Postface: Additional Explanations to Element No. 155

True number of elements in Mendeleev's Periodic Table is the most important problem to the scientists working on the theory of the Periodic Table. The theory is based in the core on our views about the properties of the electron shells and sub-shells in atoms, which obviously change with increasing nuclear change (the nuclei themselves remains unchanged in chemical reactions). The electron shells change due to re-distribution of electrons among the interacting atoms. Therefore, it is important that we know the limits of stability of the electron shells in the heavy elements (high numbers in the Periodic Table); the stability limits are the subjects of calculation in the modern quantum theory which takes into account the wave properties of electron and nucleons. To do it, the scientists employ a bulky mathematical technics, which gives calculations for the 8th and 9th periods of the Table (a hundred new elements are joined there).

Already 40 years ago the physicists proved that no chemical elements with numer higher than 110 cannot exist. Now, 118th element is known (117th element, previous to it, is still non-discovered). In the last time, the scientists of Joint Institute for Nuclear Research, Dubna, talked that the Periodic Table ends with maybe 150th element, but they did not provided any theoretical reason to this claim. As is probable, the regular method of calculation, based on the quantum theory, gives no exact answer to the question about upper limit of the Table.

It should be noted that 10 new elements were synthesed during the last 25 years: 5 elements were synthesed in GSI[*], 4 elements were synthesed in JINR[†] (2 of these — in common with LLNL[‡]), and 1 element was synthesed in LBNL[§]. All the laboratories produced new elements as a result of nuclear reactions in accelerators: new elements were found after analysis of the products of the reactions. This is a very simplified explanation, however the essence of the process is so: problem statement, then components for the nuclear reaction and the necessary

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[*] Gesellschaft für Schwrionenforshung — Helmholtz Centre for Heavy Ion Research, Darmstadt, Germany.

[†] JINR — Joint Institute for Nuclear Research, Dubna, Russia.

[‡] LLNL — Lawrence Livermore National Laboratory, USA.

[§] LBNL — Lawrence Berkeley National Laboratory, USA.

physics condition, then — identification of the obtained products after the reaction. This method gives new elements, of course, but it gives no answer to the question about their total number in the Periodic Table.

In contrast to this approach, when I tackled this problem, I used neither calculation for the limits of stability of the electron shells in atoms, nor experiments on synthesis of new elements, but absolutely another theoretical approach which allowed me for formulation of a new law in the Periodic Table and, as a result, the upper limit in it. Here I explain how, in short.

First. Contents Y of every single element (say, of a K-th element in the Table) in a chemical compound of a molecular mass X can be given by the equation of an equilateral hyperbola $Y = K/X$, according to which Y (in parts of unit) decreases with increasing X.

Second. After as I created the hyperbolic curves for not only all known elements, but also for the hypothetical elements, expected by the aforementioned experimentalists, I looked how the hyperbolas change with molecular mass. To do it, I determined the tops of the hyperbolas, then paved a line connecting the tops.

Third. The line comes from the origin of the coordinates, then crosses the line $Y = 1$ in a point, where the top of one of the hyperbolas meets atomic mass of element, $K = X$, that is the boundary condition in the calculation. The calculated coordinates of the special point are $X = 411.663243$ and $Y = 1$. Because no elements can be above the point (contents Y of an element in a chemical compound is taken in parts of unit), the element with mass $X = 411.663243$ is the heaviest in the Periodic Table, so the Table ends with this element.

Fourth. In the next stage of this research, I was focused on the functions of atomic mass of element from its number along the Periodic Table. As a result, I have deduced the number of the last (heaviest) element in the Table. It is No. 155.

Thus, the last (heaviest) element in the Periodic Table was proved and its parameters were calculated without calculation of the stability of the electron shells in atoms on the basis of the quantum theory, but proceeding only from the general considerations of theoretical chemistry.

Of course, the methods of theoretical chemistry I applied in this reseach do not cancel the regular methods of the quantum theory; both methods are also not in competition to each other. Meanwhile calculations for the stability of the electronic shells of super-heavy elements can be resultative only in the case where the last element is known. Also, the experimentalists may get a new super-heavy element in practice, but, in the absence of theory, it is unnecessary that the element is the last in the Periodic Table. Only the aforementioned theory, created on the basis of the hyperbolic law in the Periodic Table, provides proper calculation for the upper limit in the Periodic Table, for characteristics of the last (heaviest) element, and hence sets a lighthouse for all futher experimental search for super-heavy elements.

This short postface was written due to the readers who, after reading my papers and the first edition of my book, asked me about the rôle of the calculations for the stability of the electron shells in my theory.

New York, January, 2010 *Albert Khazan*

Appendix A: Theses Presented at Meetings of the American Physical Society

2008 Annual Meeting of the Division of Nuclear Physics
October 23–26, 2008, Oakland, California

The Upper Limit in the Periodic Table — *by Albert Khazan* — Many scientists believe in the idea that the Periodic Table of Elements may be expanded to the period 8, 9, and so forth. Offered atomic nucleuses on 114, 126, 164 protons and 184, 258 neutrons. However no one claim was made yet on the upper limit of the Table. The standard methods of nucleosynthesis of super-heavy elements include recognition of the products came from nuclear reactions, where new elements may be discovered as well. This fact however gives no information about a possible limit in the up of the Table (a last element). To fill this gap a new theoretical approach is proposed, an essence of which is the idea that on any chemical composition of a molecular mass X the content Y of the recognized element K which should be related to one gram-atom, for unification. In such a case, meaning K the atomic mass, the equation $Y = K/X$ manifests an equal-side hyperbola which lies in the 1st quadrant ($K > 0$), while the top of the hyperbola should be located in a real axis directed with 45 deg to the positive direction of the abscissa axis with the boundary conditions $Y \leqslant 1$, $K \leqslant X$. The equation allows calculation for the content of any element in any chemical composition.

2008 Annual Meeting of the Division of Nuclear Physics
October 23–26, 2008, Oakland, California

Parameters of the Heaviest Element — *by Albert Khazan* — The theory of equilateral hyperbola, which looks for the heaviest element of the Periodical Table of Elements, manifests the fact that, according to the boundary conditions, the arc along the ordinate axis is limited by the line $Y = 1$, while the arc can be continued up to any value of X along the abscissa axis. Calculation shows: to draw the hyperbolae in the same scale the value $X = 600$ is necessary and sufficient. The top of each hyperbola, found through Lagrange's theorem, should be located in the real axis. Beryllium: the ratio $Y = K/X$ gives the coordinates $X = 60.9097$, $Y = 0.14796$. On the other hand, the formal properties of equilateral hyperbolae give $X_0 = Y_0 = 3.00203$ (these are the sq. root of the atomic mass of the element, 9.0122). This shows that there is the reciprocal law for coming from one reference in the case to another: $X/X_0 = Y_0/Y = 20.2895$. We call this number the scaling coefficient. As seen the tangent of the angle of the real axis is $Y/X = 0.00242917$, while this line intersects the line $Y = 1$ in the point where $K = X = 411.663243$. Assuming this X into our equation we deduced, we arrive at the number 155. These two values are attributed to the heaviest element of the Table.

75TH ANNUAL MEETING OF THE SOUTHEASTERN SECTION OF APS

October 30 — November 1, 2008, Raleigh, North Carolina

THE HYPERBOLIC LAW IN THE PERIODIC TABLE — *by Albert Khazan* — My recent presentations at the APS Meetings gave a theory which gave the heaviest (last) element of the Periodic Table of Elements. The basis of the theory is the equilateral hyperbolae $Y = K/X$. These arcs taken in the logarithm coordinates ($\ln X_0$, $\ln Y_0$) draw straight lines in the 4th quadrant right of Hydrogen, and parallel to it. The real axis ($\ln Y_0 = \ln X_0 - 6.0202$) transects them at the points which present the tops of the elements of the Periodic Table. The number of the heaviest (last) element was calculated through the exponential function of the atomic mass on the element's number and a logarithm of it. A new hyperbolic fundamental law of the Periodic Table has been conducted: the element content Y per gram-atom in any chemical composition of the molecular mass X can be given by the equations of the positive branches of the equilateral hyperbolae $Y = K/X$ ($Y \leqslant 1$, $K \leqslant X$), which are located according to the increase of the nuclear change, and are a real axis common with their tops: with distance from the origin of the coordinates they approach to the positions $Y = 1$ or $K = X$ where the atomic mass is ultimate high — the last element of the Table.

FALL 2008 MEETING OF THE OHIO SECTION OF APS

October 10–11, 2008, Dayton, Ohio

THE FRACTIONAL-LINEAR FUNCTION IN THE HYPERBOLIC LAW — *by Albert Khazan* — The maintenance of any element in a chemical compound decreases with increase of the molecular weight under the equipotential hyperbolic law $Y = K/X$ (1). However the size $(1 - Y)$ increases according to the equation $1 - Y = K/X$ or $Y = (X - K)/X$ (2). This function refers to as fractional linear one, and after transformations turns to the equation of an equipotential hyperbola whose center is displaced from the beginning of the coordinates about (0; 0) in a point with (0; 1). Hence, the real axis on which there tops of new hyperbolas are, pass perpendicularly to the axes of the equation (1). We shall enter names for hyperbolas: (1) "straight one", (2) "adjacent one". Their directions are mutually opposite in the point $Y = 0.5$ of crossing of each pair; this line is an axis of symmetry for all the hyperbolas; the abscissa is equal to the double nuclear weight of any element ($2K$). Coordinates of other crossing points of the hyperbolas have following parameters: $X = (K_1 + K_2)$, $Y_1 = [K_1/(K_1 + K_2)]$, $Y_2 = [K_2/(K_1 + K_2)]$. At the last element the curves designate the borders of the existence of possible chemical compounds.

2008 MEETING OF THE APS OHIO-REGION SECTION
October 10–11, 2008, Dayton, Ohio

THE LAW OF HYPERBOLES FOR CHEMICAL COMPOUNDS — *by Albert Khazan* — The essence of the law of the hyperbolas is that the contents of substance of a specific chemical element should take the quantity of one gram-atom. Earlier, there in the equation $Y = K/X$ any element of the Periodic Table was considered at the numerator. Now we expand the law: we enter the groups OH, CO_3, SO_4 and the others into the numerator. In this case the direct and adjacent hyperbolas exchange their places, but their shape remains unchanged. Besides, the position of one gram-mole with the number of the group cannot be more than the unit should be carried out. Then the hyperbolas have smooth shape without breaks. It confirms that fact, that the hyperbolas with various values K are similar against each other, but they are not congruent. At the same time through a point with the coordinates X, Y it is possible to describe only one hyperbola, for which $K = XY$ [for adjacent $K = X(1-y)$]. The opportunity of application of groups of elements testifies the universality of the law of the hyperbolas, and it expands the mathematical base of chemical research.

2008 FALL MEETING OF THE TEXAS AND FOUR CORNERS SECTIONS OF APS
October 17–18, 2008, El Paso, Texas

THE LAST/HEAVIEST ELEMENT OF THE PERIODIC TABLE AND THE NEUTRON-PROTON DIAGRAM — *by Albert Khazan* — The raised stability of the atomic nucleus containing 2, 8, 20, 28, 50, 82 and 126 protons and neutrons, is caused by that growth of number of neutrons advances quantity of protons in heavy nucleus. As a result they become energetically steadier. The nucleus we have calculated, including an element 155, is located in the line of a trend whose size of reliability makes 0.9966. The element predicted by some scientists, with nucleus $Z = 114$, $N = 184$, is far distant in the party. Thus it was found out, that with $Z = 114$ the N should be 179, and also $N = 184$ results $Z = 116$. In the field of the numbers 104–114 there are essential fluctuations of the nuclear masses and the numbers of neutrons. It is due to the fact that, in the Periodic Table, the nuclear mass of the most long-living isotopes of an element is a result of that fact that the breaking of the strict law of increase in the mass with the growing up of the charge of a nucleus. Independence of the line of a trend of the position of the last element has been verified by calculation. Therefore it is offered to consider No.155 for diagnosing products of nuclear reactions.

2008 FALL MEETING OF THE NEW ENGLAND SECTIONS OF APS
October 10–11, 2008, Boston, Massachusetts

THE LAST ELEMENT IN A NEW PERIODIC TABLE — *by Albert Khazan* — Among scientists there is no common opinion about possible number of the elements in the Periodic Table. The existing points of view lay within the limits from 120 up to 218 and more. However if to arrange the number of isotopes depending on the charge of a nuclei of atoms the broken curve in the form of the average parabola will turn out, in descending which branch the number of the isotopes sharply decreases, reaching units at all up to the end of the 7th period. After achievement of the maximum in the 6th period, the number of the isotopes sharply decreases. Hardly it is necessary to tell about prospective new 100 elements when are unsolved all of the problem up to No.119. As a result of the establishment of the top border of the Periodic Table there is a question about the location of the last element. From the views on the symmetry, it should be close to the 1st group. On the electronic configuration calculated for 218 elements, its place in the 5th group: 2, 8, 18, 32, 50, 32, 11, 2. Considering that fact, that in the 8th period has not 50 elements, we offer a following version to discuss: 2, 8, 18, 32, 36, 32, 18, 8, 1.

2009 APS MARCH MEETING

March 16–20, 2009, Pittsburgh, Pennsylvania

THE RÔLE OF THE ELEMENT RHODIUM IN THE HYPERBOLIC LAW OF THE PERIODIC TABLE OF ELEMENTS — *by Albert Khazan* — The method of equilateral hyperbolas assumes that their tops should be certain with high accuracy by means of Lagrange's theorem. On this basis the scaling factor for transition from the coordinate system usual to mathematicians to that which is to be used in chemistry is calculated. Such an approach has allowed calculating parameters of the last element. The calculation can be checked by means of the first sequel from the hyperbolic law, proceeding only from the atomic mass of the element Rhodium. As it has appeared, the direct and adjacent hyperbolas are crossed in a point with the coordinates 205.811; 0.5, which abscissa makes a half of the last element's atomic mass (the deviation is about 0.01%). The real axes of the hyperbolas coincide with the tangents and normals, and the scaling factor differs from the first calculation as 0.001%. However these insignificant divergences are so small to the most important conclusion that the validity of the hyperbolic law, as calculation on Rhodium our data consists of (Progr. Physics, 2007, v. 1, 38; v. 2, 83; v. 2, 104; 2008, v. 3, 56).

2009 SPRING MEETING OF THE APS OHIO-REGION SECTION

April 24–25, 2009, Ada, Ohio

UPPER LIMIT OF MENDELEEV'S PERIODIC TABLE OF ELEMENTS — ELEMENT NO.155 — *by Albert Khazan* — The most important problem for the scientists, who are working on the theory of Mendeleev's Periodic Table, is how to determine the real number of elements in it. One of the mainstream methods applied to resolving this problem suggests a calculation for the stability limits of the electronic shells of atoms. In this way, one sets up a number of elements for a period of the Table, and then calculates (as a sequence) the respective atomic masses for the elements. A second mainstream way is synthesis of new elements in nuclear reactions, with identification of the obtained products among which a new element may be found (meanwhile the element may unnecessary be the last). 10 new elements were obtained in this way during the last 25 years. In contrast, the basis of my calculation were neither calculations for the stability limits of the atomic shells nor synthesis of new elements, but a study of chemical processes which allowed, through the mathematical apparatus, to formulate a new law of Hyperbolas in the Periodic Table, and led to the last element No.155 whose atomic mass is 411.66 (details in: Khazan A. Progress in Physics, 2007, v. 1, 38; v. 2, 83, 104; 2008, v. 3, 56; 2009, v. 2, 19, L12).

2009 APS April Meeting

May 2–5, 2009, Denver, Colorado

Theoretical Grounds to the Table of the Elements of Anti-Substance — *by Albert Khazan* — If equilateral hyperbolas were created with $X < 0$, $Y < 0$ $(K > 0)$, they build the second branches in the 3rd quadrant. In contrast to hyperbolas in mathematics, the conditions $Y \leqslant 1$ and $K \leqslant X$ don't give congruency (this is because the different scales and dimensions of the axes). This inadequacy vanishes if using the coefficient M (20.2895). With it the properties of the hyperbolas in the 1st quadrant are verified in the 3rd quadrant. The 2nd and 4th quadrants show the same on the hyperbolas. Reducing the axes to the joint scale doesn't lead to congruency in full. The ordinate (the rate of transformation of matter) is negative in the 3rd and 4th quadrant that is unseen in nature. Thus, we consider the 1st and 2nd quadrants (there is $K > 0$, $K < 0$). In the quadrants, the curves meet each other around the ordinate. Thus, the hyperbolic law is true in the 2nd quadrant as well (it is "inhabited" by "negative matter", i.e. anti-matter consisting antiparticles). This allowed me to create the Periodic Table of the elements of anti-matter (see Progr. Phys., 2007, v. 1, 38; v. 2, 83; v. 2, 104; 2008, v. 3, 56).

2010 APS March Meeting

March 15–19, 2010, Portland, Oregon

A Method for Calculation of the Upper Limit of Mendeleev's Periodic Table — *by Albert Khazan* — 40 years ago some scientists claimed that elements heaviest than No.110 are impossible. The technics got much progress in the last years: element 118 has already been registered. Now, the researchers of Joint Inst. for Nuclear Research (Dubna, Russia) claim that the Periodic Table will end with element 150. However they do not provide theoretical proofs to this claim, because the stability limits of electronic shells they calculated by means of Quantum Mechanics do not answer this question in exact. In contrast, I focused onto the contents of chemical compounds along the Table. The used method is as follows. First, it was found that, given any chemical compound, the contents of any element in it (per 1 gram-atom) is described by the equation of a equilateral hyperbola $Y = K/X$. Then the scaling coefficient was deduced for the hyperbolas, thus the atomic mass of the last (heaviest) element, 411.66, was found as the abscissa of the ultimate point of the arc drawn by the tops of the hyperbolas. With it, the number of the last element, 155, was found as a consequence. See: Khazan A. Upper Limit in Mendeleev's Periodic Table — Element No.155. Svenska fysikarkivet, 2009.

2010 APS APRIL MEETING

February 13–16, 2010, Washington, DC

THE LAST ELEMENT OF MENDELEEV'S PERIODIC TABLE — *by Albert Khazan* — Despite much achievements of the synthesis for super-heavy elements (10 new elements were obtained during the last 25 years), the experts in Mendeleev's Periodic Table have not answered the most fundamental question: where the Table ends? The calculations produced on the basis of Quantum Mechanics (the physical conditions in micro-scales) do not not answer this question till now. In my study of chemical compounds, I focused onto the physical conditions observed in macro-scales (the subjects of the regular physics and chemistry). Thus, the Law of Hyperboles was discovered in the Periodic Table: given any chemical compound, the contents of any element in it (per 1 gram-atom), including the contents of unknown elements, whose atomic masses can be set up arbitrarily, is described by the equation of a equilateral hyperbola $Y = K/X$. The tops of all the arcs are distributed along a real axis crossing the line $Y = 1$ in the point of abscissa 411.66, which manifests the actual atomic mass of the last (heaviest) element of the Periodic Table: its location is Period 8, Group 1; its atomic mass is 411.66, its number is 155 (Khazan A. Upper Limit in Mendeleev's Periodic Table — Element No.155. Svenska fysikarkivet, 2009).

