Applying Adjacent Hyperbolas to Calculation of the Upper Limit of the Periodic Table of Elements, with Use of Rhodium

Albert Khazan

E-mail: albkhazan@gmail.com

In the earlier study (Khazan A. Upper Limit in Mendeleev's Periodic Table — Element No. 155. 2nd ed., Svenska fysikarkivet, Stockholm, 2010) the author showed how Rhodium can be applied to the hyperbolic law of the Periodic Table of Elements in order to calculate, with high precision, all other elements conceivable in the Table. Here we obtain the same result, with use of fraction linear functions (adjacent hyperbolas).

1 Introduction

In the theoretical deduction of the hyperbolic law of the Periodic Table of Elements [1], the main attention was focused onto the following subjects: the equilateral hyperbola with the central point at the coordinates (0; 0), its top, the real axis, and the line tangential to the normal of the hyperbola. All these were created for each element having the known or arbitrary characteristics. We chose the top of the hyperbolas, in order to describe a chemical process with use of Lagrange's theorem; reducing them to the equation $Y = K/X$ was made through the scaling coefficient 20.2895, as we have deduced.

The upper limit of the Table of Elements, which is the heaviest (last) element of the Table, is determined within the precision we determine the top of its hyperbola [1]. Therefore hyperbolas which are related to fraction linear functions were deduced. These hyperbolas are equilateral as well, but differ in the coordinates of their centre: $x = 0$, $y = 1$. To avoid possible mistakes in the future, the following terminology has been assumed: hyperbolas of the kind $y = k/x$ are referred to as *straight*; equilateral hyperbolas of the kind $y = (ax + b)/(cx + d)$ are referred to as *adjacent*. The latter ones bear the following properties: such a hyperbola intersects with the respective straight hyperbola at the ordinate $y = 0.5$ and the abscissa equal to the double mass of the element; the line $y = 0.5$ is the axis of symmetry for the arcs; the real and tangential lines of such hyperbolas meet each other; the normal of such a hyperbola is the real axis and the tangential line of another hyperbola of this kind.

The found common properties of the hyperbolas provided a possibility to use them for determination of the heaviest (last) element in another way than earlier.

2 Method of calculation

Once drawing straight hyperbolas for a wide range of the elements, according to their number from 1 to 99 in the Table of Elements, where the atomic masses occupy the scale from Hydrogen (1.00794) to Einsteinium (252), one can see that the real axis of each straight hyperbola is orthogonal to the real axis of the respective adjacent hyperbola, and they cross each other at the point $y = 0.5$.

Then we draw the intersecting lines from the origin of the adjacent hyperbolas (0; 1). The lines intersect the straight hyperbolas at two points, and also intersect the real axis and the abscissa axis where they intercept different lengths.

Connection to molecular mass of an element (expressed in the Atomic Units of Mass) differs between the abscissas of the lengths selected by the intersecting lines and the abscissas of transection of the straight and adjacent hyperbolas. Therefore, the line which is tangent to the straight in the sole point (102.9055; 205.811) is quite complicated. These coordinates mean the atomic mass of Rhodium and the half of the atomic mass of the heaviest (last) element of the Periodic Table.

The right side of the line can easily be described by the 4th grade polynomial equation. However the left side has a complicate form, where the maximum is observed at the light elements (Nitrogen, Oxygen) when lowered to (102.9055; 0) with the increase in atomic mass.

According to our calculation, the straight and adjacent hyperbolas were determined for Rhodium. The real axes go through the transecting points of the hyperbolas to the axis X and the line $Y = 1$, where they intercept the same lengths 411.622. This number differs for 0.009% from 411.66.

Thus, this calculation verified the atomic mass 411.66 of the heaviest element (upper limit) of the Periodic Table of Elements, which was determined in another way in our previous study [1].

3 Algorithm of calculation

The algorithm and results of the calculation without use of Rhodium were given in detail in Table 3.1 of the book [1]. The calculation is produced in six steps.

Step 1. The data, according to the Table of Elements, are written in columns 1, 2, 3.

Step 2. Square root is taken from the atomic mass of each element. Then the result transforms, through the scaling coefficient 20.2895, into the coordinates of the tops of straight hyperbolas along the real axis. To do it, the square root of the data of column 3 is multiplied by 20.2895 (column 4), then is divided by it (column 3).

