The Cylindrical Periodic Table with Seven Vertical Columns

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Abstract:

In this article, a new model of the periodic table in cylindrical form wrapped around its outer circumference is presented, departing from the traditional periodic table of elements adopted by the International Union of Pure and Applied Chemistry (IUPAC). The cylinder is designed to encompass seven periodic periods, with elements distributed throughout based on their atomic order. This design allows for six vertical columns on the surface of the cylinder to represent the distribution of elements.

Introduction:

The periodic table is the form in which the elements are arranged vertically and horizontally includes periods (shown horizontally) and groups (shown vertically) according to the atomic number so that periodic properties of the elements (chemical periodicity) are made clear. The periodic table is a masterpiece of organized chemical information. However, there is no one single or best structure for the periodic table, but most standard form and the evolution of chemistry's periodic table into the current form of the IUPAC's is very useful and the most common and an astonishing achievement.

Everything is made of atoms, and about of 118 different elements was discovered yet, these elements individually have been named and described by symbols, and according to atomic number they all were tabulated into rows (Periods) and columns (Groups) in the periodic table. In the early years of the 17th century, when new isotopes of many elements were discovered and about only 60 elements were known, Robert Boyle in 1661 proved that elements are formed by atoms. Building on the element's properties, Johann Wolfgang Dobereiner achieved in 1829 a form of arrangement to the known elements into families or Triads, and in 1865 a new step came by John Newlands who noticed that element properties were more similar to the following element, which was named the Octaves, unfortunately there was not a suitable pattern to fit with Newlands, and this step was rejected as it was not fitting with the attitude of British chemical society [1-6].

There was not a really advanced step till the 1869 when Russian chemistry professor Dmitri Mendeleev achieved a revolutionary improvement in the main body of the periodic table of elements. Mendeleev published his tabulated element in a paper in which he drawn a tabular arrangement of the chemical elements as each the 63 known elements were arranged in groups according to their properties, this step allowed him to recognize that there is a clear pattern in which the elements were columned whenever the atomic mass number was decreased [7].

However, Mendeleev left gaps in his table whenever he did not found the suitable elements to fill these gaps, thus he was able to have predictions about the properties to the missed elements, and he also gave detailed predictions for the properties of elements he had earlier noted were missing, but should exist. The first outcomes from Mendeleev's table came in 1875 when Gallium element was discovered to fill the gap according to predicted properties predicted by Mendeleev's table, later Germanium and Scandium elements also proved the Mendeleev's table predictions filling the gaps [8,9].

In 1913, the second revolutionary improvement in the periodic table achieved by Henry Moseley, by rearranging the table according to increasing in the atomic number instead the previous indication of the atomic mass number. Moseley's table was internationally adopted as it allowed successfully adding all current and these new discovered elements with their predicted properties, and his organization of the periodic table can be used to derive relationships between the various element properties, but also the predicted chemical properties and behaviour of undiscovered or newly synthesized elements.

More advanced development was added to the periodic table by Glenn Seaborg, an American scientist. In 1945 Seaborg made the suggestion that the actinide elements, like the lanthanides, were filling an f sub-level [10,11]. Seaborg's suggestion was found to be correct and he subsequently went on to win the 1951 Nobel Prize in chemistry for his work in synthesizing actinide elements.

In 2010, a joint Russia-US collaboration claimed to have synthesized six atoms of element 117 (Tennessine), making it the most recently claimed discovery [12,13]. It, along with element 113 (Nihonium), element 115 (Moscovium), and element 118 (Oganesson), are the four most recently named elements, whose names all became official by the International Union of Pure and Applied Chemistry's (IUPAC) on 28 November 2016 [14-16].

The most radical development to take place in contemporary research on the periodic table has been a willingness to challenge tradition by questioning whether the periodic system should be displayed in a two-dimensional form and whether it should even be displayed as a table. Nevertheless, there is no one single or best structure for the periodic table. Most standard formats of the periodic table generally place the f-block elements below the main body of the periodic table.

Even the current periodic table adopted by IUPAC is not a perfect form; the table has gaps in its main body such as these in columns and rows between Hydrogen and Helium (gaps from Period 1 till 18), in addition to the separation in the table body between the 6th and 7th Groups, and the intersection at 3rd Group. Also, there are two huge gaps in elements list after the elements 56th and 88th, in which, 28 elements in the f-block of Lanthanum are split off the table body as all were individually located down the main body of the table. The result is a gap in the element series starting by the element number 56 till number 72, and also from element number 88 till 104, both these tow gaps are containing elements of Lanthanides and Actinides involved in the central body of the table at Periods 6 and 7, and snapped with Group 3.

Thus, the IUPAC's modern periodic table unconnectedly placed the f-block elements below the main body of the periodic table leaving two gaps split off the main body of the table. Obviously, this separation in the f-block elements will be increased in future whenever additional future elements needed to be listed in the table. Building on these points, this research presents a new improvement in the current periodic table to tackle these gaps and split group of Lanthanum without doing any changes in the systematic arrangement of the IUPAC's modern periodic table. In fact, the solution built on viewing the periodic table by 3d-dimentional views and systemizing the f-block element to be listed into the main body of table at the same position to its elements in which the f-block elements are systemized into their natural position between the s- and d-blocks. Form this arrangement, f-block elements of Lanthanides and Actinides were in no interruptions in the sequence of increasing atomic numbers. In addition, the relationship of the f-block to the other blocks of the periodic table also becomes easier to see.