Appendix B: Calculation for Atomic Masses of the Elements of the Periodic Table, According to Our Formula

The equation we have deduced in this book (it gives atomic masses of elements depending from their numbers) gave the advantage that the atomic masses of the elements from No. 104 to No. 155 included we calculated. These data will be useful to researches in many fields of science, including researchers in Quantum Mechanics, for further studies of Mendellev's Periodic Table with taking its upper limit into account. These data will also be needed to theoretical physicists, experts in nuclear reactions, physical chemists, and chemists. The calculations cover 15 elements of the 7th period, and 37 elements of the 8th period. These data are given in Table B-1. Table B-2 compares our theoretical calculation to the data, obtained by FLW Inc. and also IUPAC (for the years 2001 and 2005).

Even short view on Table B-1 manifests that the atomic mass of an element increases, with its number, for three units on the average. In connexion to this finding, we studied this dependency in the scale of the numbers 1–83, 90, 92 (natural isotopes), 1–104, and 1–155. We have found that this dependency exists in all these cases. An evidence to it are the high values of approximation of the lines of trend, which cover each other (see Fig. B-2). Hence, we are lawful to create the aforementioned dependency upto No. 155.

As Mendeleev wrote, in already 1905, "As probable, the future does not threaten to the Periodic Law to be destroyed, but promises to it to be only updated and developed".

No.	Element, its symbol		At. mass	No.	Element, its symbol		At. mass
104	Rutherfordium	Rf	265.28	131	Untriunium	Utu	341.89
105	Dubnium	Db	268.09	132	Untribium	Utb	344.76
106	Seaborgium	Sg	270.89	133	Untritrium	Utt	347.63
107	Bohrium	Bh	273.7	134	Untriquadium	Utq	350.51
108	Hassium	Hs	276.52	135	Untripentium	Utp	353.38
109	Meitherium	Mt	279.33	136	Untrihexium	Uth	356.26
110	Darmstadium	Ds	282.15	137	Untriseptium	Uts	359.14
111	Roentgenium	Rg	284.97	138	Untrioctium	Uto	362.02
112	Ununbium	Uub	287.8	139	Untriennium	Ute	364.91
113	Ununtrium	Uut	290.62	140	Unquadnilium	Uqn	367.8
114	Unuquadium	Uuq	293.45	141	Unquadunium	Uqu	370.68
115	Ununpentium	Uup	296.28	142	Unquadbium	Uqb	373.58
116	Ununhexium	Uuh	299.11	143	Unquadtrium	Uqt	376.47
117	Ununseptium	Uus	301.95	144	Unquadqadium	Uqq	379.63
118	Unuoctium	Uuo	304.79	145	Unquadpentium	Uqp	382.26
⇓ 8th period starts herefrom				146	Unquadhexium	Uqh	385.16
119	Ununennium	Uue	307.63	147	Unqadseptium	Uqs	388.06
120	Unbinilium	Ubn	310.47	148	Unquadoctium	Uqo	390.96
121	Unbinium	Ubu	313.32	149	Unquadennium	Uqe	393.87
122	Unbibium	Ubb	316.16	150	Unpentnilium	Upn	396.77
123	Unbitrium	Ubt	319.01	151	Unpentunium	Upu	399.68
124	Unbiquadium	Ubq	321.86	152	Unpentbium	Upb	402.59
125	Unbipentium	Ubp	324.72	153	Unpenttrium	Upt	405.5
126	Unbihexium	Ubh	327.57	154	Unpentqadium	Upq	408.42
127	Unbiseptium	Ubs	330.43	155	Unpentpentium	Upp	411.35
128	Unbioctium	Ubo	333.29	No.119 – No.155 create the 8th period of the Periodic Table of Elements			
129	Unbiennium	Ube	336.16				
130	Untrinilium	Utn	339.02				

Table B-1: Calculation for the atomic masses of the elements of Mendeleev's Periodic Table, from No. 104 to No. 155, according to the equation we have deduced in the book.

Atomic number	Symbol	Atomic masses, according to the data:				Number of neutrons
		FLW Inc.	**Our calc.**	IUPAC, 2001	IUPAC, 2005	
104	Rf	261*	**265**‡	261*	267‡	157, **161**, 157, 163
105	Db	262	**268***	262	268*	157, **163**, 157, 163
106	Sg	263‡	**271***	266‡	271*	157, **165**, 160, 165
107	Bh	262	**274**‡	264	272‡	155, **167**, 157, 165
108	Hs	—	**277***	277*	270	—, **167**, 169, 162
109	Mt	266	**279**‡	268	276‡	157, **170**, 159, 167
110	Ds	262	**282**‡	281*	281*	152, **172**, 171, 171
111	Rg	272*	**285**	272*	280	161, **174**, 161, 169
112	Uub	277	**288**‡	285*	285*	165, **176**, 173, 173
113	Uut	289‡	**291**‡	—	284	176, **178**, —, 171
114	Uuq	291‡	**293**‡	289*	289*	177, **179**, 175, 175
115	Uup	295‡	**296**‡	—	288	180, **181**, —, 173
116	Uuh	297‡	**299**‡	—	293	181, **183**, —, 177
117	Uus	310	**301**	—	—	193, **184**, —, —
118	Uuo	314	**305**	—	294	196, **186**, —, 176
119	Uue	316	**308**	—	—	197, **188**, —, —
120	Ubn	318	**310**	—	—	198, **190**, —, —
126	Ubh	334	**327**	—	—	208, **201**, —, —
155	Upp	412*	**411.66***	—	—	257, **257**, —, —
168	Uho	462				
218	Buo	622				

Table B-2: The atomic masses of the elements. Column 3 gives atomic masses according to the calculation data of FLW Inc. Column 4 — atomic masses, according to our calculation. Column 5 — atomic masses, according to the IUPAC data for the year 2001. Column 5 — atomic masses, according to the IUPAC data for the year 2005.

* Complete coincidence of the data.
‡ The data, which meet each other within 1–3 units.
Boldshaped are the numbers given according to our calculation.
Underlined are the numbers, equal by pairs (can be broken in the rows).
Long dash is signed for undetermined values (in the cases where a parameter was unknown).
The IUPAC data of 2005 were published only in the end of 2006.
Our data first appeared, in the internet, in October 25, 2005.
Our calculations meet the IUPAC data of 2005, in complete, in 9 cases.
According to the FLW Inc. data, only No. 155 gives complete coincidence of the atomic mass with our calculation.

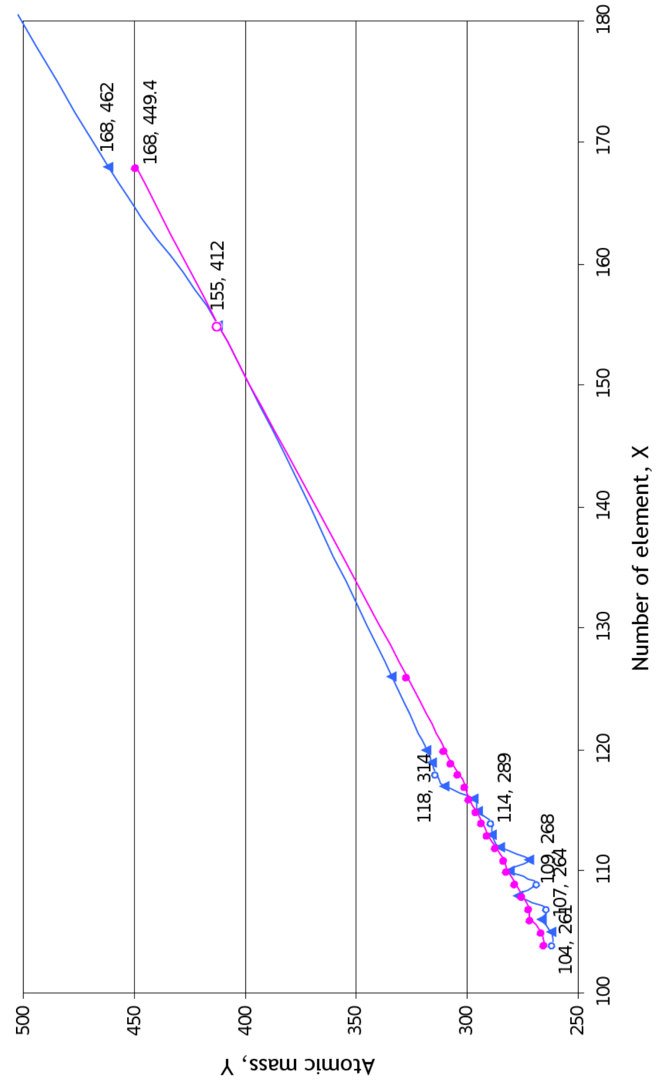

Fig. B-1: Dependence of the atomic mass of an element from its number in the Periodic Table. Lower line (circles) — our data. Upper line (triangles) — FLW Inc.

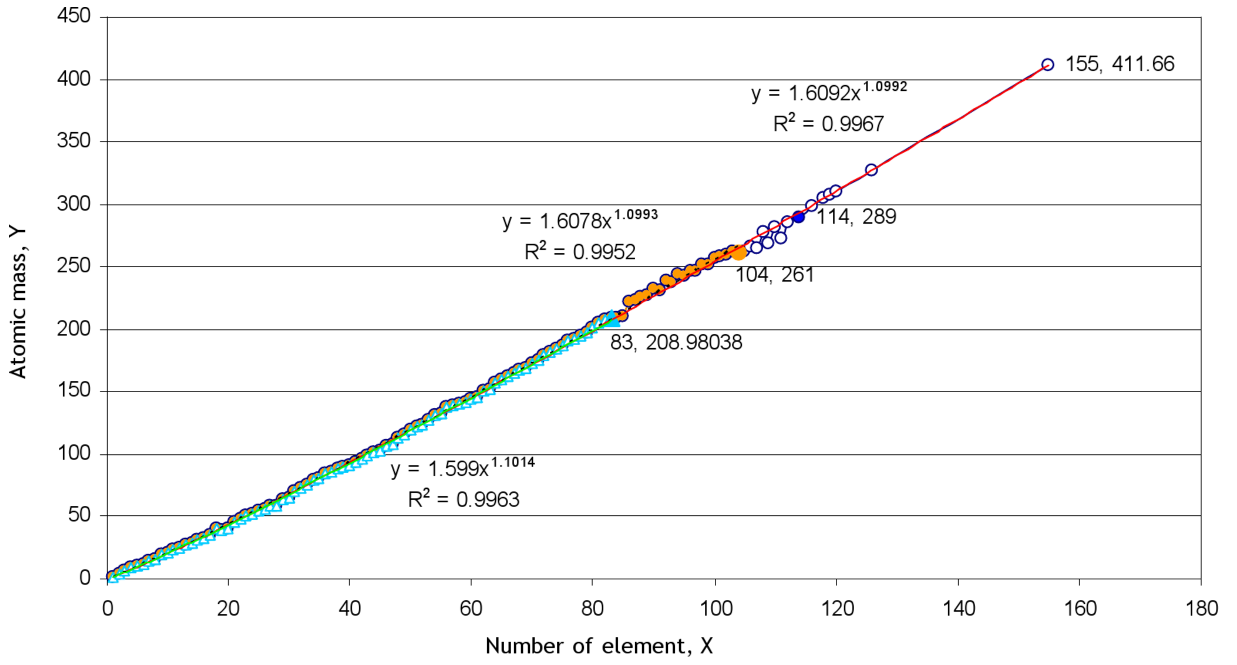

Fig. B-2: Dependence of the atomic mass of an element from its number in the Periodic Table. Triangle is given for No. 1–83, black circle — for No. 1–104, and circle — for 1–155. Lines of trend have been drawn to all three versions.

Appendix C: The Hyperbolic Diagrams of All Elements of the Periodic Table, Including the Hypothetic Elements

Initially, the theory of the hyperboles of the Periodic Table of Elements, presented in this book, was a reply to the practical needs of the fine compounds of the refractory metals.

Just a few details. When analyzing the chlorides, in particular — the chloride of Wolfram, numerous admixtures in addition to the main contents were found. The admixtures distorted the measurement results. Therefore, in several cases, there was also Oxygen in addition to Wolfram and Chlorine.

Using the general purpose analysis, we already obtained the common content of the elements. Meanwhile, we were still unable to find the correlation among the elements due to the scattering of the data (see line W-Cl in Fig. C-1). In this case, we were should take into account the fact that, in the substances under study, the compounds containing 1 gram/mole of Wolfram were presented (according to our calculation, see Fig. C-1, line W). Therefore, we were should produce only a correction for Chlorine and Oxygen, reducing their contents to 1 gram/mole of the compound. As a result, we obtained three hyperboles. The hyperboles, being taken separately or commonly, characterize the contents of the compound we were looking for.

Checking this conclusion on the other metals, analogous to the previous, completely verified the obtained hyperbolic correlations. Thus, it was permitted to expand this research method (I refer to it as the method of hyperbolas, in short) onto the other chemical compounds.

Several parts of the obtained arcs deviated from the common hyperbolic shape. I therefore was enforced to add, into these parts of the arcs, the numerical values of the molecular masses related to the hypothetical compounds, constructed from the same elements. Because the arcs, according to the equation of hyperbola, did not change their meaning, this step did not produce any break of the general chemical laws.

As an illustration to the research process I followed with, here are the graphs, containing the hyperbolas (in the linear and logarithmic coordinates) created for all elements of the Periodic Table, including both already known elements and the hypothetical elements upto No. 155.

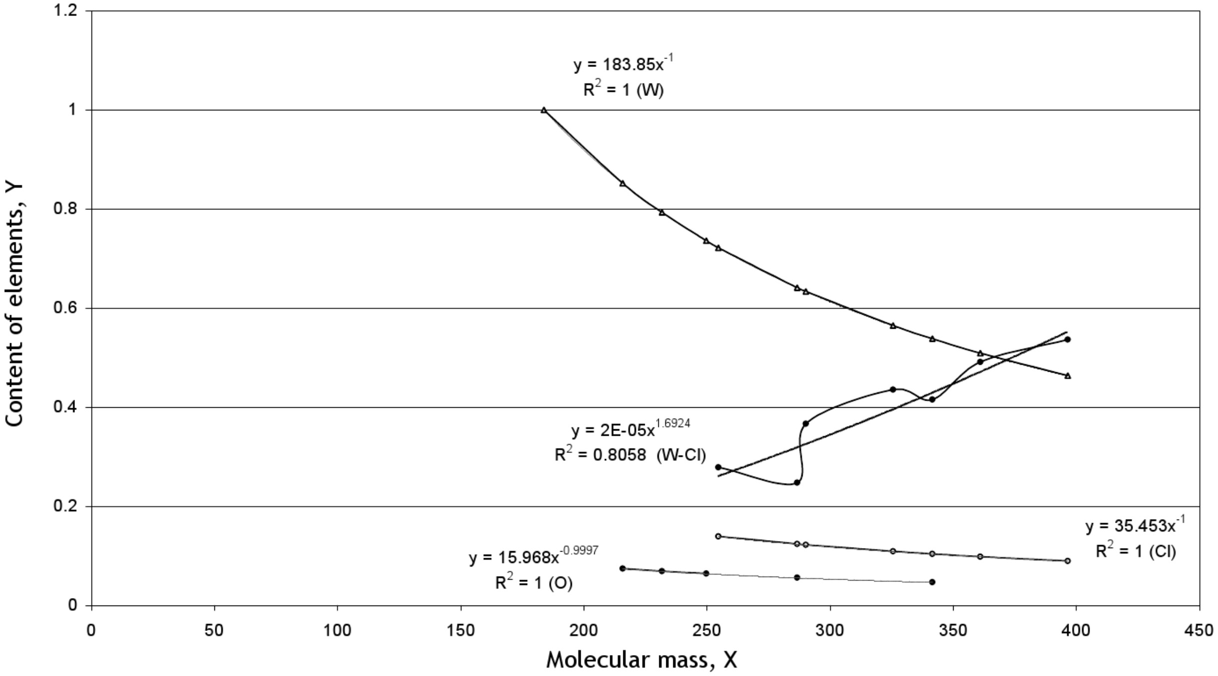

Fig. C-1: Content of Wolfram, Clorine and Oxygen in 1 gram-mole of the compounds of Wolfram (W, Cl, O). Intersecting curve: (W-Cl).

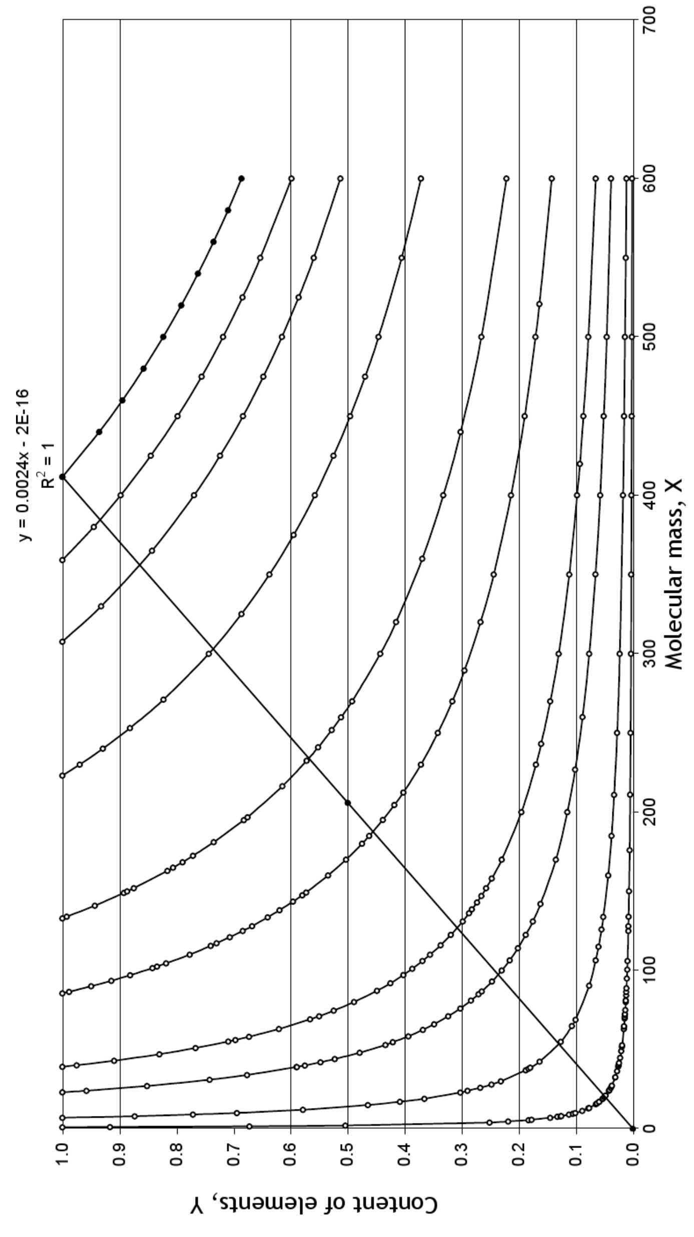

Fig. C-2: Contents of elements in the chemical compounds for Group 1 of the Periodic Table. From left to right: H, Li, Na, K, Rb, Cs, Fr, No. 119, No. 137, No. 155. The real axis, diagonally crossing the graph, and its equation are shown.