Step 3. We draw transecting lines from the centre (0; 1) to

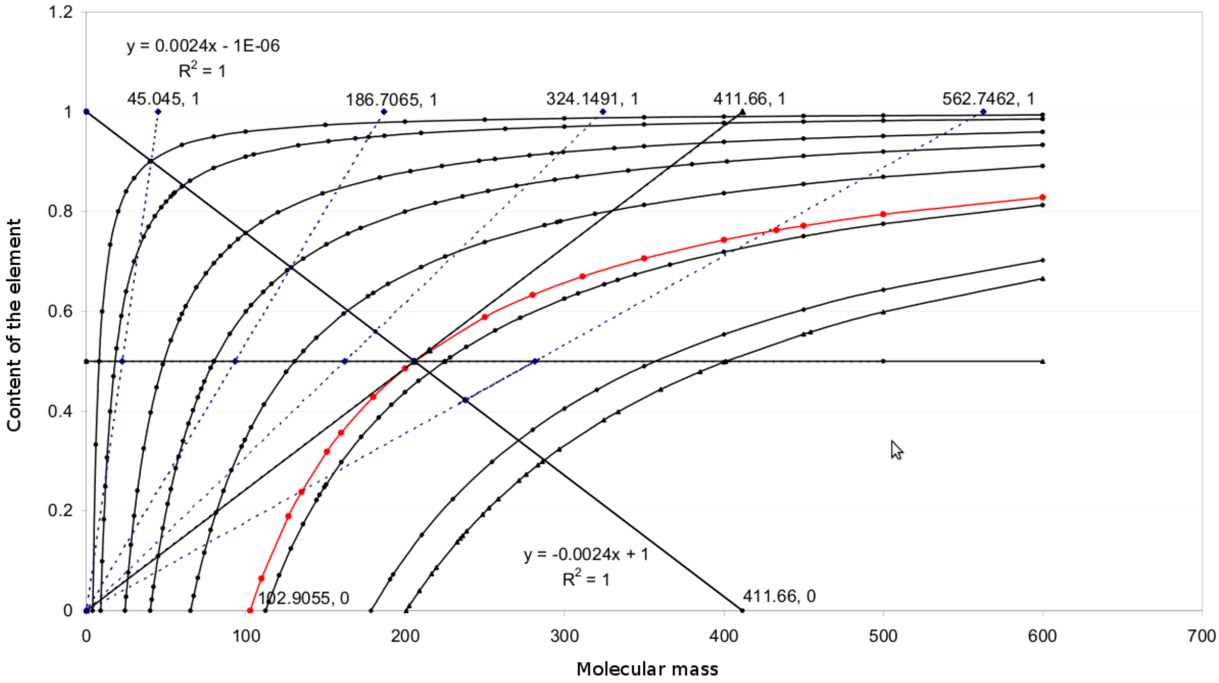

Fig. 1: Calculation with the centre at the point (0;0).

the transections with the line $y = 0.5$, with the real axis at the point $(X_0; Y_0)$, and so forth up to the axis X. To determine the abscissa of the intersection points, we calculate the equation of a straight line of each element. This line goes through two points: the centre (0; 1) and a point located in the line $y = 0.5$ or in the axis X: $(X-0)/(X_0-0) = (Y-1)/(Y_0-1)$. For instance, consider Magnesium. After its characteristics substituted, we obtain the equation $(X-0)/(100.0274-0) = (Y-1)/(0.242983-1)$, wherefrom the straight line equation is obtained: $Y = 1 - 0.007568\,X$. Thus, the abscissa of the transecting line, in the line $y = 0.5$, is 66.0669 (column 6).

Step 4. We write, in column 7, the abscissas of the points of transection of the straight and adjacent hyperbolas. The abscissas are equal to the double atomic mass of the element under study.

Step 5. We look for the region, where the segment created by a hyperbola and its transecting line is as small as a point (of the hyperbola and its transecting line). To find the coordinates, we subtract the data of column 7 from the respective data of column 6. Then we watch where the transecting line meets the real axis. The result is given by column 8. Here we see that the numerical value of the segments increases, then falls down to zero, then increases again but according to another law.

Step 6. Column 9 gives tangent of the inclination angle of the straights determined by the equations, constructed for two coordinate points of each element: $Y = -KX + 1$, where K is the tangent of the inclination angle.

4 Using adjanced hyperbolas in the calculation

Because straight and adjacent hyperbolas are equilateral, we use this fact for analogous calculations with another centre, located in the point (0; 0). The result has been shown in Fig. 1. In this case X_0 remains the same, while the ordinate is obtained as difference between 1 and Y_0. The straight line equation is obtained between two points with use of the data of column 9, where tangent should be taken with the opposite sign. As a result, we obtain an adjacent hyperbola of Rhodium. For example, consider Calcium. We obtain $X_0 = 128.4471$, $Y_0 = 0.31202$ (the ordinate for the straight hyperbola of Calcium), and $Y_0 = 1 - 0.31202 = 0.68798$ (for the adjacent hyperbola). The straight line equation between these two points is $Y = 0.005356\,X$. Thus, we obtain $x = 186.7065$ under $y = 1$, and $x = 93.3508$ under $y = 0.5$.

The new calculations presented here manifest that determining the heaviest (last) element of the Periodic Table of Elements is **correct for both ways of calculation**: the way with use of Lagrange's theorem and the scaling coefficient [1], and also the current method of the hyperbolas adjacent to that of Rhodium (method of adjacent hyperbolas). As one can see, the calculation results obtained via these two methods differ only in thousand doles of percent.

Submitted on October 22, 2010 / Accepted on December 12, 2010

References

1. Khazan A. Upper Limit in Mendeleev's Periodic Table — Element No. 155, 2nd edition, Svenska fysikarkivet, Stockholm, 2010.