For the previous reason, this research is motivated by mentioned gaps; it seems largely fit with an aspect standard form that fits on to the IUPAC's table of atomic number, groups, and periods. The paper tried to fill the current table's gaps focusing on the f-block 28 elements of Lanthanum to be inserted into the resulting space. In this paper, the table is the standard form of the IUPAC's table using the 3d dimensional table projected by engineering projection drawing theory to draw the table. This feature presented in this research is rather important because it is based solely on atomic number, groups, and periods, the only criterion of the elements regarded as three-Dimensional Method of element arrangement and representation in the periodic table rather than simple two dimensional recommended by IUPAC. In this research, 3D-modified periodic table displays 7 Periods, and 12 Groups, which all lie at a surface of vertical cylinder with length and radius of 7 periods, Figure 1.

In this article the periodic table of the cylindrical periodic table with seven vertical columns is the latest model developed on May 3, 2024, by the Iraqi scientist Laith H. Al-ossmi. The table features a cylindrical design consisting of seven vertical columns for each of the seven periods of the chemical elements, without any changes in the arrangement of elements according to their atomic weight. This is the second model of the periodic table presented by Dr. Al-ossmi, with the first one introduced in 2019.

Methods

The research is design to deal with the current IUPAC's periodic table, without any change in the arrangement of elements that vertically presents the periods, and horizontally the groups systemized in the IUPAC's table. The research methodology is design to fill these mentioned gaps in the periodic table (elements of Lanthanide and Actinide), without any change in the elements arrangement that presents the periods vertically, and the groups horizontally systemized by atomic number as in the IUPAC's table. Horizontally, rows (Periods) were divided into 7 steps starting from element No.1 down to element number (87), whereas at the (Z-coordinator) the columns (Groups) starting form element No. 1 (Hydrogen) till element No. 2 (Hilum), as all were vertically listed within (12) steps.

Slice 1: the top view from the period No. 1,2,3 & 4, in which the following elements lie at the circumference of ring, Table and Figure 1:

Period 1	H	He	-	-	-	-	-	-	-
Period 2	Be	B	C	N	O	F	-	-	-
Period 3	-	-	-	-	-	-	-	-	-
Period 4	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu
	Zn	-	-	-	-	-	-	-	-

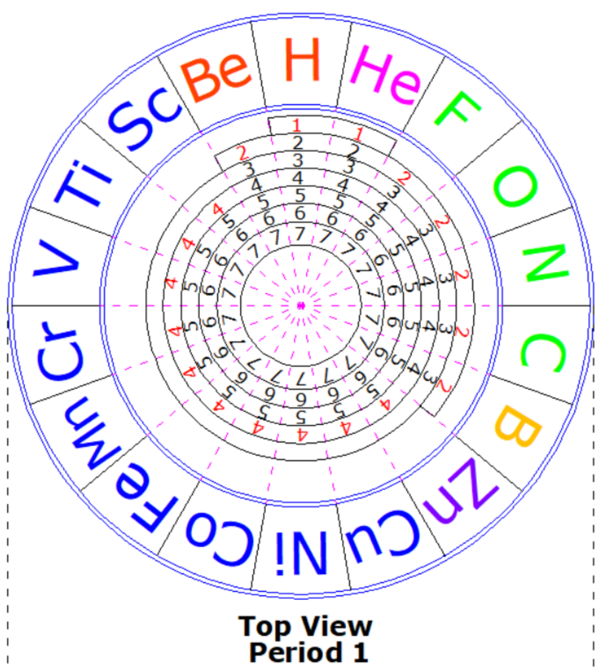

Figure 1: elements of Slice 1.

Slice 2: the top view from the period No. 2, in which the following elements lie at the circumference of ring, Table and Figure 2:

Period 2	Li	Be	C	N	O	F	Ne	B	-
Period 4	Zn	Cu	Ni	Co	Fe	Mn	Cr	V	Ti
	Sc	-	-	-	-	-	-	-	-