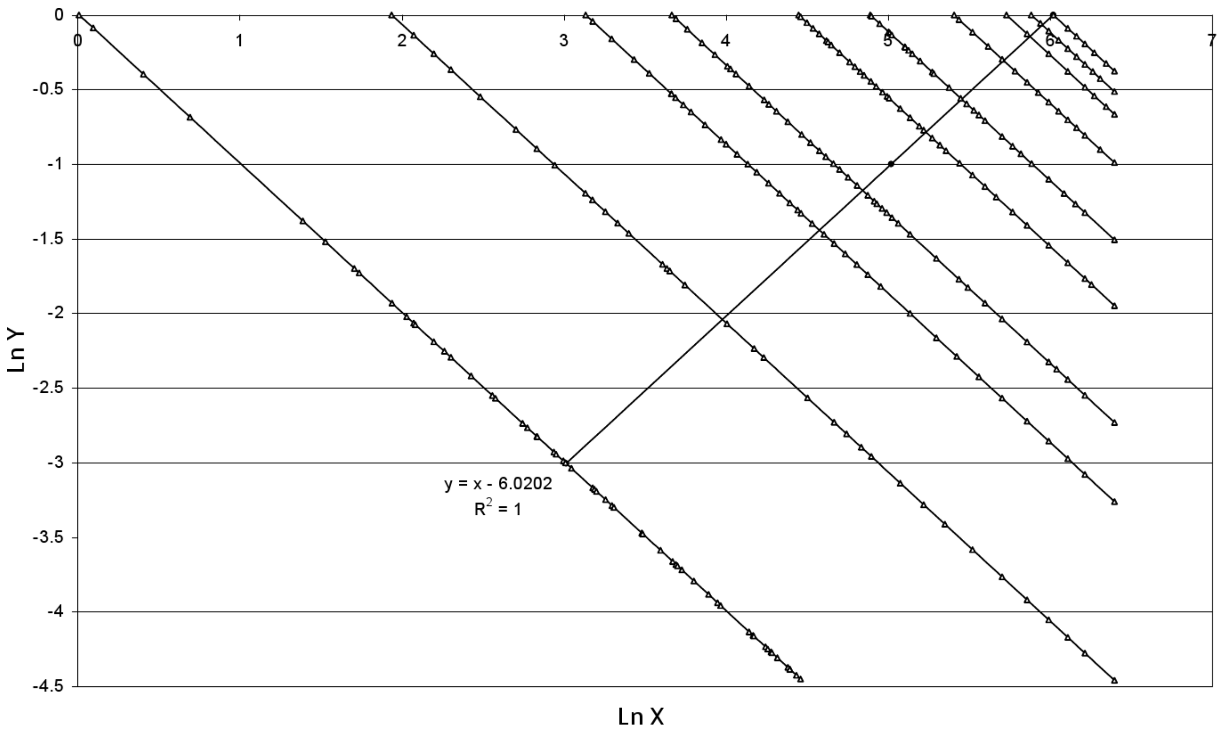

Fig. C-3: The same data of Group 1 of the Periodic Table, repsented in the logarithmic coordinates. The real axis, diagonally crossing the lines, and its equation are shown.

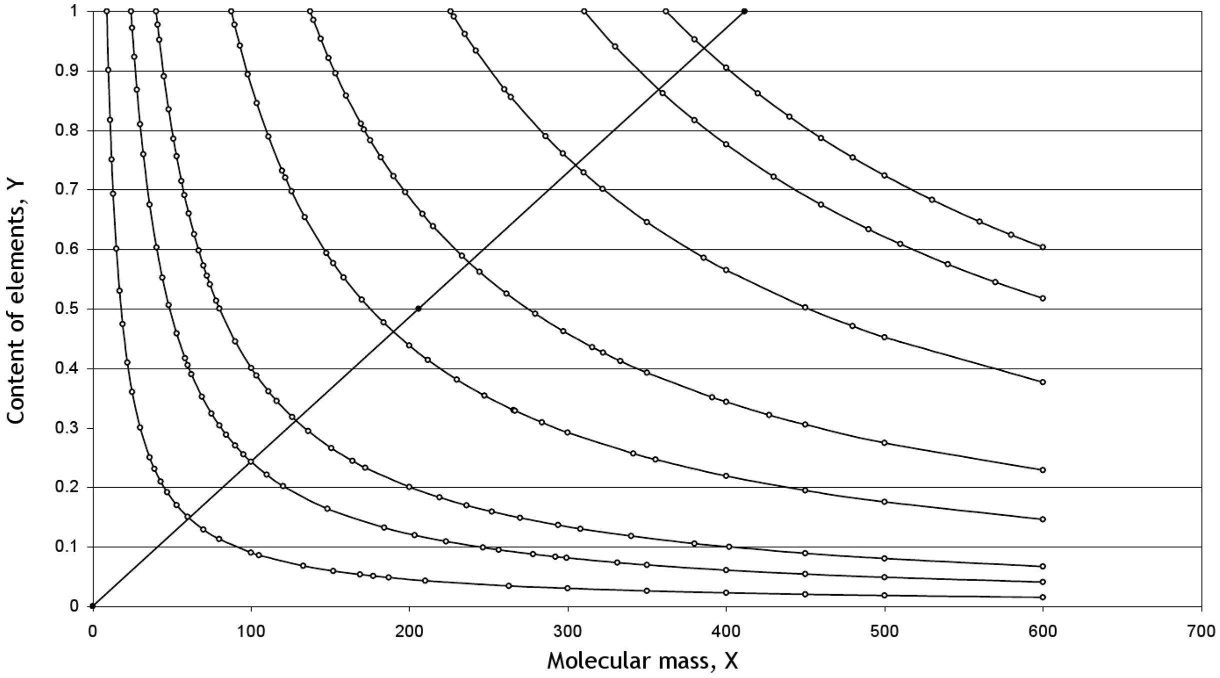

Fig. C-4: This is alike Fig. C-2. Hyperbolas created for the elements of Group 2 of the Periodic Table. From left to right: Be, Mg, Ca, Sr, Ba, Ra, No. 120, No. 138. The real axis and its equation are here the same as in Fig. C-2.

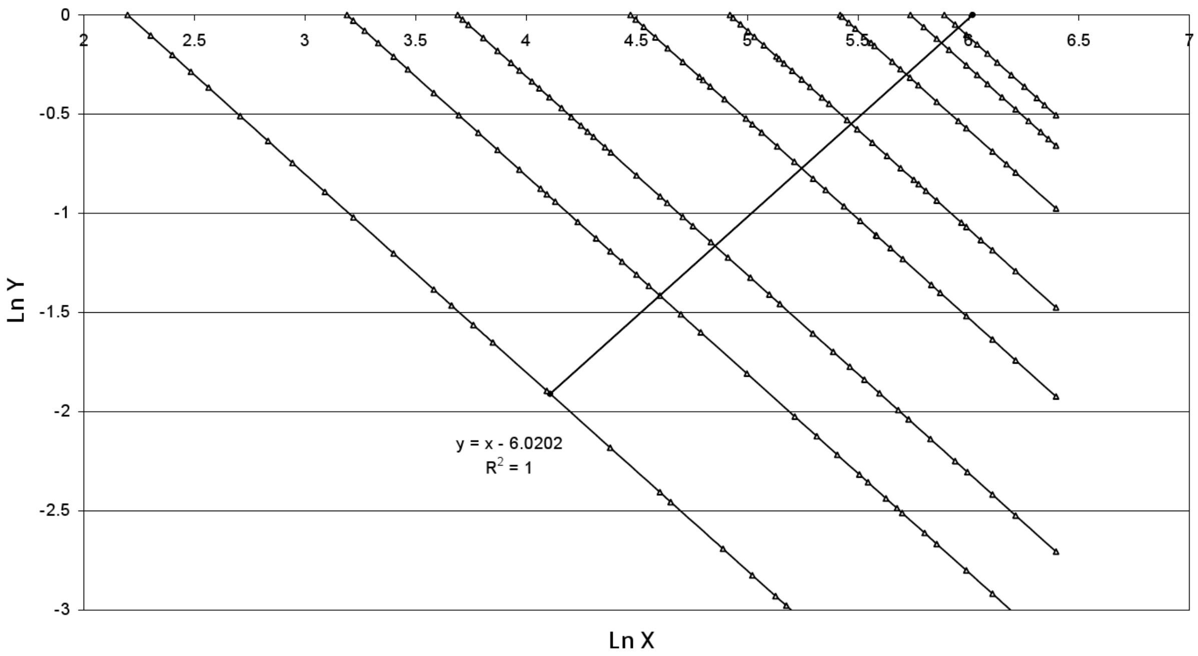

Fig. C-5: Elements of Group 2 of the Periodic Table, repesented in the logarithmic coordinates. From left to right: Be, Mg, Ca, Sr, Ba, Ra, No. 120, No. 138. The real axis is diagonally crossing the lines.

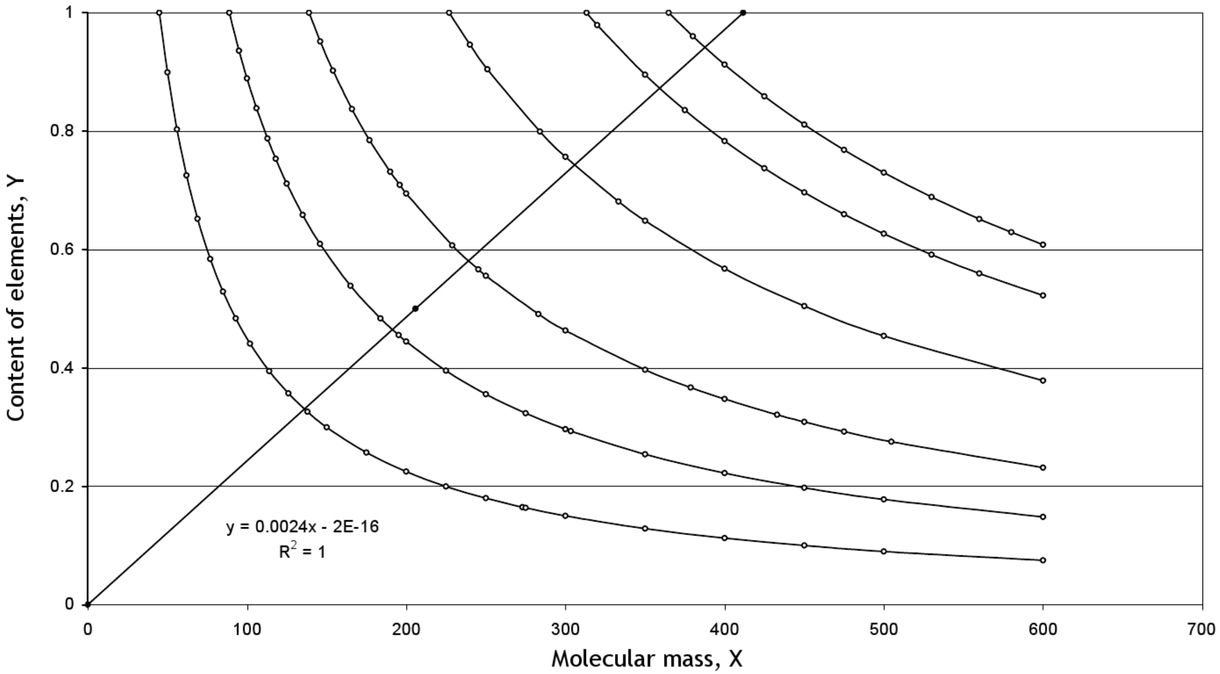

Fig. C-6: Hyperbolas created for the elements of Group 3 of the Periodic Table. From left to right: Sc, Y, La, Ac, No. 121, No. 139. The real axis is diagonally crossing the graph.

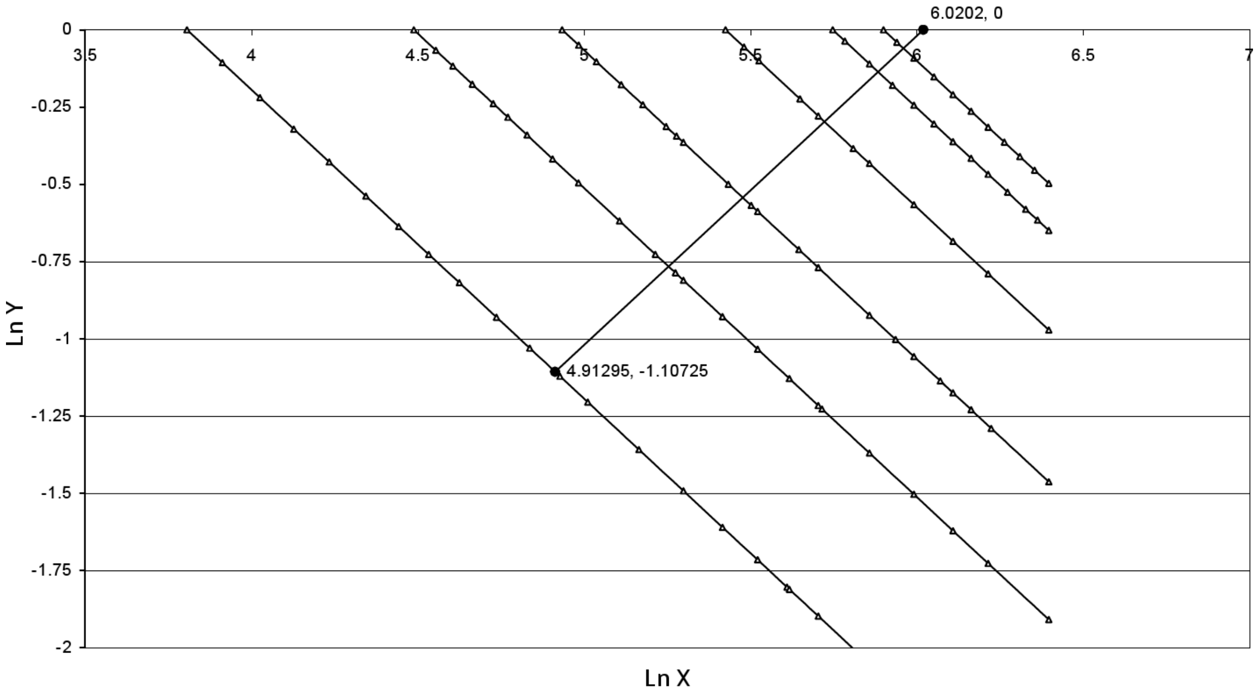

Fig. C-7: The same data of Group 3 of the Periodic Table, repsented in the logarithmic coordinates. From left to right: Sc, Y, La, Ac, No. 121, No. 139. The real axis is diagonally crossing the lines.

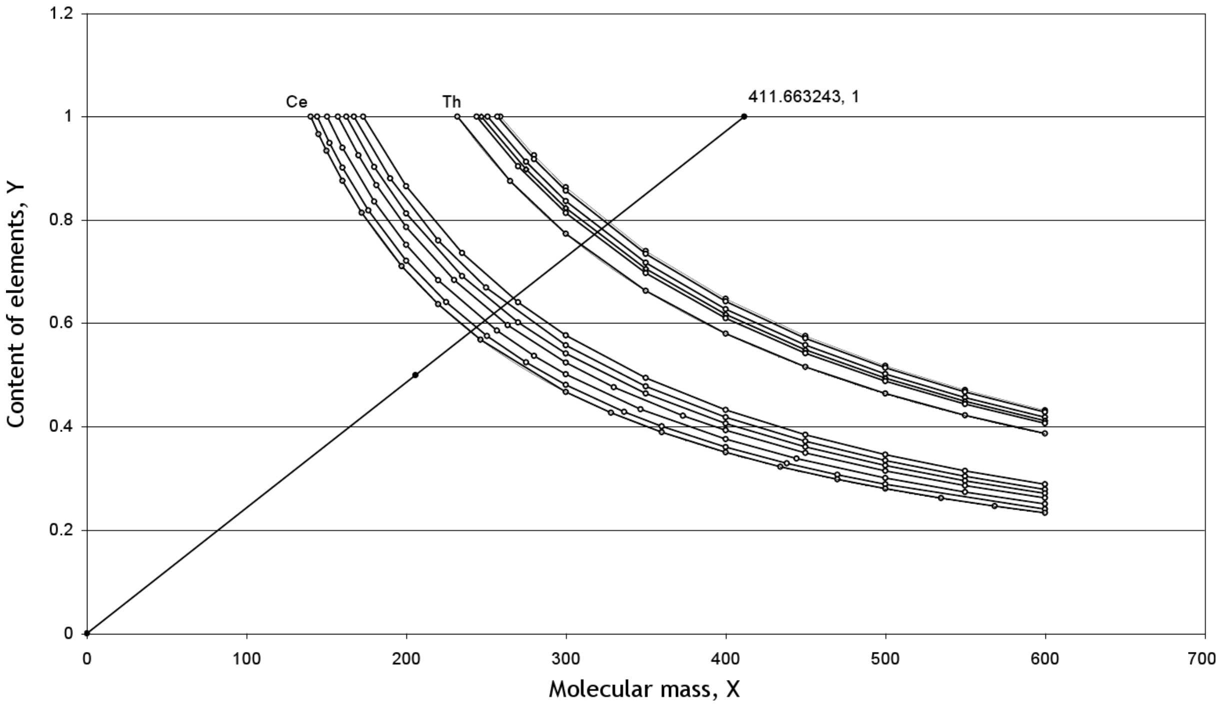

Fig. C-8: Function $Y = K/X$ for the lanthanides (Ce, Nd, Sm, Gd, Dy, Er, Yb) and the actinides (Th, U,Pu, Cm, Cf, Fm, No), from left to right. The real axis is diagonally crossing the graph.

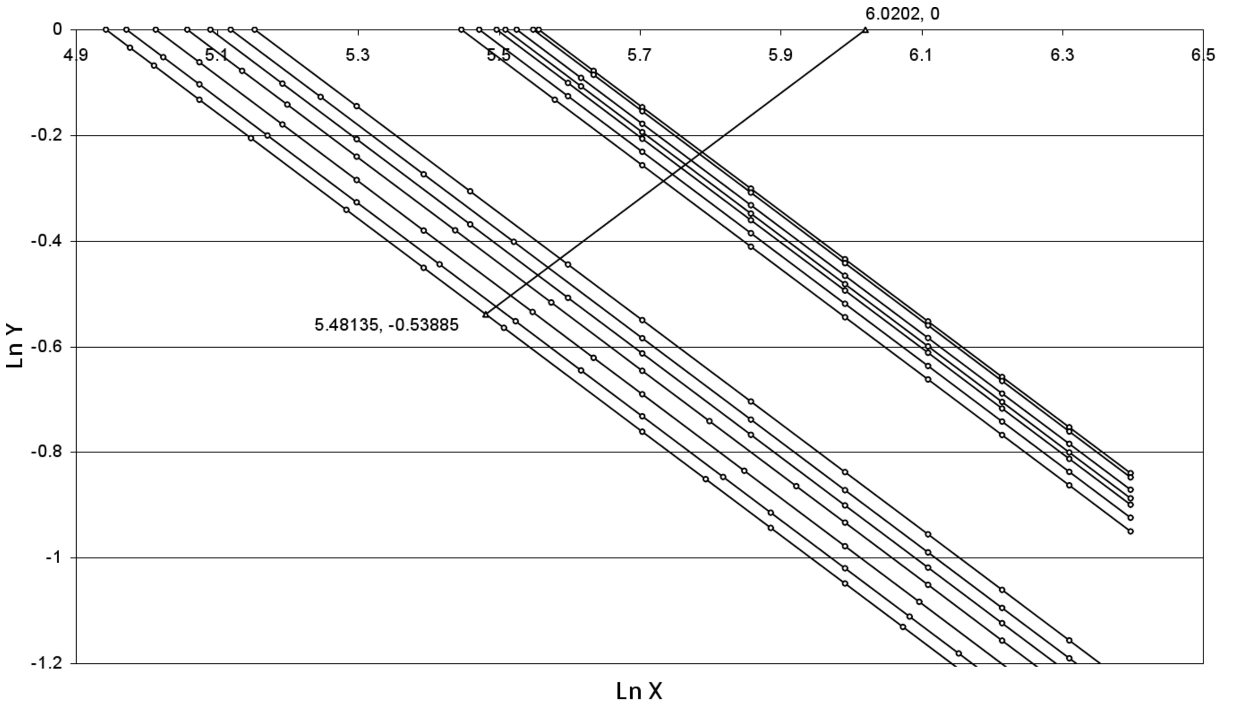

Fig. C-9: Function $Y = K/X$ represented, in the logarithmic coordinates, for the lanthanides (Ce, Nd, Sm, Gd, Dy, Er, Yb), which are the straight lines at the left side, and the actinides (Th, U,Pu, Cm, Cf, Fm, No), which are the straight lines at the right side. The real axis is diagonally crossing the lines.

