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Unitary Symmetry of Atoms, Molecules and Codons. Part 1. Introduction to the Unitary Symmetry for Everyone

Vladimir Komarov

Department of Chemistry, St Petersburg State University, St Petersburg, Russia.

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Abstract: You want to study less and learn more? You want to remember less and understand more? You would like to explore a little bit of physics and chemistry, but to understand the biology, history, geography, economics, statistics? ... If ΣYES ≥ 1 follow me

When we build a house, first we are building a foundation. Imagine a house without a foundation can be easy. It is cave. You want to continue to live in a cave? You want to use the cave as a livelihood? ... Do you want to die young, like our ancestors died? If Σ NO ≥ 1, follow me

Symmetry is the foundation of knowledge. Many of you have no idea about this and exists, getting the pleasure from everyday events and life in general. But this is because very few people knew, they know now and will know in the future the chain and the correct sequence of laws and regularities arising from symmetry.

However, many of you have heard about the geometric symmetry. You come across on the subway with symmetrical bodies every day and using the symmetrical objects you drive to work. But if you "to dig" deeper, you can discover asymmetric heart, not symmetrically located one liver, etc. These are the manifestations of the Broken symmetry. Broken geometric symmetry (symmetry in a system of geometric coordinates) is the impelling reason for Evolution, a stimulus to find reasons for the change or save the FORM of the object.

But besides the geometric coordinates the parametric coordinates exists. This is the quantitative characteristics, of the object or process. Examples: weight, number of particles, the energy of electron detachment, the dielectric constant and the binding energy of atoms in the molecule, boiling point, solubility ...

The role of the object in this case is played by a specially selected **set of objects (Hyperobject).** Symmetry in the parameter space at first glance is not visible, but it is easily possible to find the ruler with the values of the measured

Corresponding author: Vladimir Komarov, Department of Chemistry, St Petersburg State University, St Petersburg, Russia.

parameter. It manifests itself in the form of saving the difference between separate parts of the Hyperobject (by the specially selected objects). Since the parameters of the object reflects its essence, the symmetry in the parameter space can be regarded as a reflection of the properties and the provision of the conservative element of Evolution.

Broken Parametric Symmetry - it is an occasion to reflect on the chemical purity of the original elements and possible distortions in the hierarchical intervals energy interactions between the original components of combinatorial elements which assembled Hyperobject.

The symmetry of this phenomenon of nature, clean, simple and accessible to everyone. This is a source to build a foundation of knowledge. It did not elaborate by mathematical turbid suspensions.

The name "Parametric Symmetry" is more understandable to the general public in my opinion, but never before consumed. The name "Unitary symmetry" is widespread in theoretical community - a single, universal ... Paying tribute to the founding father and the discoverer of this type of symmetry for elementary particles - M. Gell-Mann, I decided to leave in the title of his first-born value.

This article is the first in a series of papers devoted virtually unknown to chemists (and even more so to biologists) phenomenon of Symmetries and Unitary symmetry, in particular. That is why I decided to start with a simple explanation of the physical meaning of this kind of symmetry. Then followed the second part, (who understand the theory of groups or want to "dive deeper") - theoretical The next part will focus on the representation of the unitary symmetry applications in genetics, and other fields of natural science. Separate part will be devoted to the creation of databases of physical, chemical and biological data..

I want to emphasize the fact that the idea of Symmetries underlie not only the various scientific disciplines. They are important for school educational disciplines which are extremely overcrowded by information. The introduction of concepts of Symmetry in school courses in physics, chemistry and biology will allow to compress the information flow to the level of study of the principles: **Knowing some principles easily compensates ignorance of some facts** (Claude Adrien Helvétius)

Key words: geometric symmetry, unitary symmetry, homology, combinatorics, invariants for molecules

1. Introduction

Nature is very "laconic" and "conservative" in its basic Paradigm: **a set of basic elements - a combination - selection** (natural, depending on environmental conditions and man-stimulated by human) **of the resulting combinations**. This three-tier chain is repeated at every level of matter: elementary particles, nucleus, atoms (nucleus + electrons), the molecules (atoms family), codons (a family of nitrogenous bases), proteins (the family of amino acid residues) ...