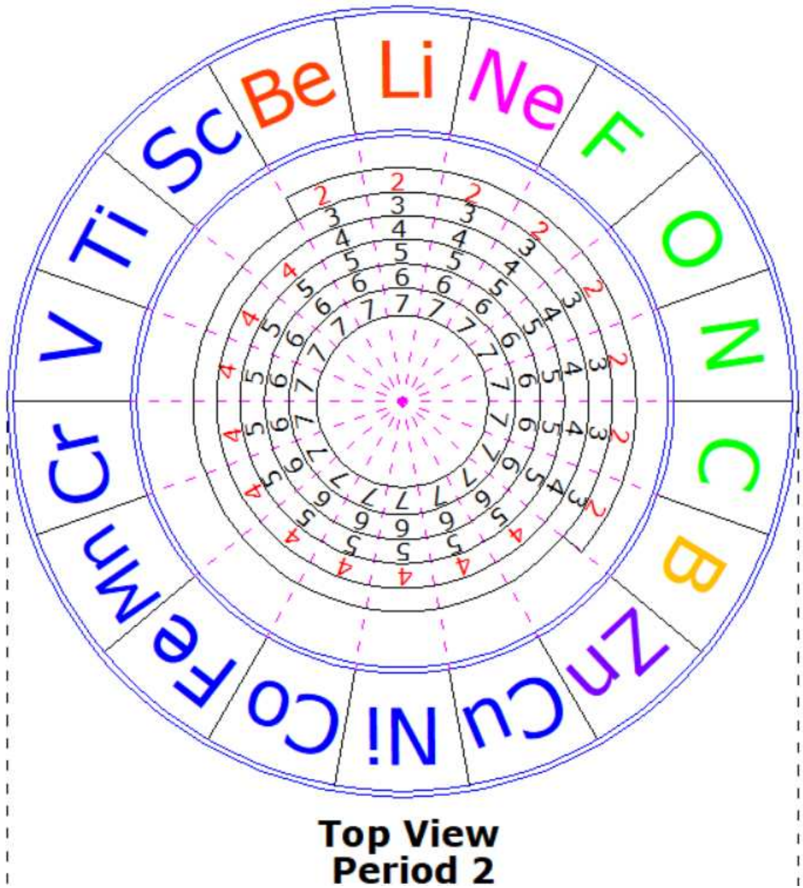

Figure 2: elements of Slice 2.

Slice 3: the top view from the period No. 3, in which the following elements lie at the circumference of ring, Table and Figure 3:

Period 3	Na	Ma	Al	Si	P	S	Si	Al	-
Period 4	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu
	Zn	-	-	-	-	-	-	-	-

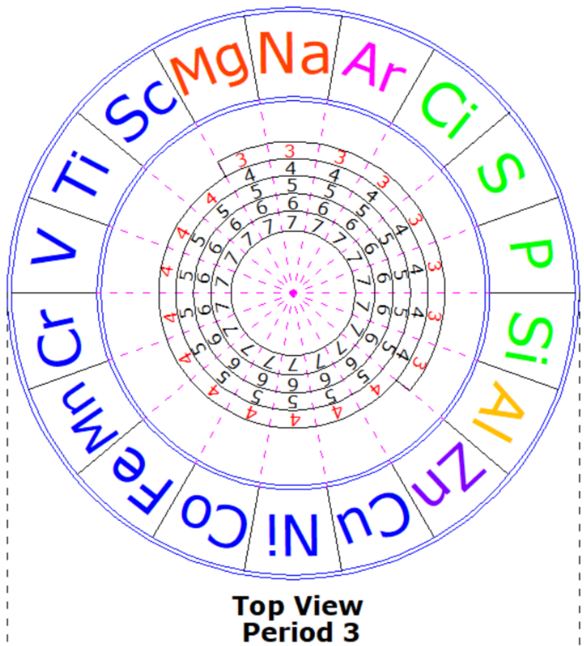

Figure 3: elements of Slice 3.

Slice 4: the top view from the period No. 4, in which the following elements lie at the circumference of ring, Table and Figure 4:

Period 4	K	Ca	Ga	Ge	As	Se	Br	Kr	-
Period 4	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu
	Zn	-	-	-	-	-	-	-	-

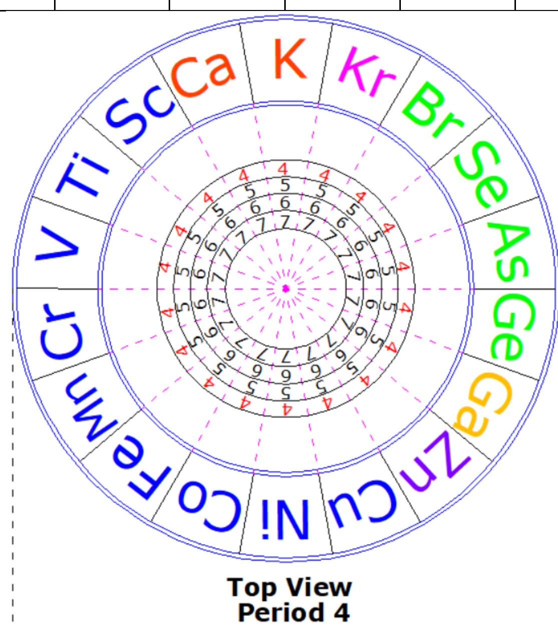

Figure 4: elements of Slice 4.

Slice 5: the top view from the period No. 5, in which the following elements lie at the circumference of ring, Table and Figure 5:

Period 5	Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh
Period 5	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
	-	-	-	-	-	-	-	-	-

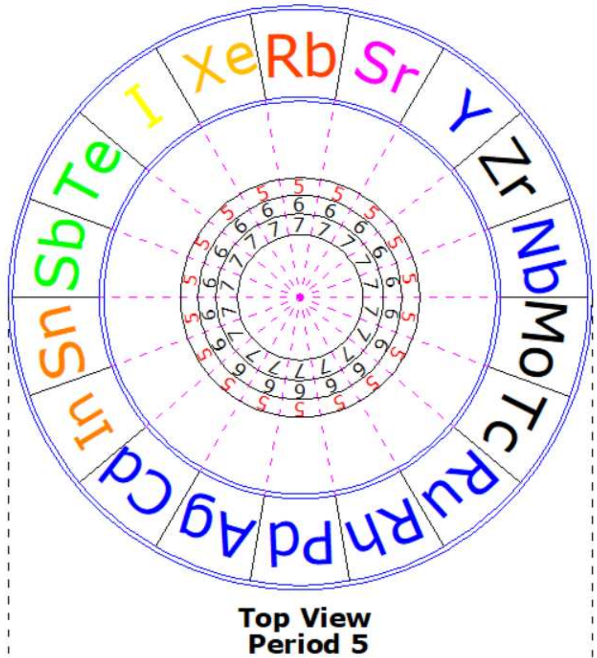

Figure 5: elements of Slice 5.