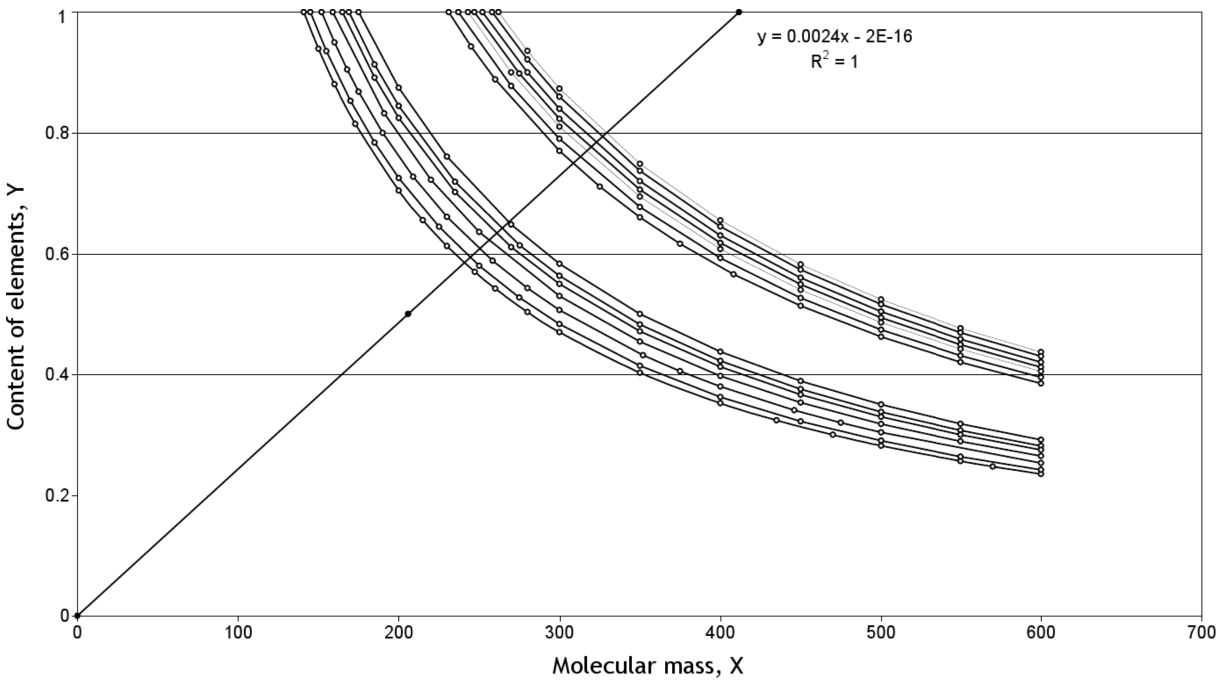

Fig. C-10: Function $Y = K/X$ for the the lanthanides (Pr, Pm, Eu, Tb, Ho, Tm, Lu), which are the arcs at the left side, and for the second group of the actinides (Pa, Np, Am, Bk, Es, Md, Lr), which are the arcs at the right side. The real axis is diagonally crossing the graph.

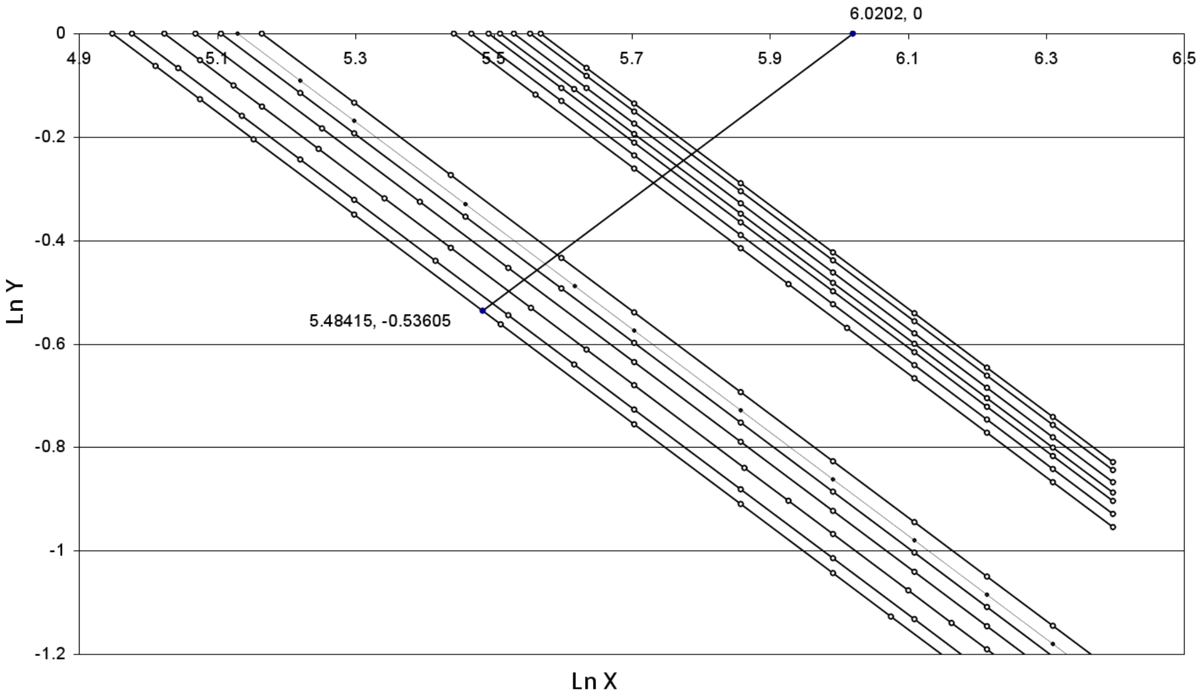

Fig. C-11: Function $Y = K/X$ represented, in the logarithmic coordinates, for the lanthanides (Pr, Pm, Eu, Tb, Ho, Tm, Lu), which are the straight lines at the left side, and the actinides (Pa, Np, Am, Bk, Es, Md, Lr), which are the straight lines at the right side. The real axis is diagonally crossing the graph.

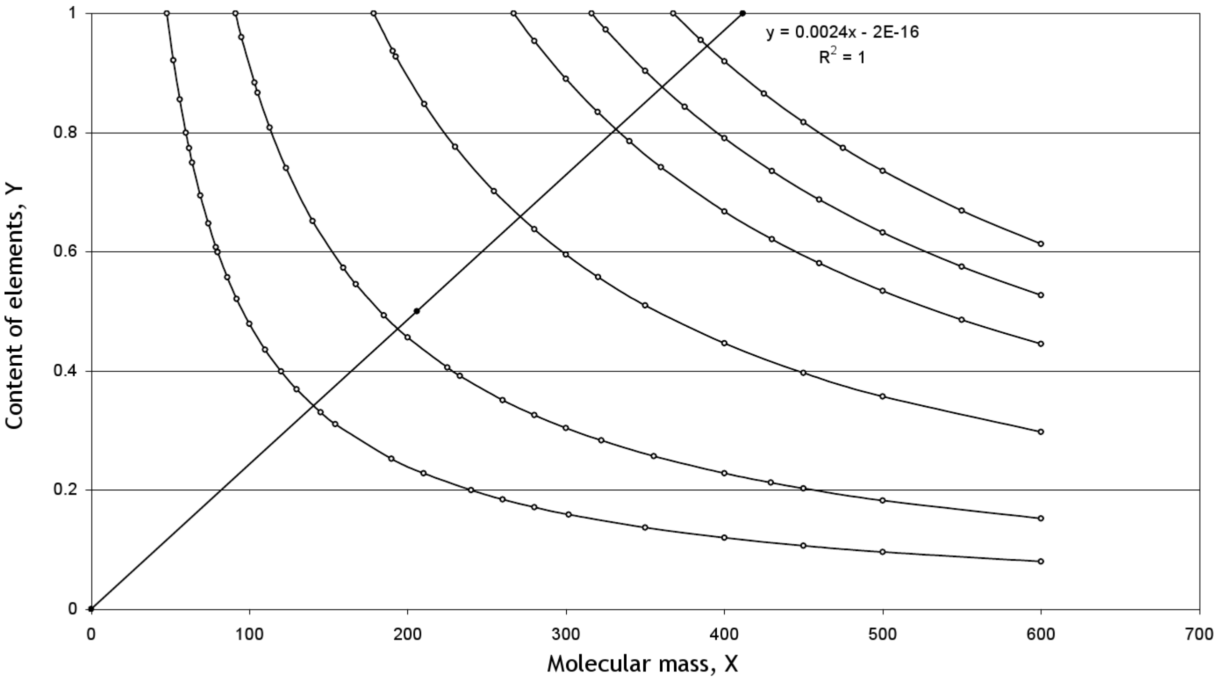

Fig. C-12: Hyperbolas created for the elements of Group 4 of the Periodic Table. From left to right: Ti, Zr, Hf, Rf, No. 122, No. 140. The real axis is diagonally crossing the graph.

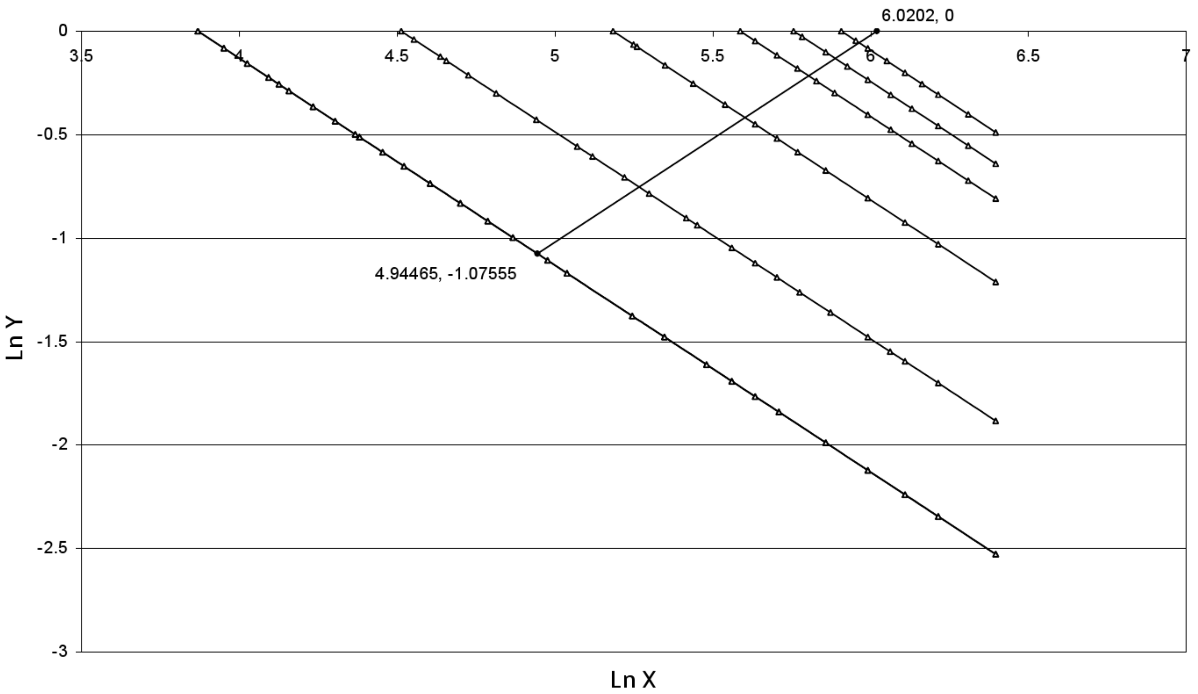

Fig. C-13: The same data of Group 4 of the Periodic Table, repsented in the logarithmic coordinates. From left to right: Ti, Zr, Hf, Rf, No. 122, No. 140. The real axis is diagonally crossing the lines.

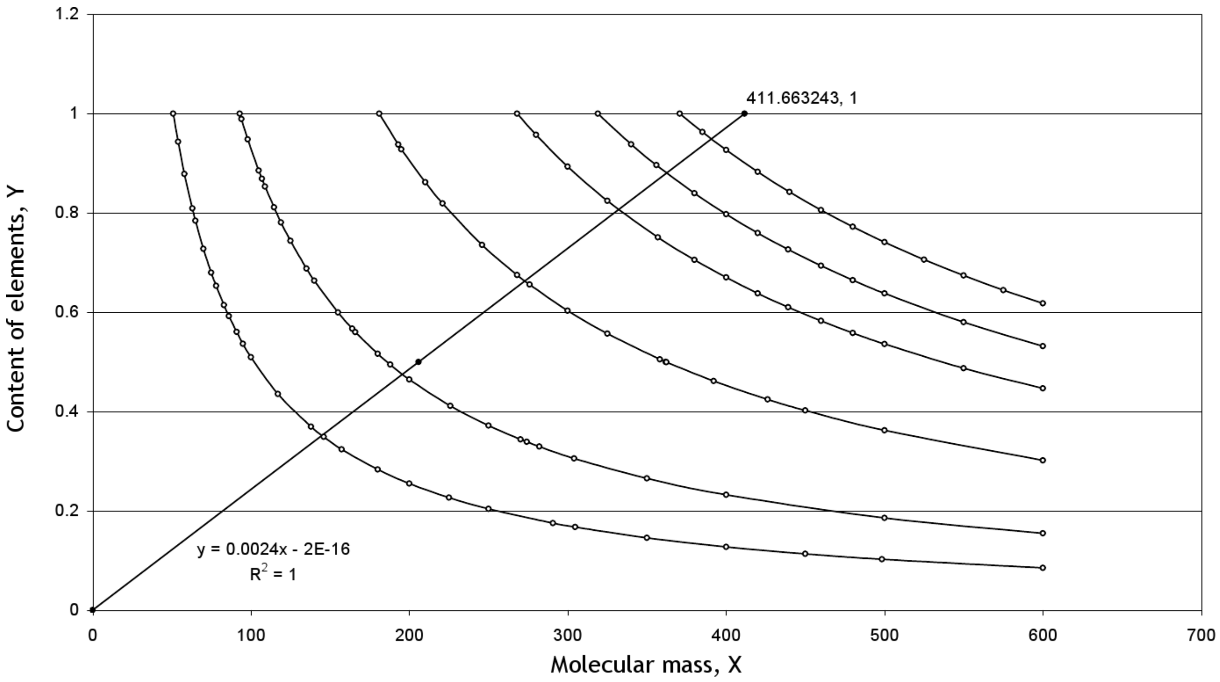

Fig. C-14: Hyperbolas created for the elements of Group 5 of the Periodic Table. From left to right: V, Nb, Ta, Db, No. 123, No. 141. The real axis is diagonally crossing the graph.

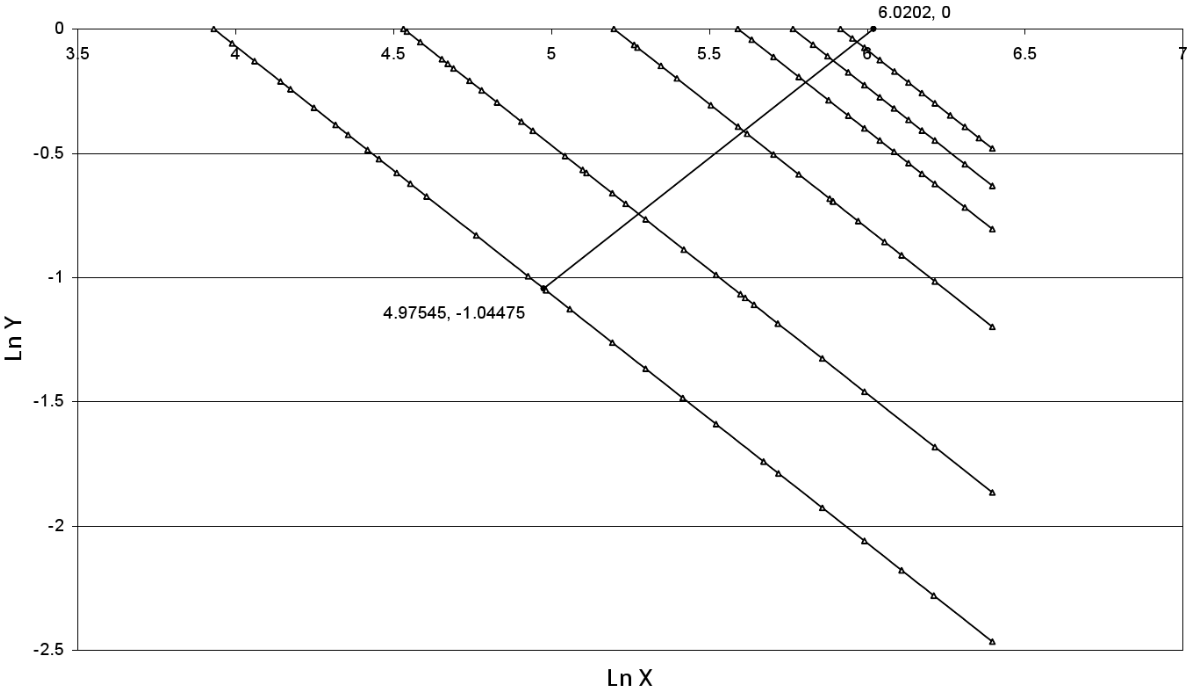

Fig. C-15: The same data of Group 5 of the Periodic Table, repsented in the logarithmic coordinates. From left to right: V, Nb, Ta, Db, No. 123, No. 141. The real axis is diagonally crossing the lines.

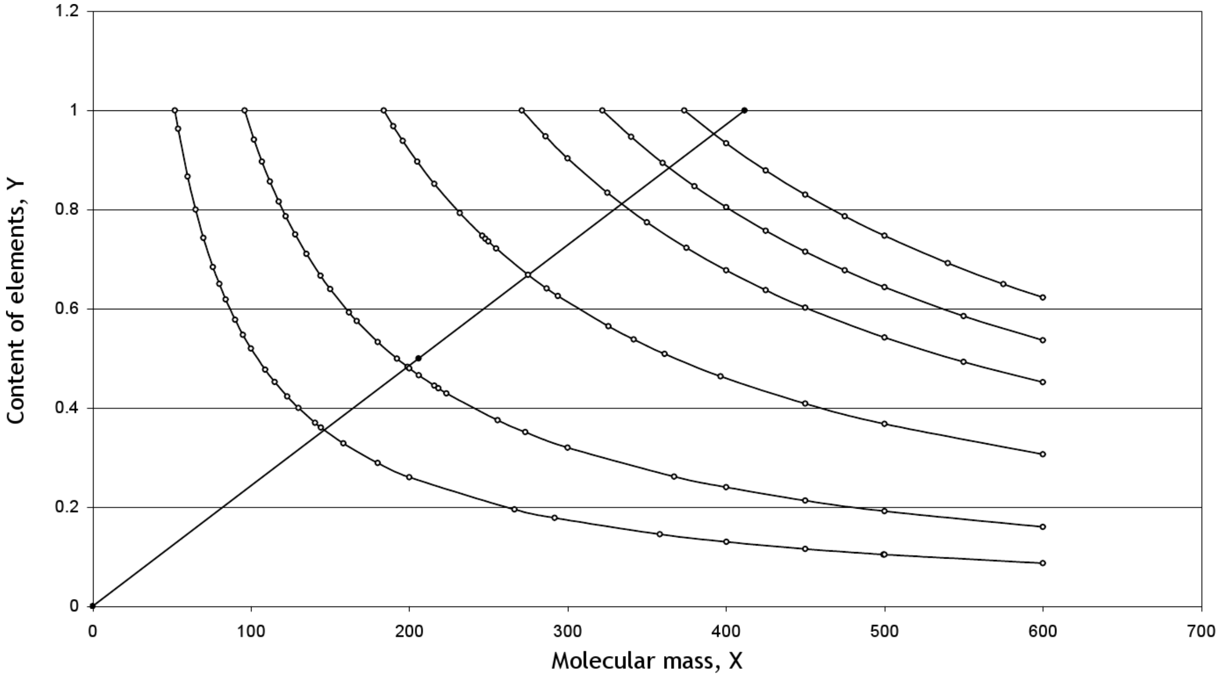

Fig. C-16: Hyperbolas created for the elements of Group 6 of the Periodic Table. From left to right: Cr, Mo, W, Sg, No. 124, No. 142. The real axis is diagonally crossing the graph.