Next "conservatism" is the level of evolution - or the serial replacement of one element of the initial set of combinable elements to another **of the same set**, or connection to one of the compounds of one-level elements **of the other set** of initial elements from the other level of development of matter.

An example for the first case: the formation of a proton and neutron of quarks (.....) *, the formation of multiple nuclei of a proton and a neutron combinations with repetitions, (.....) **, the formation of a combination of molecules with repetitions and permutations of atoms, (.....) ***, polymer formation of combinations with repetitions and permutations of relatively simple molecules ...

Examples of the second case: (.....) * - the formation of different classes of elementary particles when attached to the proton of any of the quarks, (.....) ** - the formation of variety of atoms from adhering to one of the combinations of protons and neutrons (the level of nuclei) a certain number of electrons (elementary particle level), (.....) *** - the formation of complex molecules by replacing one of the atoms in its composition by a group of atoms (simple molecules) ...

In this case, at each stage of evolutionary changes can reveal the sequence of states (objects), when the next state (the object) is different from the previous one by only one element. This sequence is what I call **true homological series**. The homology has great predictive potential. In the last century it was underdeveloped - at the level of interpolation and extrapolation. Detection of unitary symmetry radically change its predictive capabilities - up to the heights of parallelism in the comparative analysis of the objects and processes of the different levels of development of matter.

Next "conservatism" - is being shared by all of combinatorial objects hierarchy energy particle interactions, which is composed of a combinatorial object. The existence of a hierarchy allows us in certain cases to neglect the weak interactions and build the physical model only in the approximation of strong interactions. At the same time for atoms and the preferred class of molecules we can try to find such groups of the values the parameter in question, in which the contribution of the "weak" interactions are compensated or negligible.

In elementary particle theory the concept of symmetry and related ideas about the hierarchy of interactions plays a fundamental role. So the relative smallness of the electromagnetic and weak interactions as compared to the strong interaction of nucleons in the nucleus can be considered as a model of the nucleus in the limit of exact symmetry of the strong interactions. In this model, protons and neutrons are physically indistinguishable states of the nucleon and the properties of the nucleus - invariant under isotopic transformations. In the case of atoms and molecules we can also talk about the hierarchy of interactions involved in their formation.

As an example, a "strong" interaction in this case we can point to chemical energy, which is 1-2 orders of magnitude more than energy non-bonded interactions. Another example - when the energy of the valence interactions is much higher than the energy of intermolecular bonds in a in mixtures.

Usually accounting of weak interactions in the 'chemistry is carried out by introducing into physical models of various disturbances. These disturbances typically are unmeasured parameters that are essentially the adjustable values.

2. Geometric Symmetry

A geometric shape of the object is symmetric **if it can be divided into two or more identical pieces** that are arranged in an organized fashion. This means that an object is symmetric if **there is a geometrical transformation** that moves individual pieces of **the object but doesn't change the overall shape** [1].

In this case we compare the same part of the same object - before transformation and after it - at any given time. Fixed shape of the object is observed only in the case of an object in a state of rest or motion at a constant speed, which is less than the speed of light. Under the conditions listed above geometrical symmetry is absolutely exact symmetry (see. Figure 1).

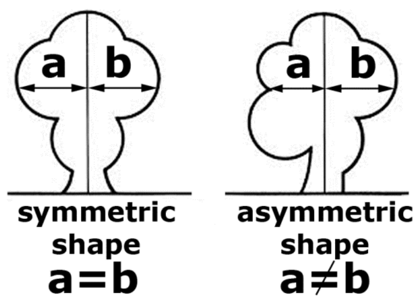

Fig.1 This is an example of the geometric symmetry - shape retention upon reflection of one half of the object in the plane The **conservation law of the form of the object** "A" for the case of reflection in the plane is:

$$A_i(\mathbf{x_i}, \mathbf{y_i}, \mathbf{z_i}) - A_p(0,0,0) = A_p(0,0,0) - A_i(\mathbf{-x_i}, \mathbf{-y_i}, \mathbf{-z_i})$$

It is known that there are many different elements of symmetry and the corresponding symmetry operations. Combining symmetry operations applied to a single object forms a **group of the symmetry operations**.