Slice 6: the top view from the period No. 6, in which the following elements lie at the circumference of ring, Table and Figure 6:

Period 6	Sc	Ba	**La**	**Ce**	**Pr**	**Nd**	**Pm**	**Sm**	**Eu**
Period 6	**Gd**	**Tb**	**Dy**	**Ho**	**Er**	**Tm**	**Yb**	**Lu**	Hf
	Ta	W	Re	Os	Ir	Pt	Au	Hg	Ti
	Pb	Bi	Po	At	Rn				

At this stage, all elements within period 6 are arranged on a circle representing a horizontal slice of the cylinder. The elements specific to the lanthanides, which are expected within the f-block, consisting of 15 elements, are associated with the outer surface of the cylinder within this period, (period 6) and arranged horizontally in a straight line extending from the body of the cylinder starting from element *La* and ending with element *Lu*, Figure 6.

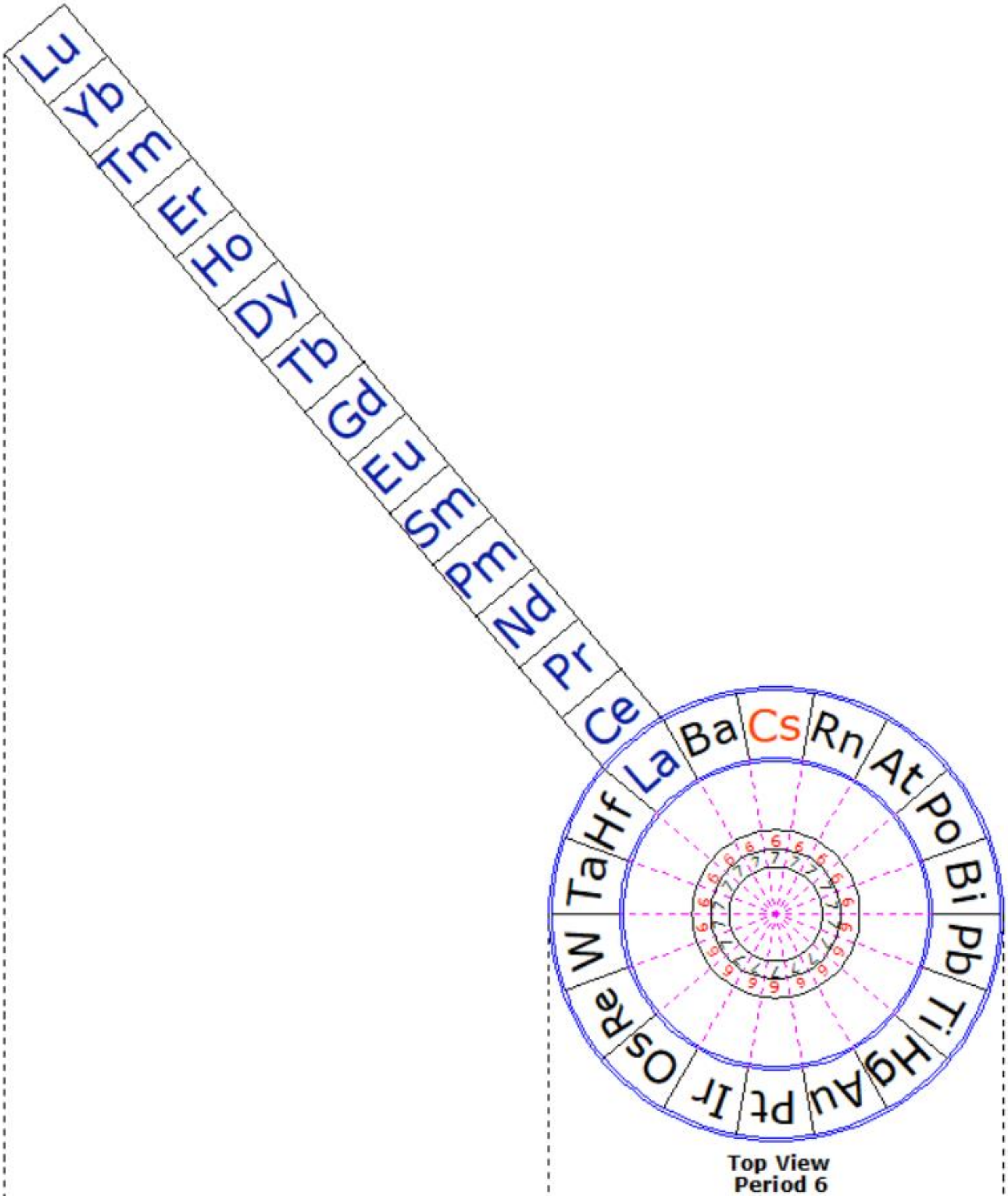

Figure 6: elements of Slice 6.