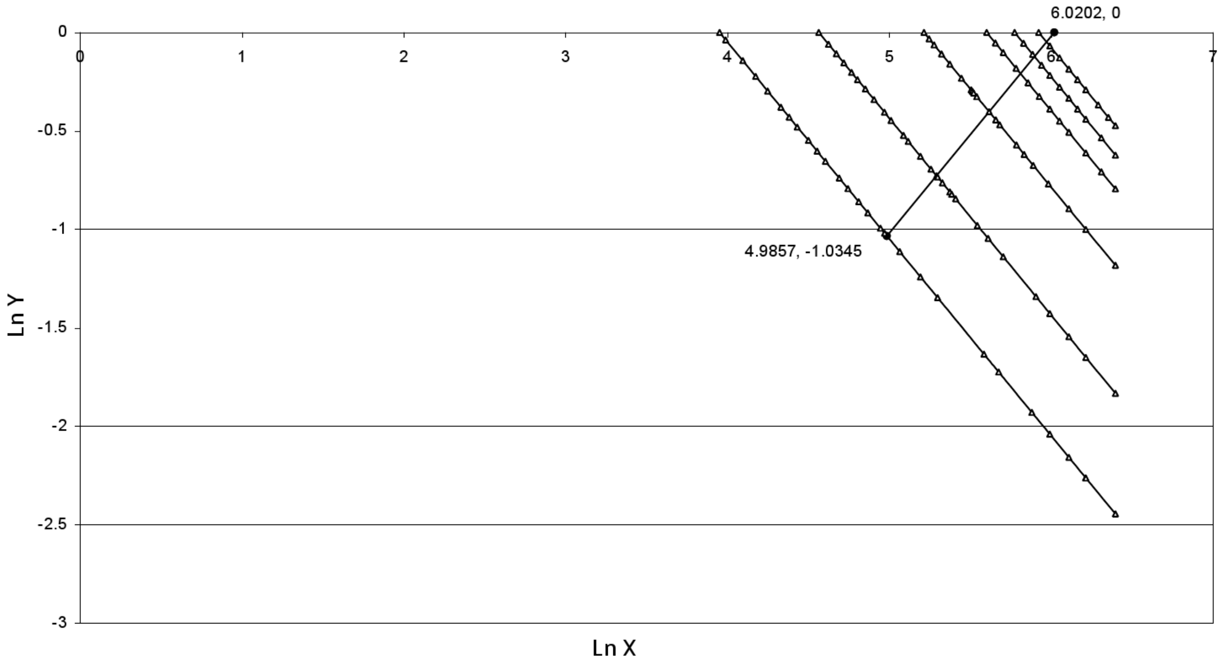

Fig. C-17a: The same data of Group 6 of the Periodic Table, repsented in the logarithmic coordinates. From left to right: Cr, Mo, W, Sg, No. 124, No. 142. The data presented here are not shifted along the coordinate axes.

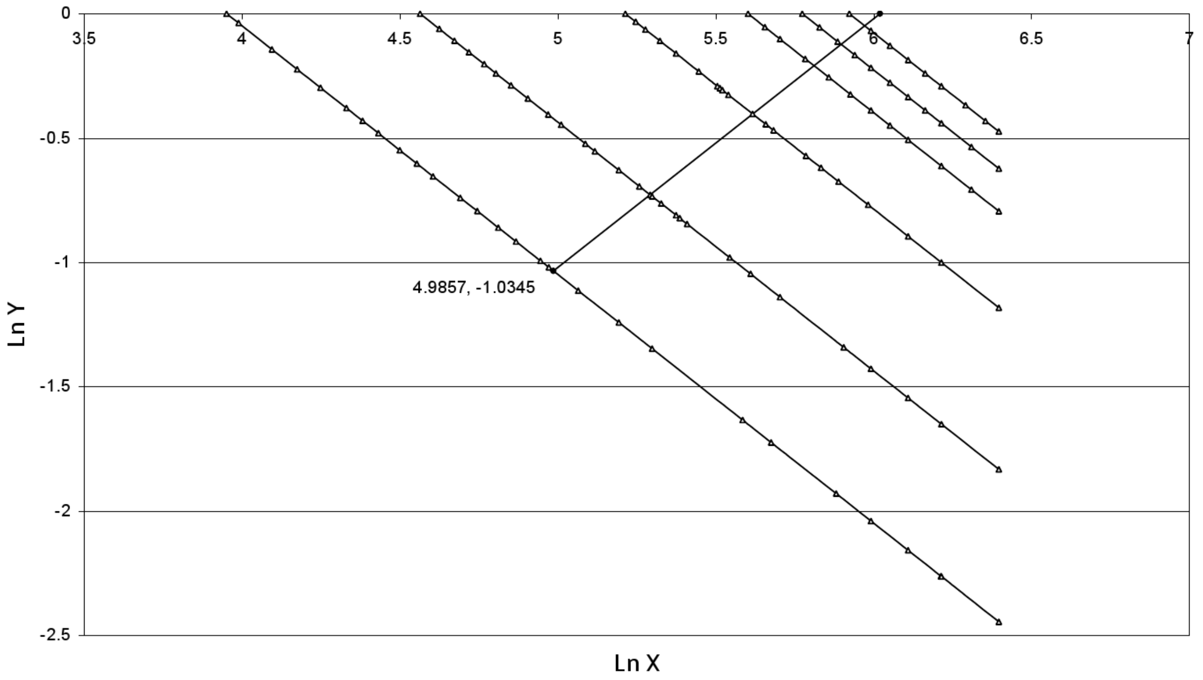

Fig. C-17b: The same data of Group 6 of the Periodic Table, repsented in the logarithmic coordinates. From left to right: Cr, Mo, W, Sg, No. 124, No. 142. The data shifted along the coordinate axes. The real axis is diagonally crossing the lines.

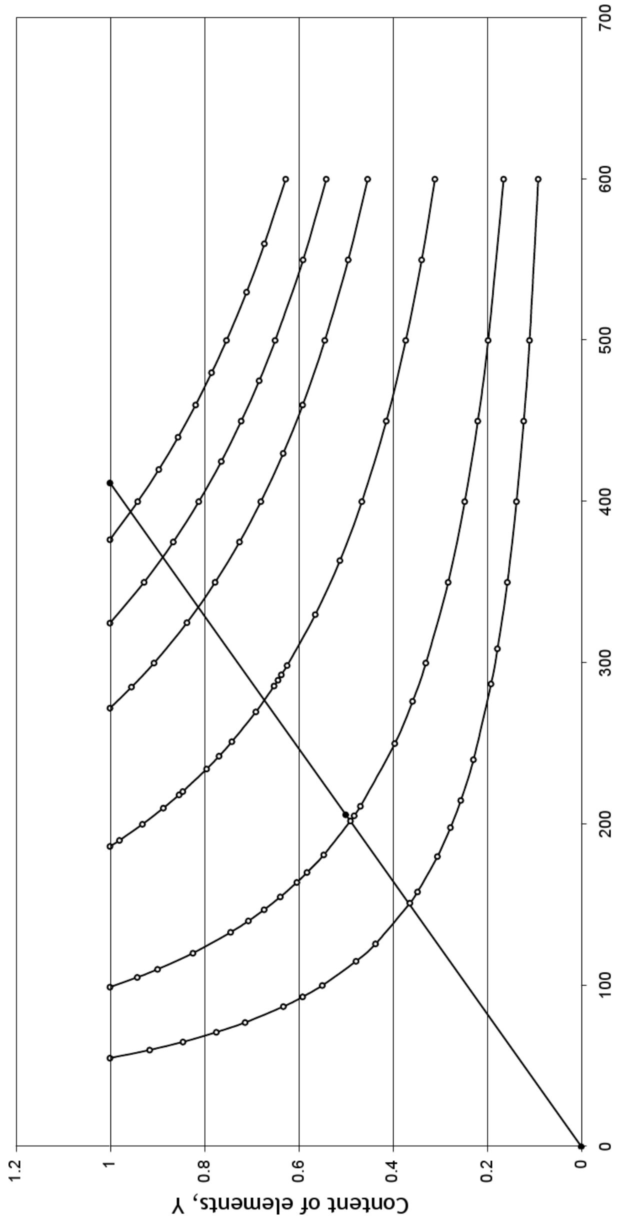

Fig. C-18: Hyperbolas created for the elements of Group 7 of the Periodic Table. From left to right: Mn, Tc, Re, Bh, No. 125, No. 143. The data presented here are not shifted along the coordinate axes. The real axis is diagonally crossing the graph.

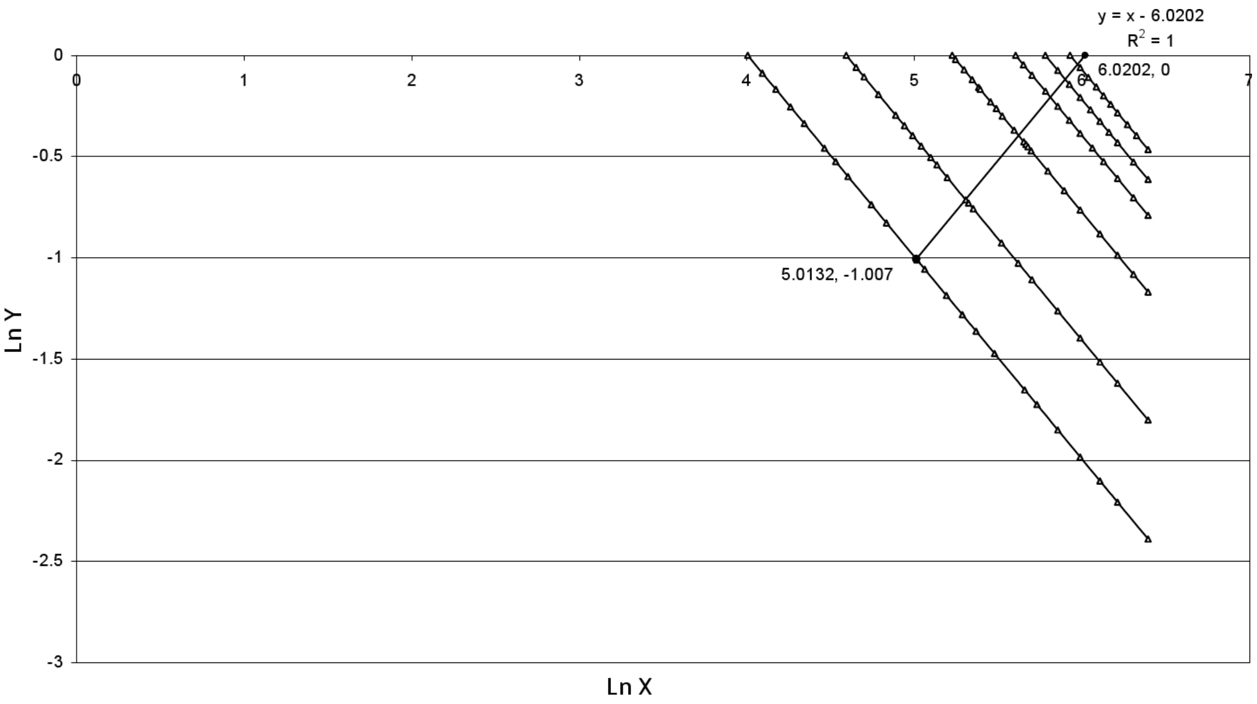

Fig. C-19: The same data of Group 7 of the Periodic Table, repsented in the logarithmic coordinates. From left to right: Mn, Tc, Re, Bh, No. 125, No. 143. The data presented here are not shifted along the coordinate axes. The real axis is diagonally crossing the lines.

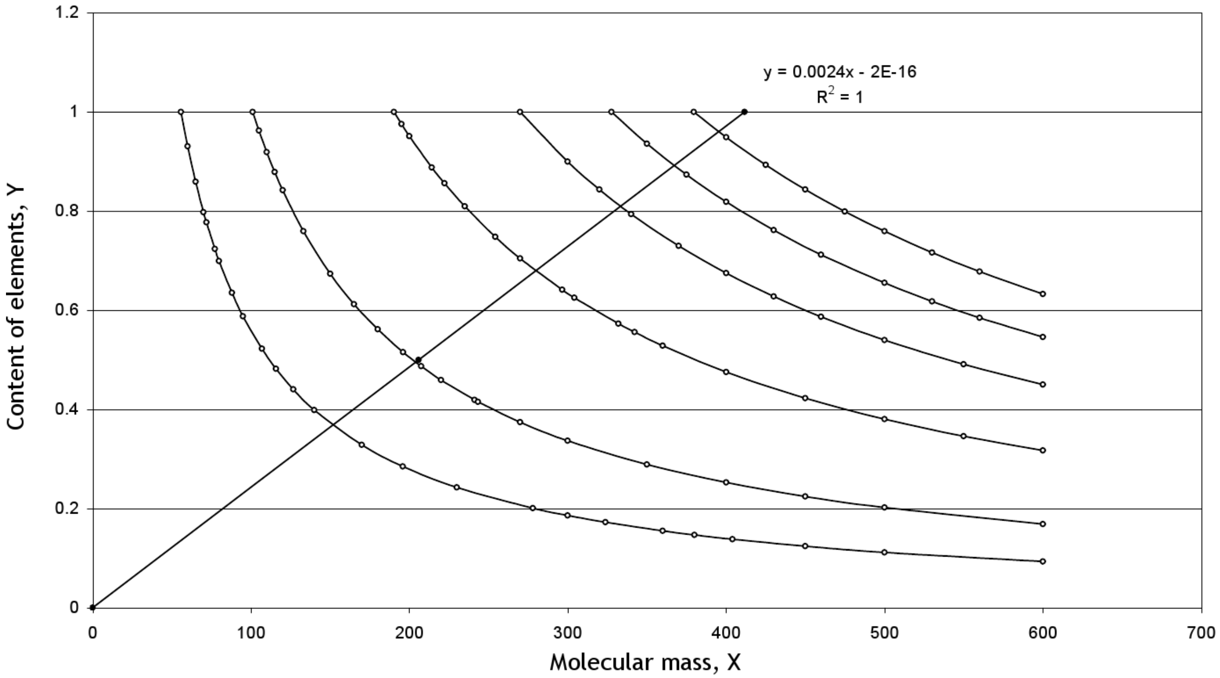

Fig. C-20: Hyperbolas created for the elements of Group 8 of the Periodic Table. From left to right: Fe, Ru, Os, Hs, No. 126, No. 144. The data presented here are not shifted along the coordinate axes. The real axis is diagonally crossing the graph.

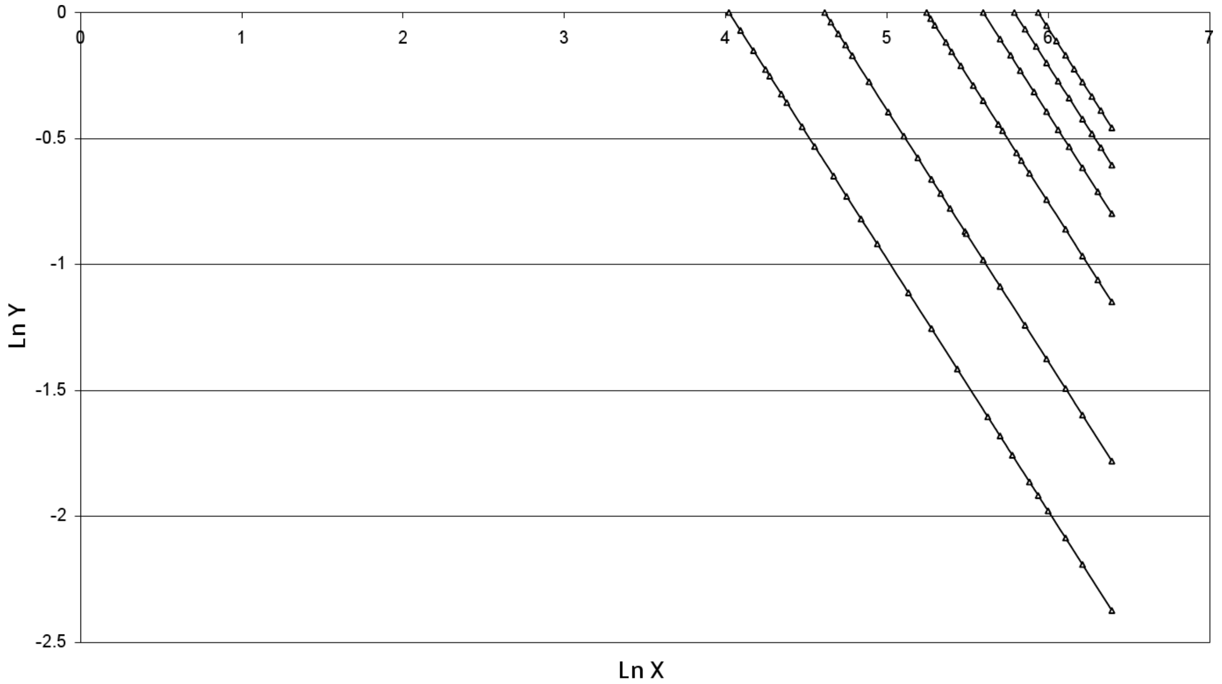

Fig. C-21: The same data of Group 8 of the Periodic Table, repsented in the logarithmic coordinates. From left to right: Fe, Ru, Os, Hs, No. 126, No. 144. The data presented here are not shifted along the coordinate axes. The real axis is diagonally crossing the lines.