Slice 7: the top view from the period No. 7, in which the following elements lie at the circumference of ring, Table and Figure 7:

Period 7	Fr	Ra	**Ac**	**Th**	**Pa**	**U**	**Np**	**Pu**	**Am**
Period 7	**Cm**	**Bk**	**Cf**	**Es**	**Fm**	**Md**	**No**	**Lr**	Rf
	Db	Sg	Bh	Hs	Mt	Ds	Rg	Cn	Nh
	Fl	Mc	Lv	Ts	Og	-	-	-	-

At this stage, all elements within period 7 are arranged on a circle representing a horizontal slice of the cylinder. The elements specific to the Actinide, which are expected within the f-block, consisting of 15 elements, are associated with the outer surface of the cylinder within this period, (period 7) and arranged horizontally in a straight line extending from the body of the cylinder starting from element *As* and ending with element *Lr*, Figure 7.

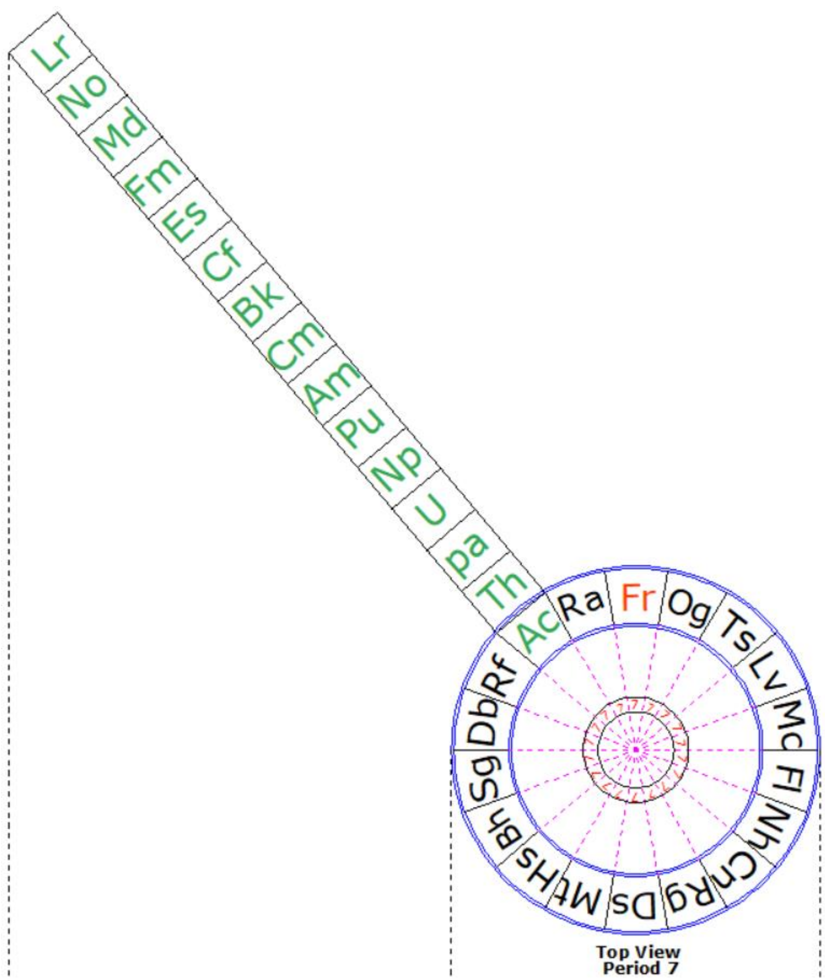

Figure 7: elements of Slice 7.

Conclusion

In this study, a novel model of 3D periodic table of chemical elements is proposed, in which elements are arranged according to their atomic weights in compliance with the periodic law. In this model, the 118 chemical elements are arranged by wrapping the currently adopted periodic table around the outer surface of a vertically oriented cylindrical body with a radius equal to the height of 7 periods of the table, starting from period 1 downwards to period 7.

This new arrangement produces a three-dimensional model that ascends according to the vertical cylindrical body, meaning that this wrapping results in six different appearances of the periodic table: the top and bottom views and four side views. All of these six sections represent a graphical representation of the arrangement of elements in the current two-dimensional periodic table adopted by the International Union of Pure and Applied Chemistry (IUPAC) on 28 November 2016.

The discrete elements in the current IUPAC periodic table within the f-block, (elements of Lanthanide and Actinide) ,consisting of two slices each comprising 15 elements per slice, have been reintroduced into the structure of the three-dimensional table by protruding them as a continuous strip attached to the side of the cylinder at both periods 6 and 7.

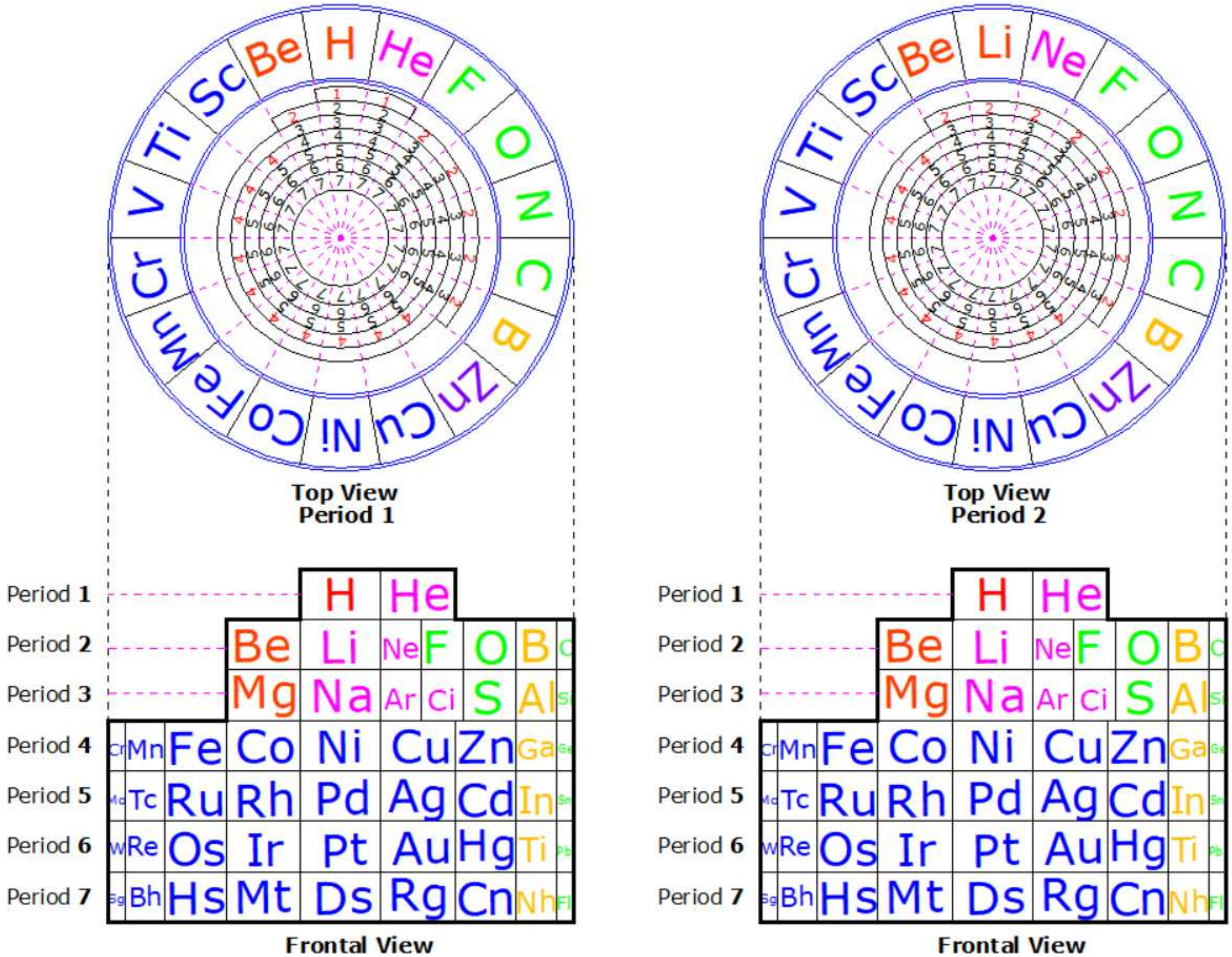

Figure (8): two vertical sections for Al-ossmi's periodic table for periods, 1 and 2.