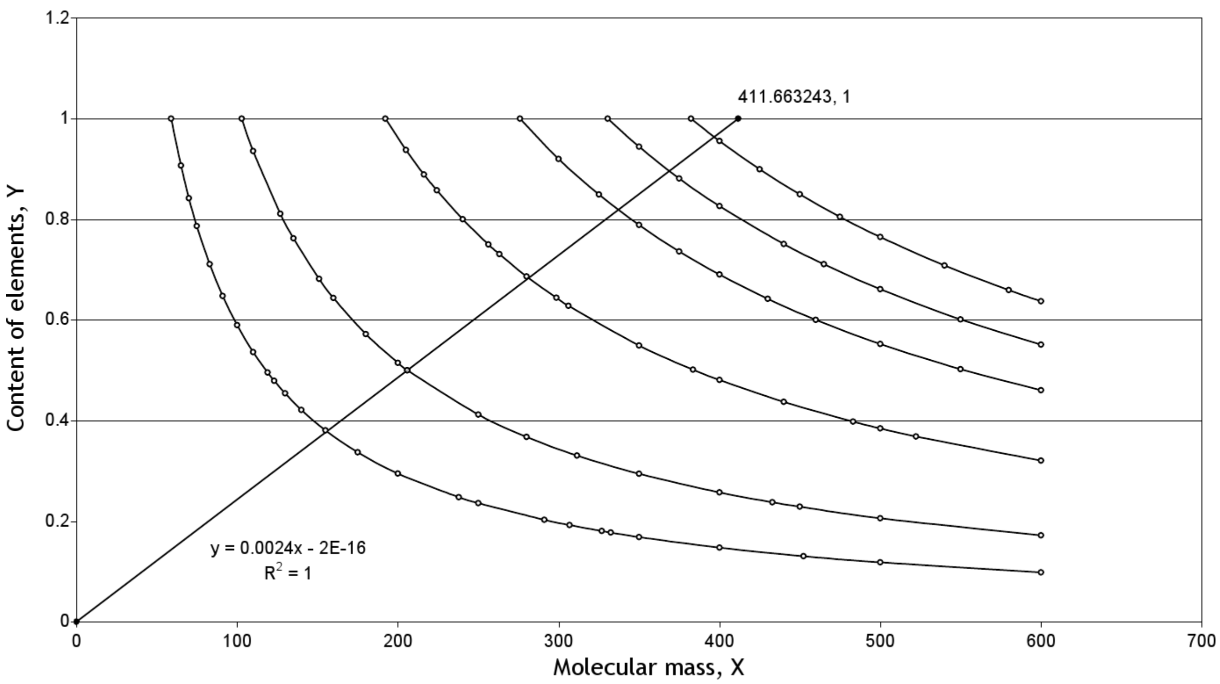

Fig. C-22: Hyperbolas created for the elements of Group 9 of the Periodic Table. From left to right: Co, Rh, Ir, Mt, No. 127, No. 145. The real axis is diagonally crossing the graph.

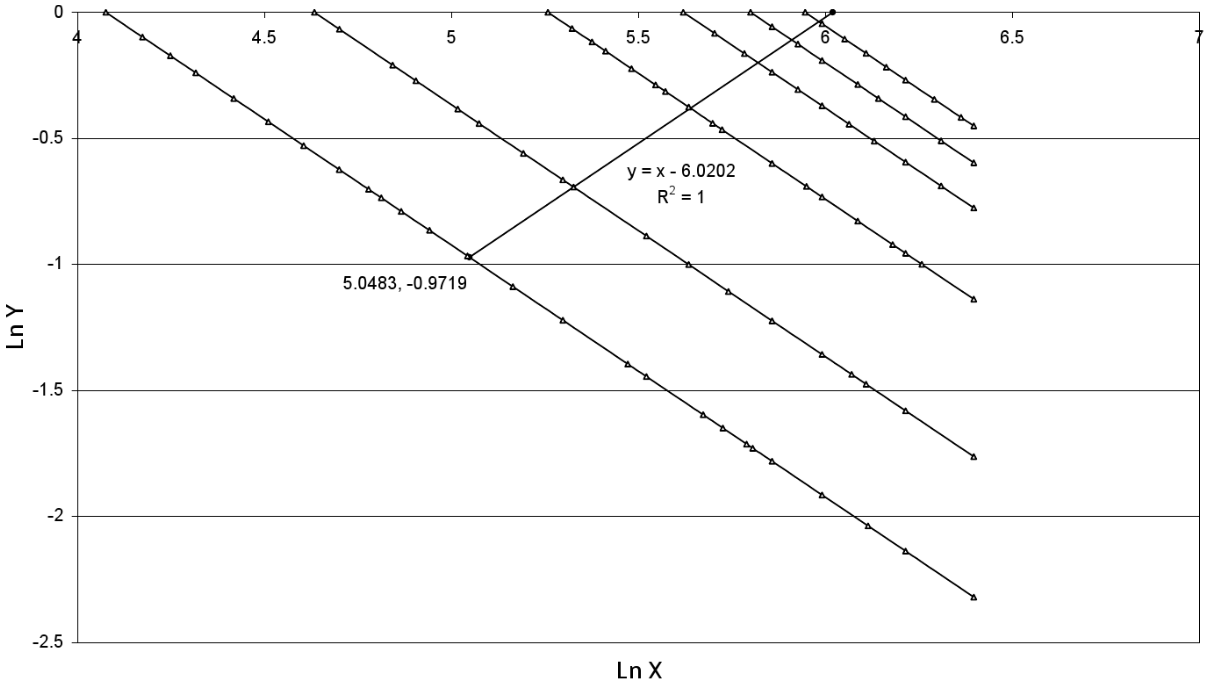

Fig. C-23: The same data of Group 9 of the Periodic Table, repsented in the logarithmic coordinates. From left to right: Co, Rh, Ir, Mt, No. 127, No. 145. The data presented here are shifted along the coordinate axes. The real axis is diagonally crossing the lines.

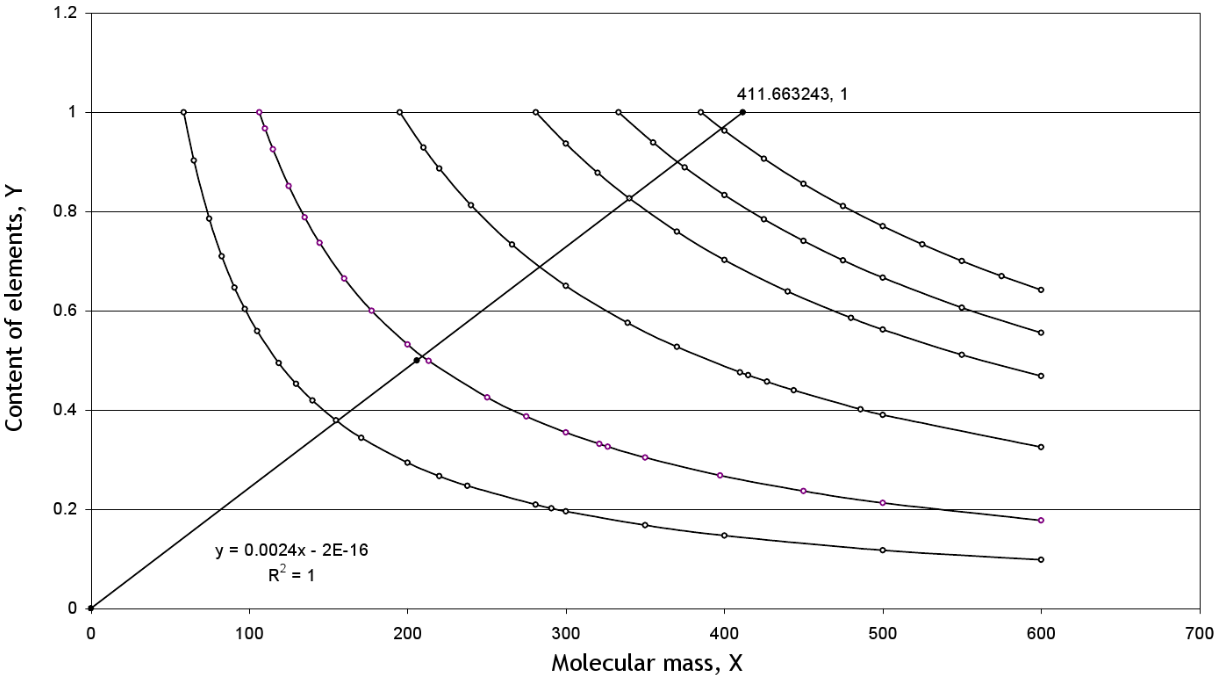

Fig. C-24: Hyperbolas created for the elements of Group 10 of the Periodic Table. From left to right: Ni, Pd, Pt, Ds, No. 128, No. 146. The real axis is diagonally crossing the graph.

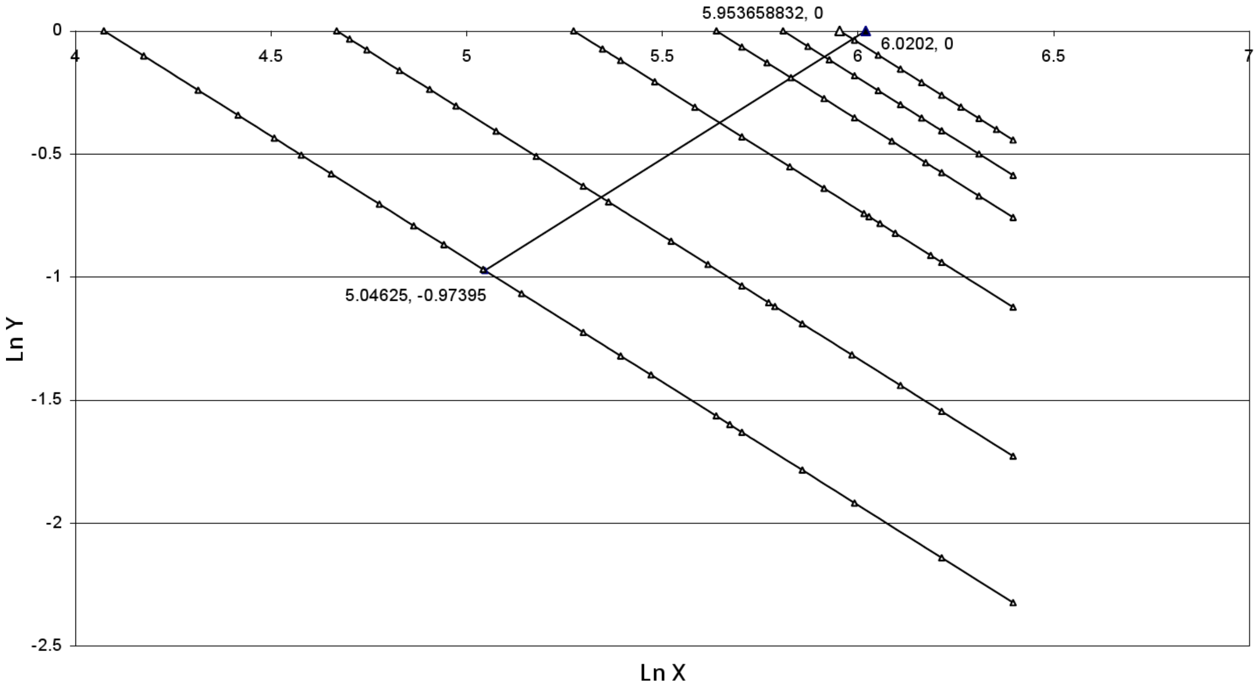

Fig. C-25: The same data of Group 10 of the Periodic Table, repsented in the logarithmic coordinates. From left to right: Ni, Pd, Pt, Ds, No. 128, No. 146. The data presented here are shifted along the coordinate axes. The real axis is diagonally crossing the lines.

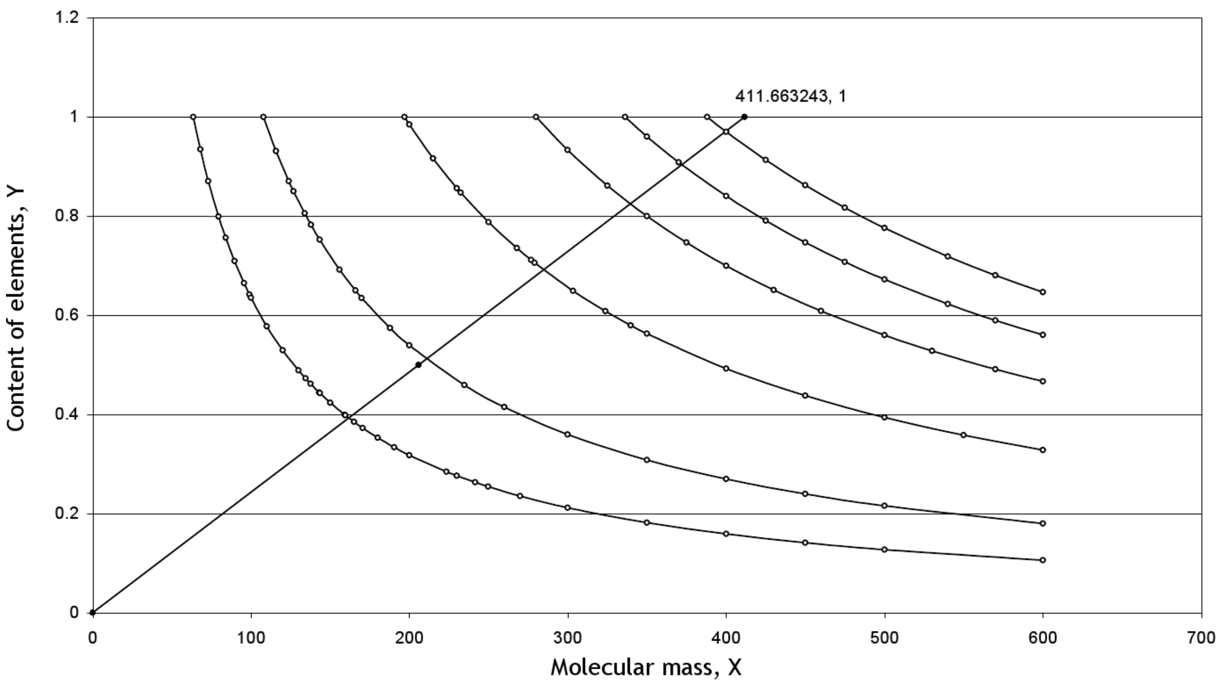

Fig. C-26: Hyperbolas created for the elements of Group 11 of the Periodic Table. From left to right: Cu, Ag, Au, Rg, No. 129, No. 147. The real axis is diagonally crossing the graph.

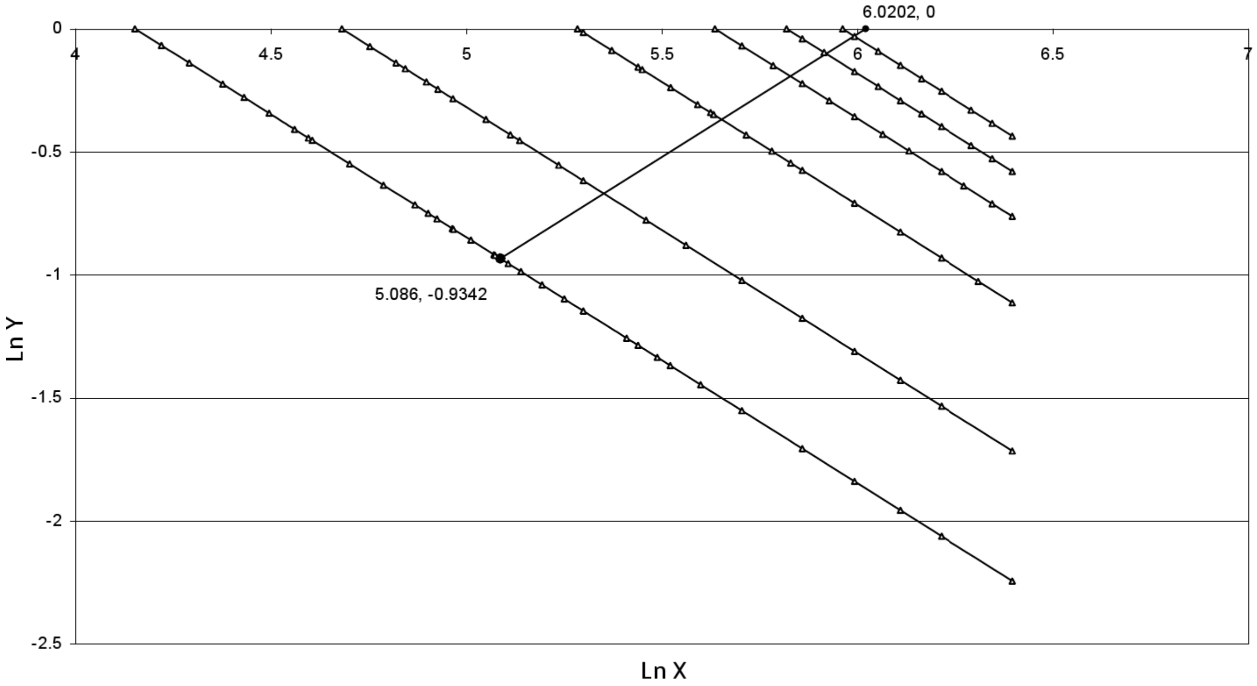

Fig. C-27: The same data of Group 11 of the Periodic Table, repsented in the logarithmic coordinates. From left to right: Cu, Ag, Au, Rg, No. 129, No. 147. The data presented here are shifted along the coordinate axes. The real axis is diagonally crossing the lines.

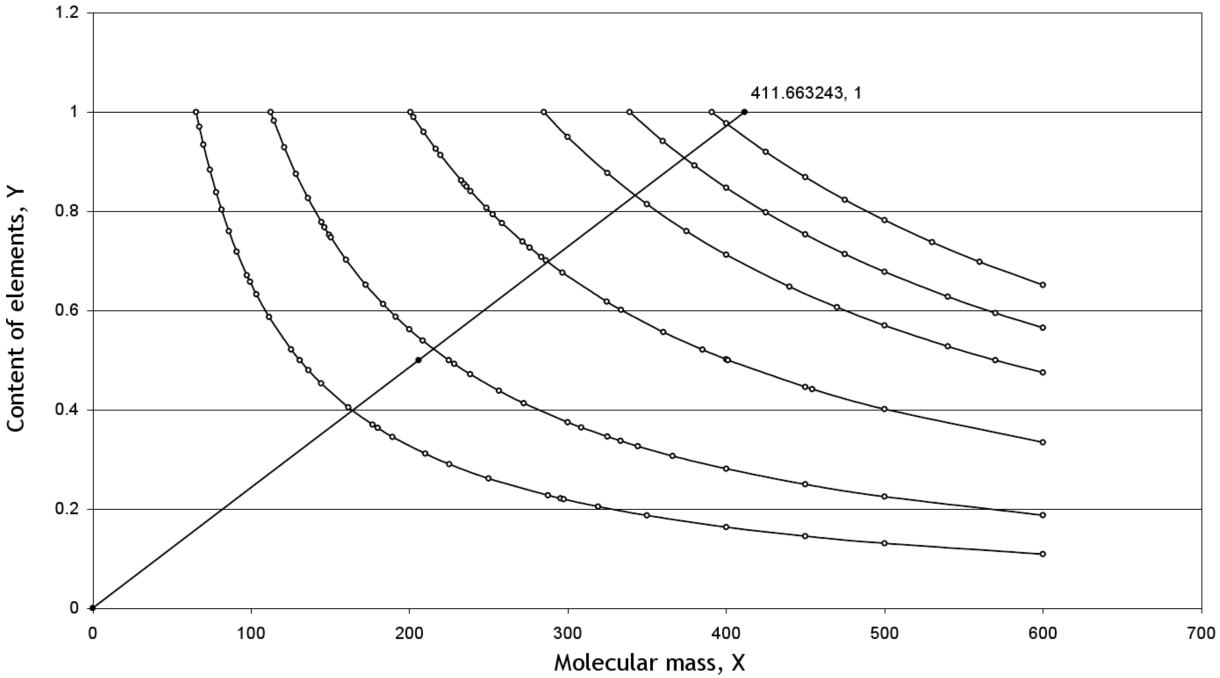

Fig. C-28: Hyperbolas created for the elements of Group 12 of the Periodic Table. From left to right: Zn, Cd, Hg, Cp, No. 130, No. 148. The real axis is diagonally crossing the graph.