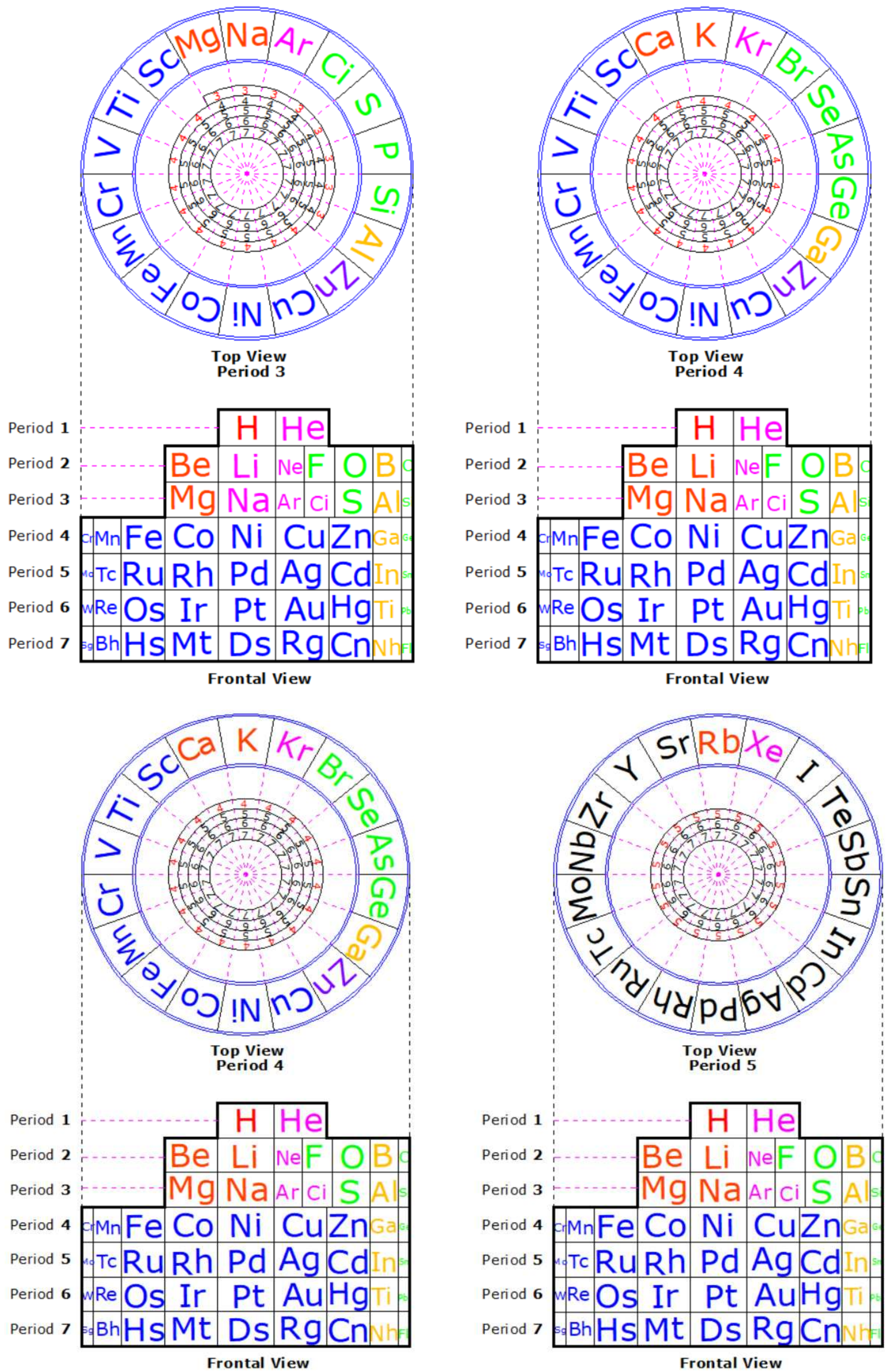

Figure (9): Four vertical sections for Al-ossmi's periodic table for periods, 1, 2, 3 and 4.

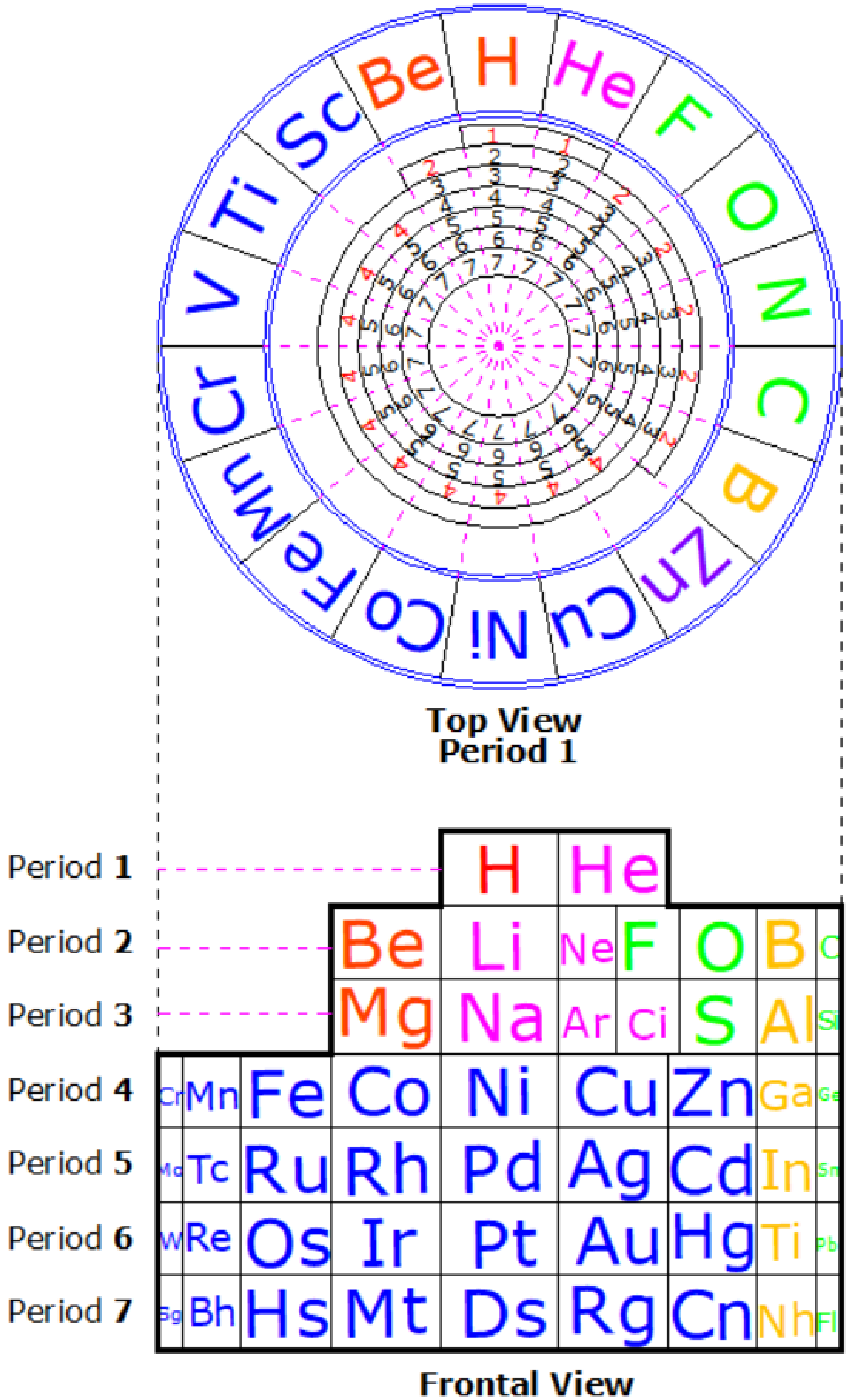

Figure (10): two vertical sections for Al-ossmi's periodic table for period, 1.

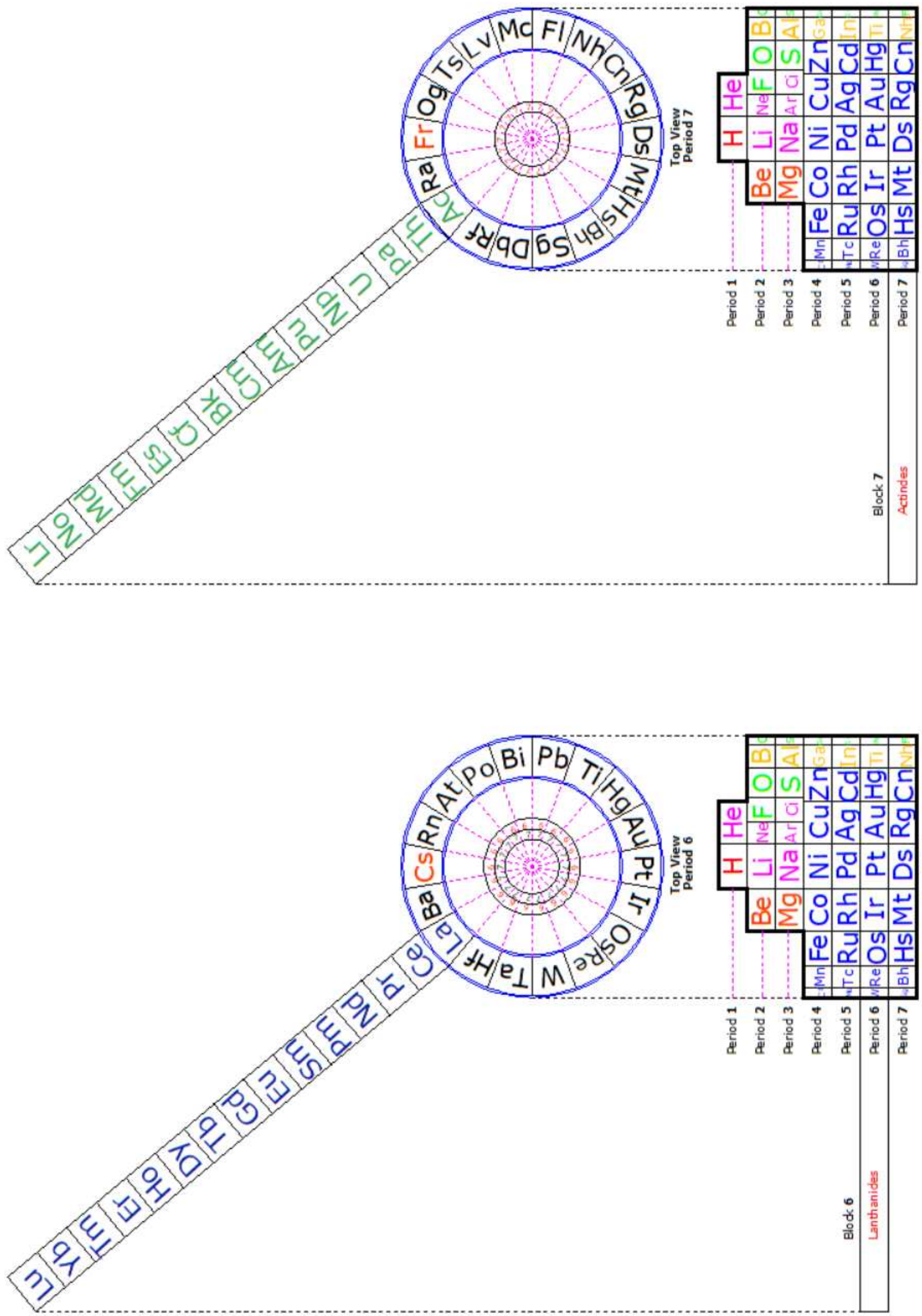

Figure (11): two vertical sections for Al-ossmi's periodic table for periods, 6 and 7.

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