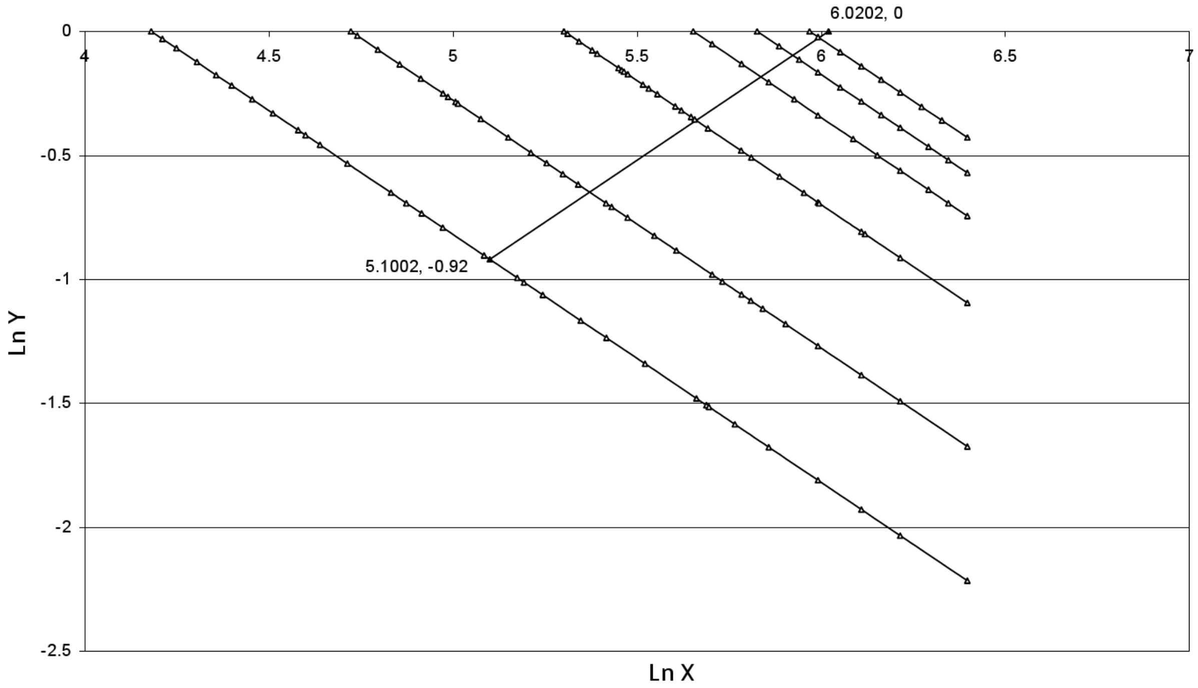

Fig. C-29: The same data of Group 12 of the Periodic Table, repsented in the logarithmic coordinates. From left to right: Zn, Cd, Hg, Cp, No. 130, No. 148. The data presented here are shifted along the coordinate axes. The real axis is diagonally crossing the lines.

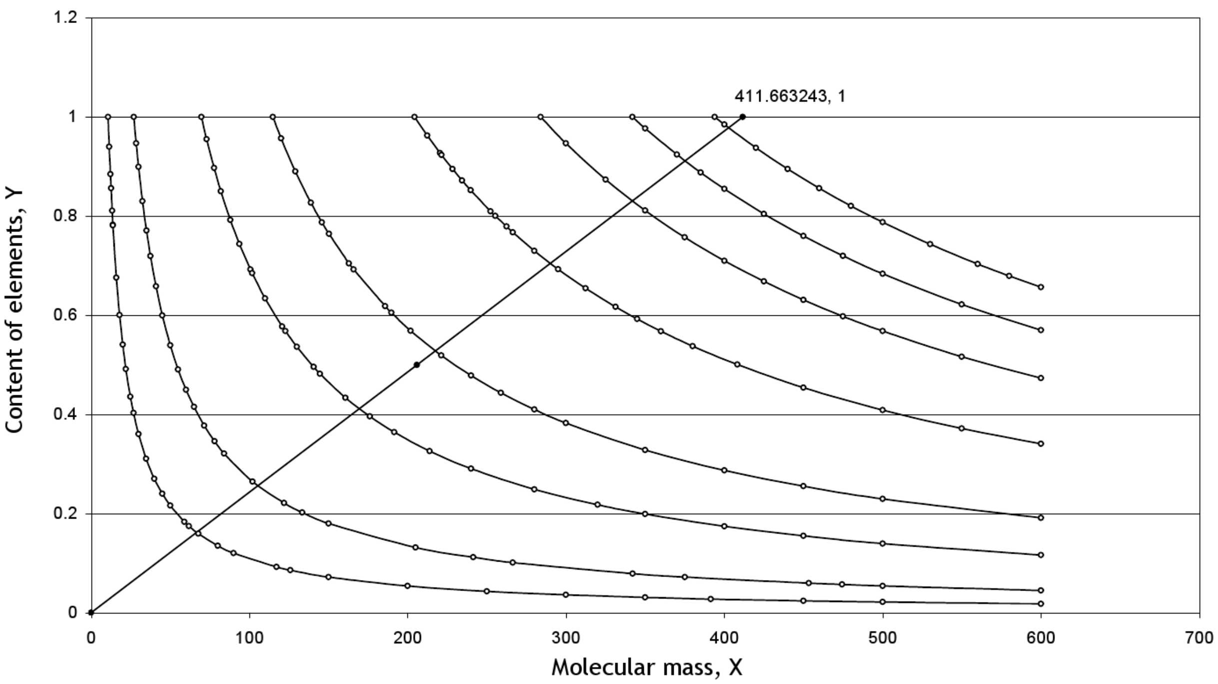

Fig. C-30: Hyperbolas created for the elements of Group 13 of the Periodic Table. From left to right: B, Al, Ga, In, Tl, Uut, No. 131, No. 149. The real axis is diagonally crossing the graph.

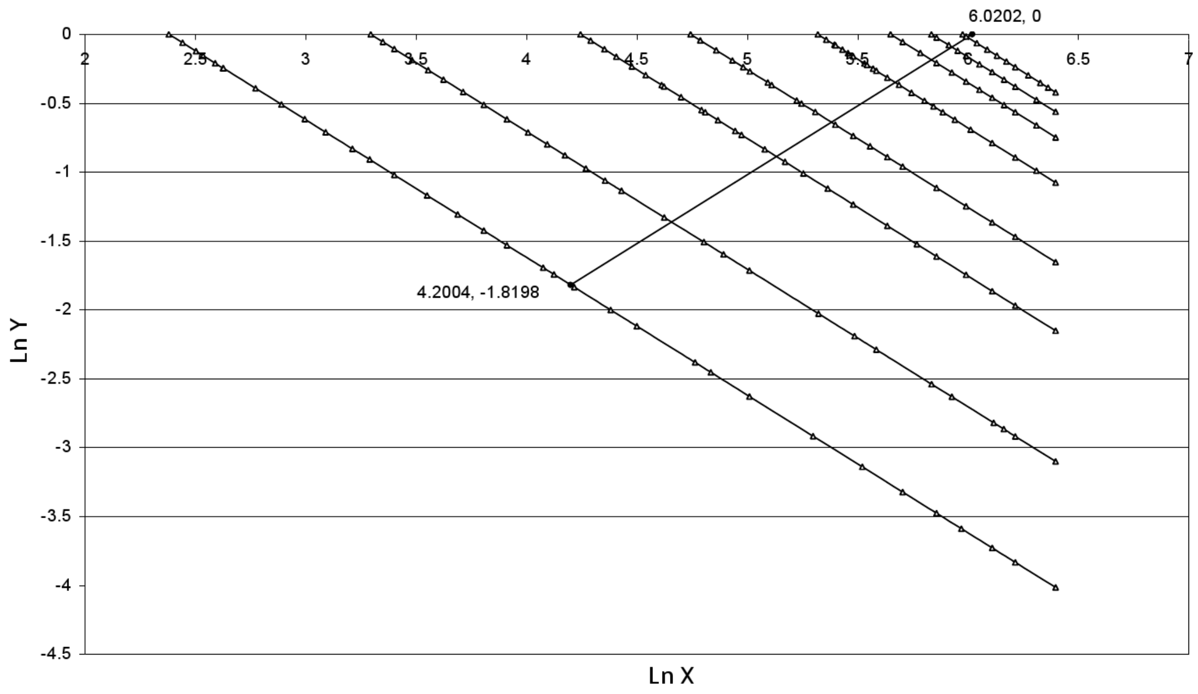

Fig. C-31: The same data of Group 13 of the Periodic Table, repsented in the logarithmic coordinates. From left to right: B, Al, Ga, In, Tl, Uut, No. 131, No. 149. The data presented here are shifted along the coordinate axes. The real axis is diagonally crossing the lines.

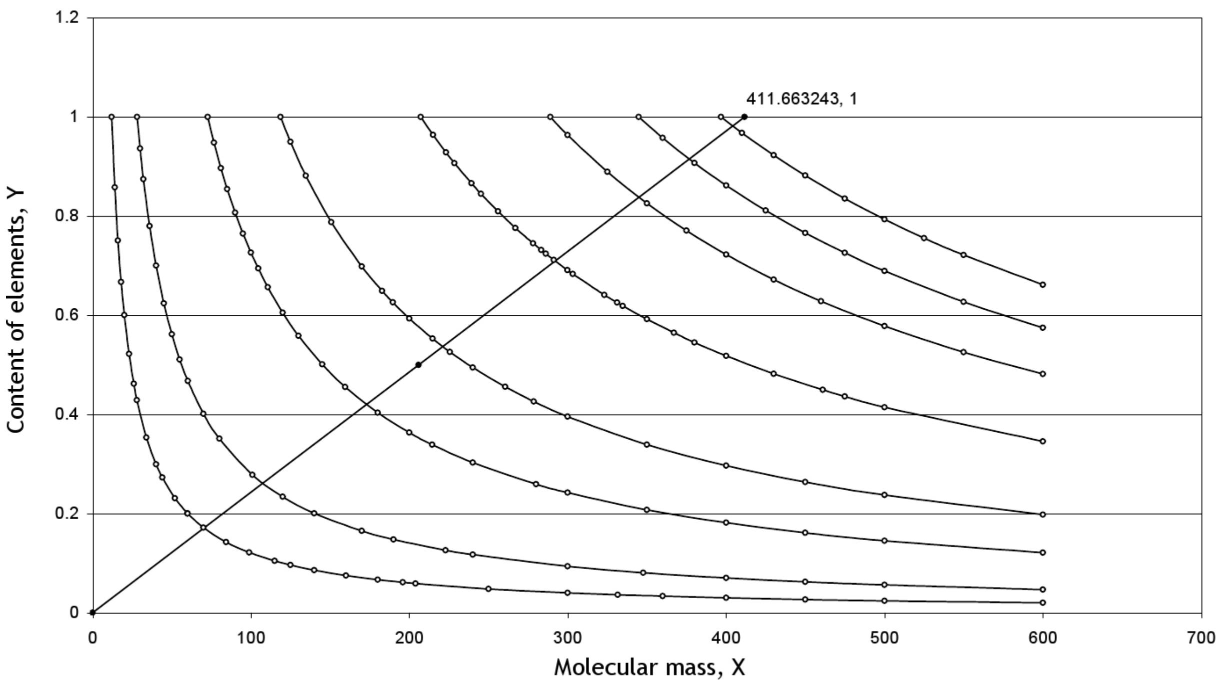

Fig. C-32: Hyperbolas created for the elements of Group 14 of the Periodic Table. From left to right: C, Si, Ge, Sn, Pb, Uuq, No. 132, No. 150. The real axis is diagonally crossing the graph.

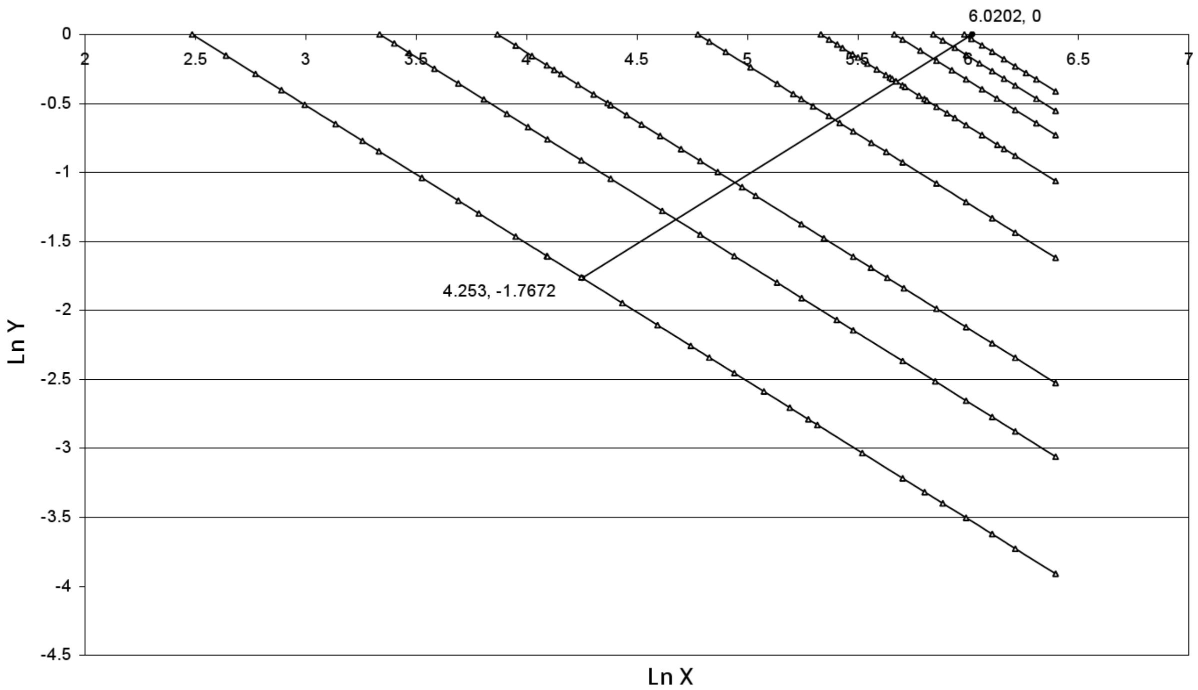

Fig. C-33: The same data of Group 14 of the Periodic Table, repsented in the logarithmic coordinates. From left to right: C, Si, Ge, Sn, Pb, Uuq, No. 132, No. 150. The data presented here are shifted along the coordinate axes. The real axis is diagonally crossing the lines.

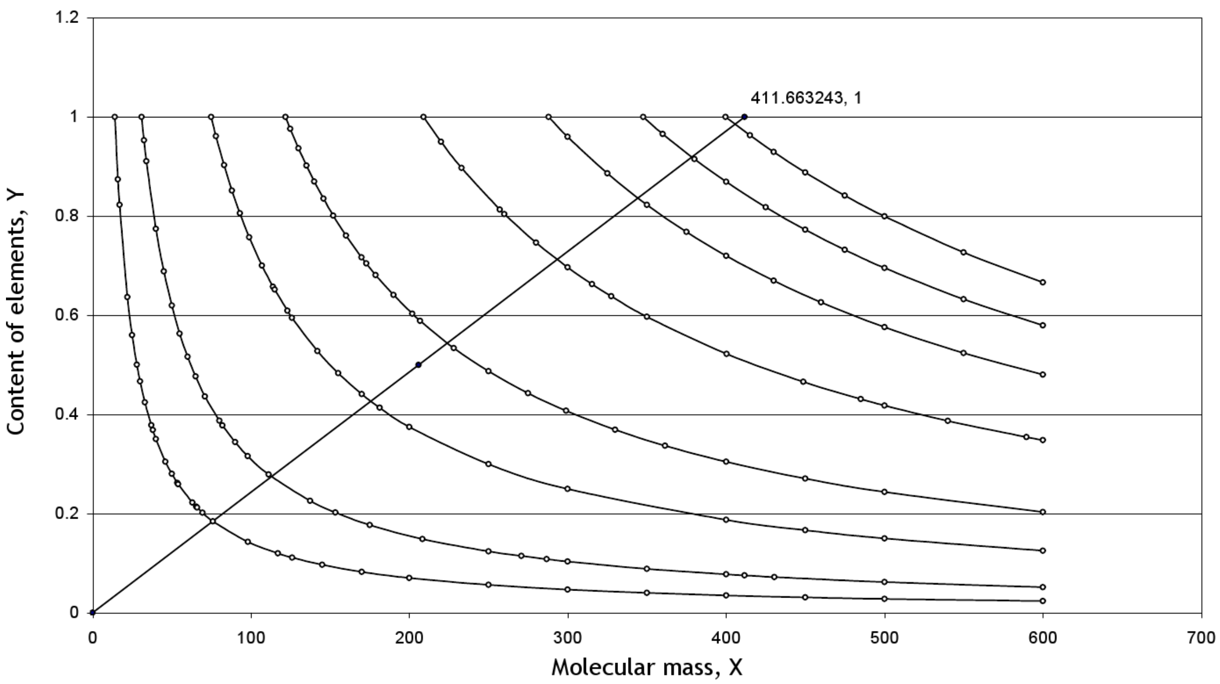

Fig. C-34: Hyperbolas created for the elements of Group 15 of the Periodic Table. From left to right: N, P, As, Sb, Bi, Uup, No. 133, No. 151. The real axis is diagonally crossing the graph.

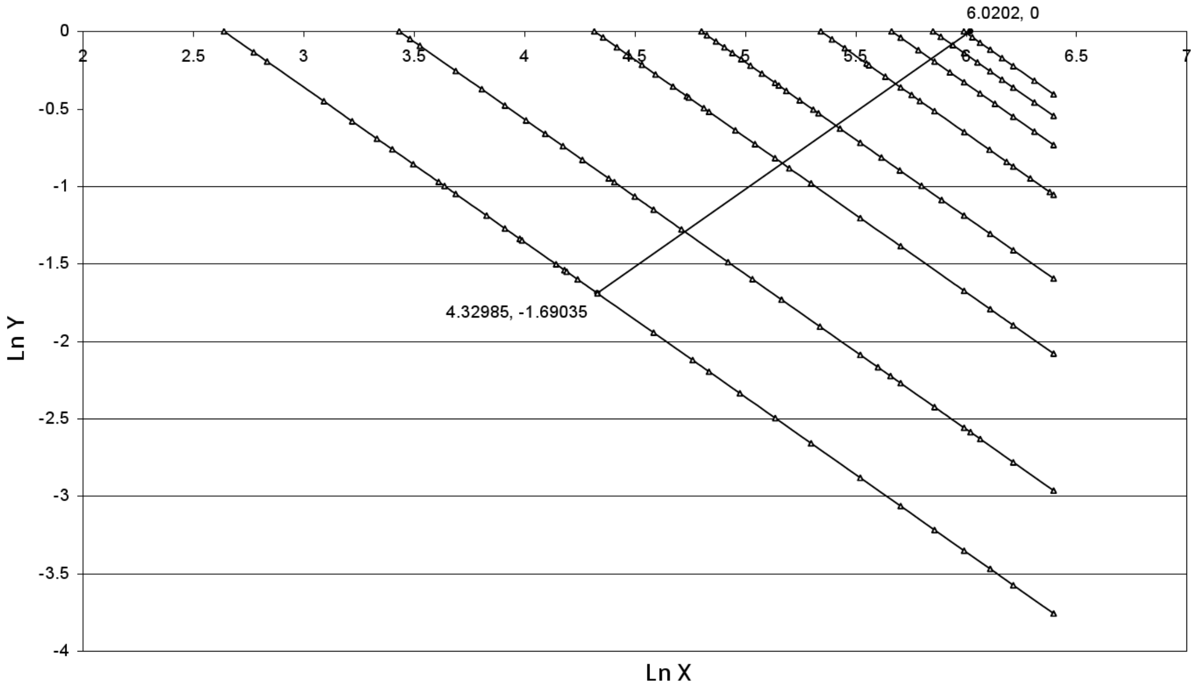

Fig. C-35: The same data of Group 15 of the Periodic Table, repsented in the logarithmic coordinates. From left to right: N, P, As, Sb, Bi, Uup, No. 133, No. 151. The data presented here are shifted along the coordinate axes. The real axis is diagonally crossing the lines.

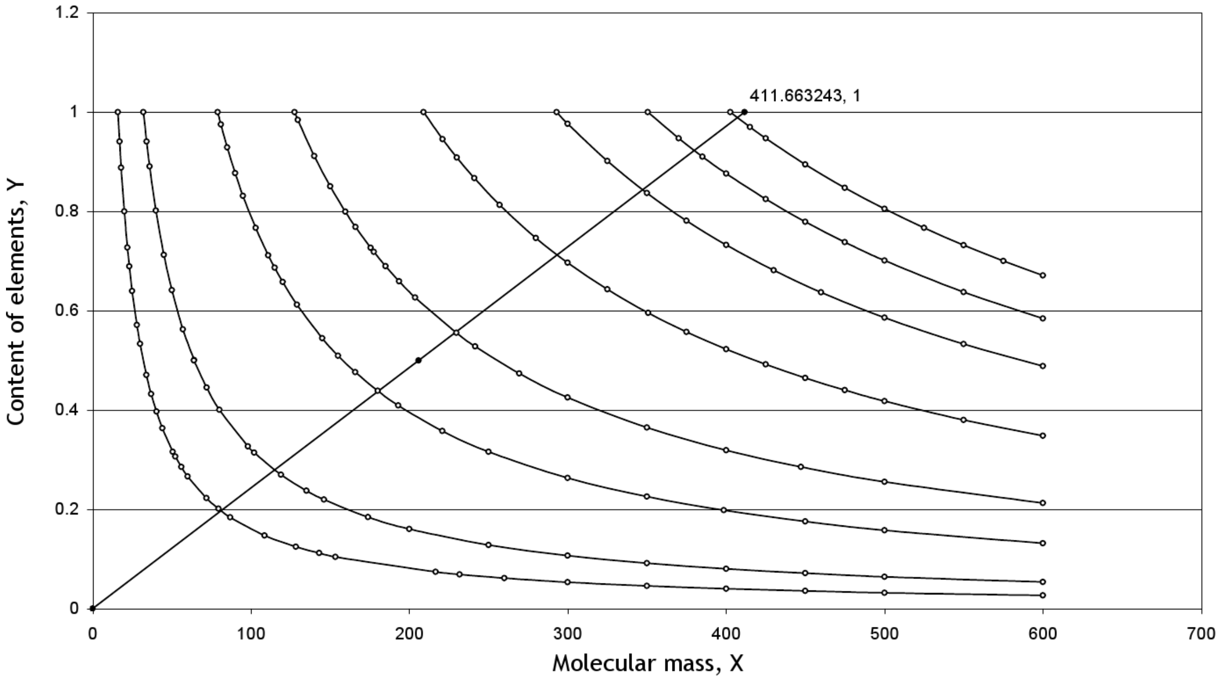

Fig. C-36: Hyperbolas created for the elements of Group 16 of the Periodic Table. From left to right: O, S, Se, Te, Po, Uuh, No. 134, No. 152. The real axis is diagonally crossing the graph.

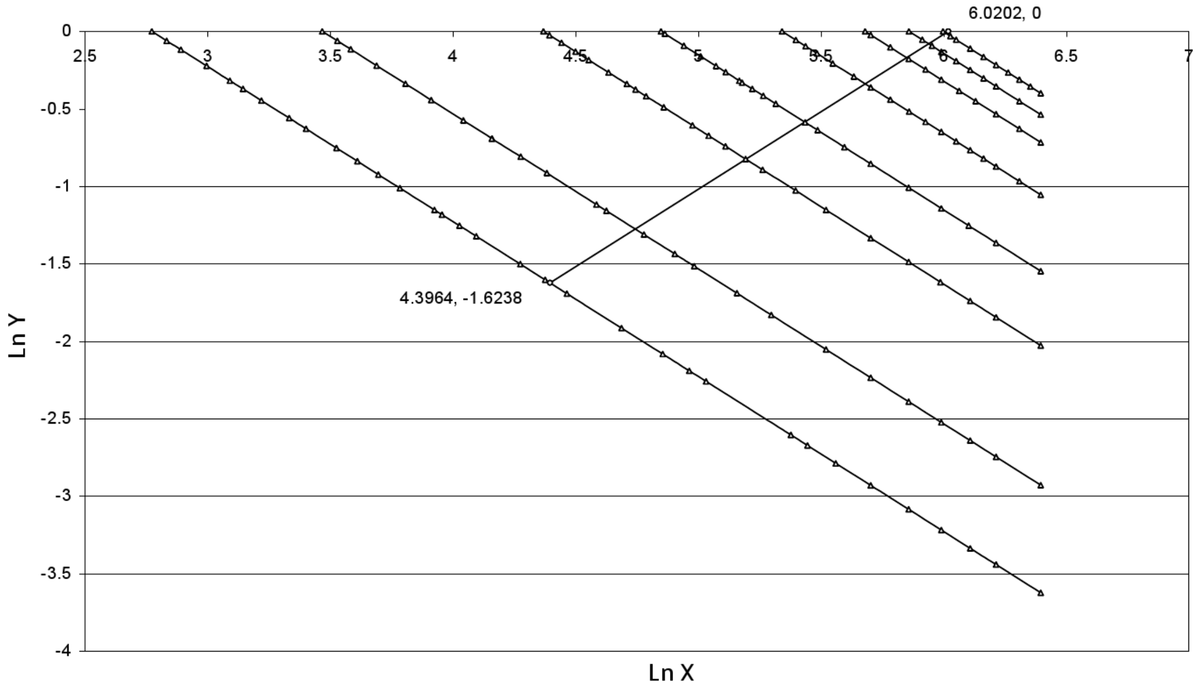

Fig. C-37: The same data of Group 16 of the Periodic Table, repsented in the logarithmic coordinates. From left to right: O, S, Se, Te, Po, Uuh, No. 134, No. 152. The data presented here are shifted along the coordinate axes. The real axis is diagonally crossing the lines.

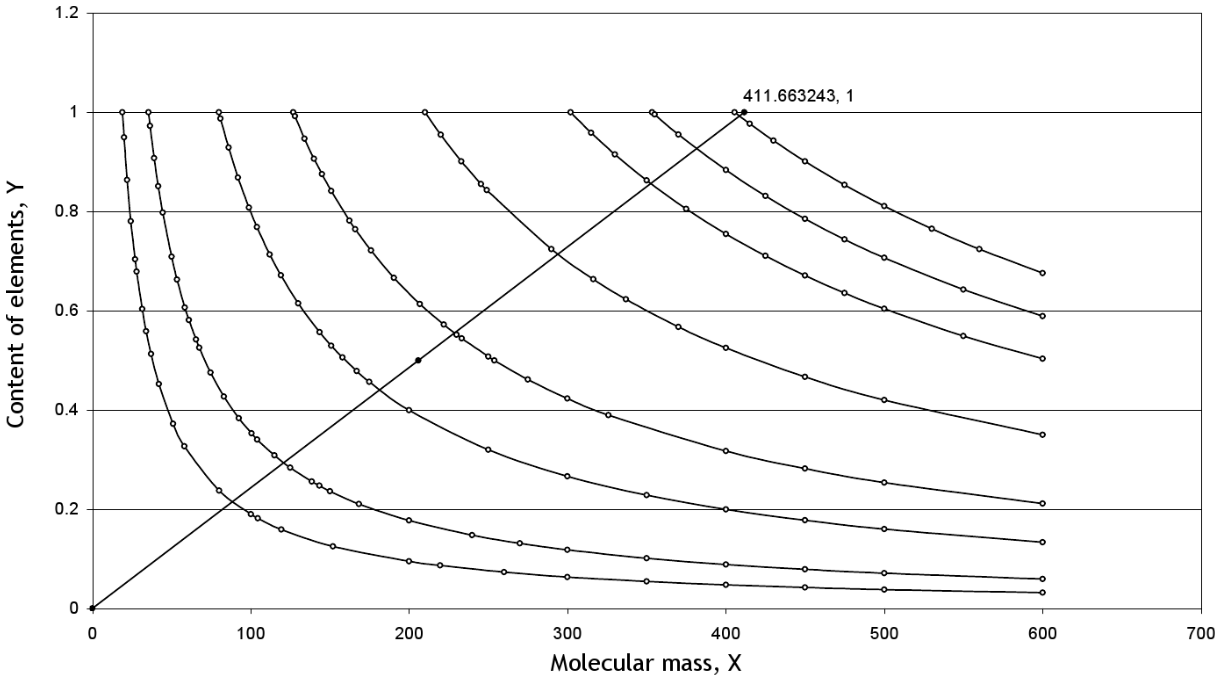

Fig. C-38: Hyperbolas created for the elements of Group 17 of the Periodic Table. From left to right: F, Cl, Br, I, At, Uus, No. 135, No. 153. The real axis is diagonally crossing the graph.

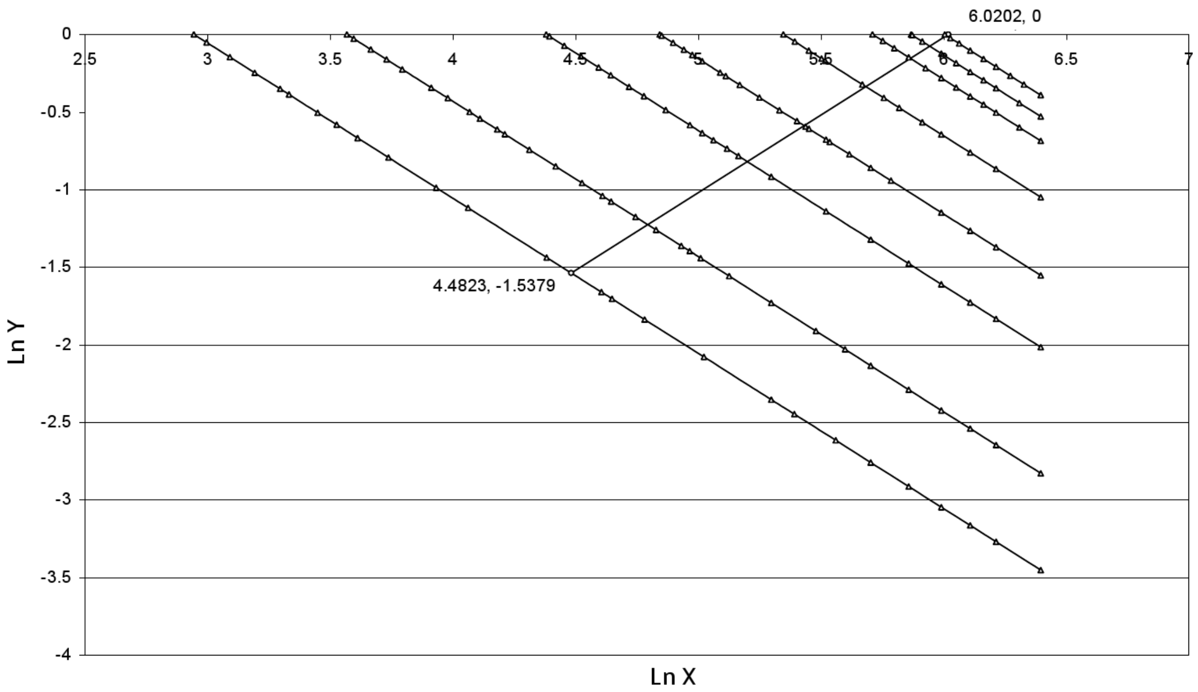

Fig. C-39: The same data of Group 17 of the Periodic Table, repsented in the logarithmic coordinates. From left to right: F, Cl, Br, I, At, Uus, No. 135, No. 153. The data presented here are shifted along the coordinate axes. The real axis is diagonally crossing the lines.

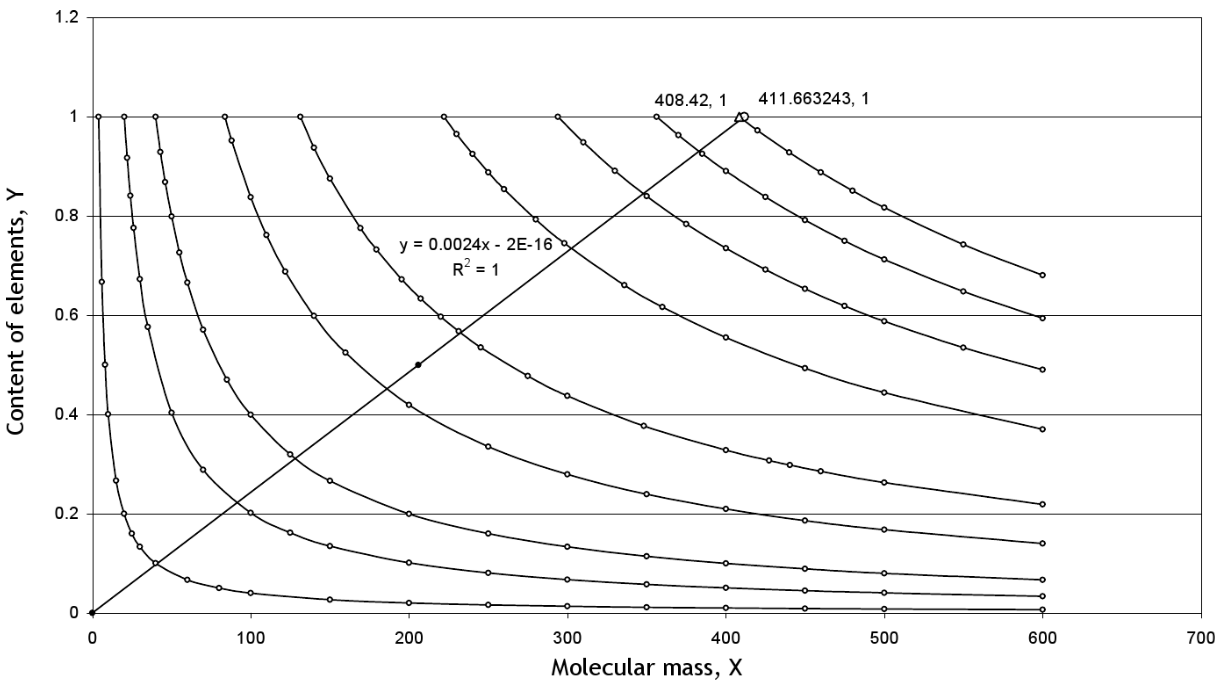

Fig. C-40: Hyperbolas created for the elements of Group 18 of the Periodic Table. From left to right: He, Ne, Ar, Kr, Xe, Rn, Uuo, No. 136, No. 154. The real axis is diagonally crossing the graph.

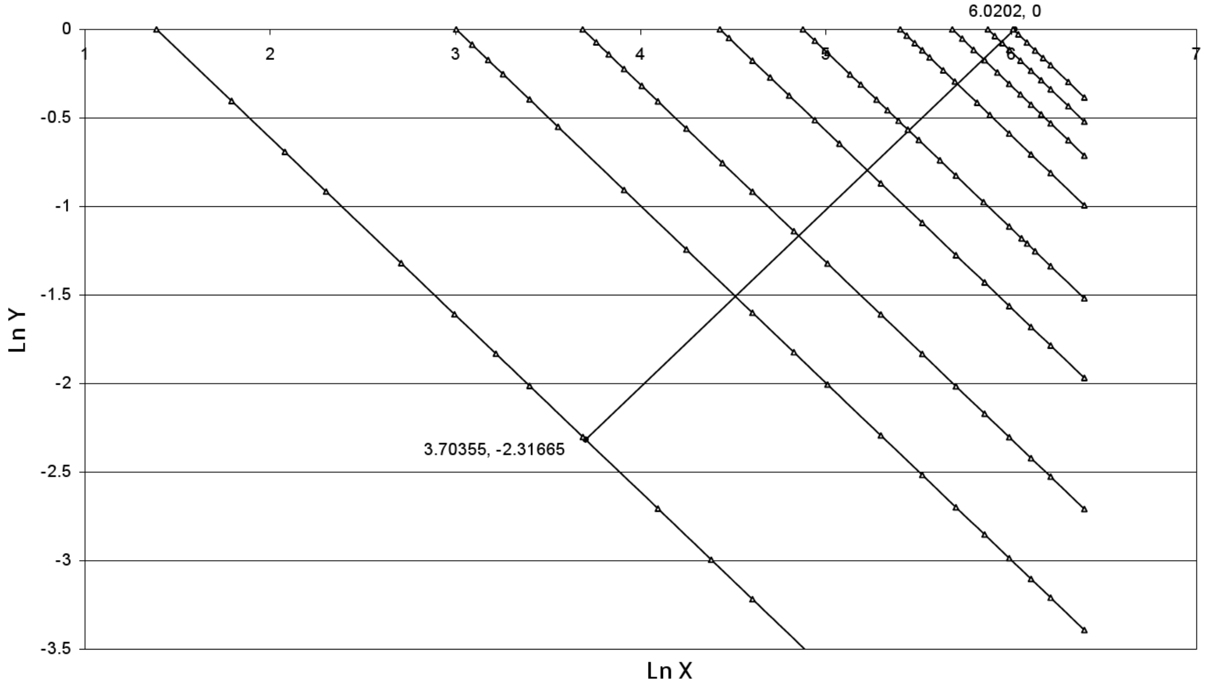

Fig. C-41: The same data of Group 18 of the Periodic Table, repsented in the logarithmic coordinates. From left to right: He, Ne, Ar, Kr, Xe, Rn, Uuo, No. 136, No. 154. The data presented here are shifted along the coordinate axes. The real axis is diagonally crossing the lines.

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Upper Limit in Mendeleev's Periodic Table — Element No.155

by Albert Khazan

This book represents a result of many-year theoretical research, which manifested hyperbolic law in Mendeleev's Periodic Table. According to the law, an upper limit (heaviest element) exists in Mendeleev's Table, whose atomic mass is 411.66 and No.155. It is shown that the heaviest element No.155 can be a reference point in nuclear reactions. Due to symmetry of the hyperbolic law, the necessity of the Table of Anti-Elements, consisting of anti-substance, has been predicted. This manifests that the found hyperbolic law is universal, and the Periodic Table is common for elements and anti-elements.

Den over gränsen i Mendelejevs periodiska systemet — element No.155

av Albert Khazan

Boken är ett resultat av mångårig teoretisk forskning som ledde till upptäckten av den hyperboliska lagen i Periodiska tabellen. Enligt denna lag har det tyngsta möjliga elementet en atomvikt på 411.66 och nummer 155. Arbetet visar också att det tyngsta elementet kan tjäna som referenspunkt i kärnreaktioner. På grund av symmetrin i hyperboliska lagen går det också att förutse en Periodisk tabell med antielementen som utgör antimateria. Detta visar att den hyperboliska lagen är universell och att Periodiska tabell är gemensam för båda elementen och antielementen.

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