In some complex cases of symmetry the process of finding the law of conservation becomes complicated mathematical problem.

In our case, in the below definition are very important three points:

1. **"can be divided into two or more identical pieces"**. This remark will be needed in determining the unitary symmetry.
2. **"geometrical transformation"**. This allows us the whole set of symmetry transformations call "geometrical symmetry" or "symmetry in space of the geometrical parameters".
3. **"the object doesn't change the overall shape"**. This remark allows us to imagine Conservation law in the case of geometric symmetry as **the Law of Conservation of the shapes of objects in geometrical space.**

The symmetry in geometric space implies that:

- it is considered a single object
- no physical fields that could affect the shape of the object
- symmetry is manifested in keeping the shape of the object at different movements of the object as a whole in the space of geometric coordinates (+ time)
- invariants have to be completely accurate

3. Unitary (Parametric) Symmetry

The object on which we will discover a unitary symmetry represents the entire class of molecules, for example, halogenated methane. Fig. 2 shows the entire combinatorial set of compounds with the general formula $Y_oH_jF_kCl_mBr_nI_p$, where Y_o - subgroup carbon atoms, or other complex atomic structure.

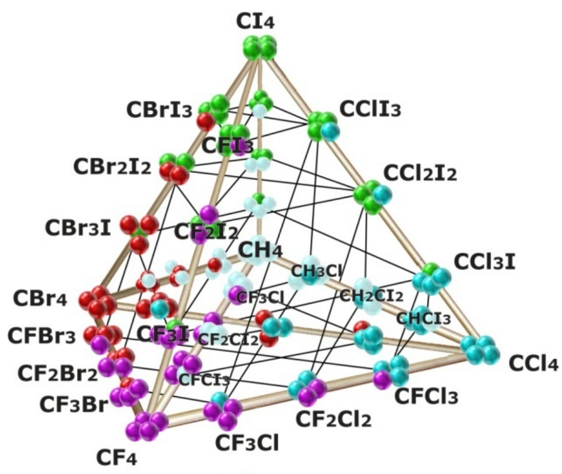

Fig. 2 The structure of the homologous series of molecules with the general formula $Y_oH_jF_kCl_mBr_nI_p$, where Y_o - subgroup carbon atoms, or other complex atomic structure.

In our case, a group of halogenated methane can be regarded as a kind of **Hyperobject**.

Considering the Hyperobject is no longer in the geometric space, and in the space of its physical or chemical parameters, we can discover a change of its "form". But it turns out that there are certain constant relation for certain "parts of the Hyperobject".

The physical meaning of the constant relations lies in the fact that during the transition from one part of the "Hyperobject." (molecules) to another part of the Hyperobject strong interaction between electrons and the nucleus are still strong, but with "weak" differing from each other. This difference can be considered as a small correction "± additive" and it can be compensated when finding certain relations for the subgroup of neighboring atoms. (see Table 1):

Table 1. The system of equations for the replacement F-H. Before each chemical compound in order to save space omitted designations of some physical or chemical parameter of the molecule (A). For some parameters, for which the geometric symmetry does not play a big role, the equation with (*) and without ( ) can be combined.

	Replacement: F ⟷ H
1	CF3Cl - CF3Br = CH3Cl - CH3Br
1*	CHF2Cl - CHF2Br = CH2FCl - CH2FBr
2	CF3Br - CF3I = CH3Br - CH3I
2*	CHF2Br - CHF2I = CH2FBr - CH2FI
3	CF3Cl - CF3I = CH3Cl - CH3I
3*	CHF2Cl - CHF2I = CH2FCl - CH2FI
4	CF2Cl2 - CF2Br2 = CHFCl2 - CHFBr2 = CH2Cl2 - CH2Br2
5	CF2Cl2 - CF2I2 = CHFCl2 - CHFI2 = CH2Cl2 - CH2I2
6	CF2Br2 - CF2I2 = CHFBr2 - CHFI2 = CH2Br2 - CH2I2
7	CFCl3 - CFBr3 = CHCl3 - CHBr3
8	CFBr3 - CFI3 = CHBr3 - CHI3
9	CFI3 - CFCl3 = CHI3 - CHCl3

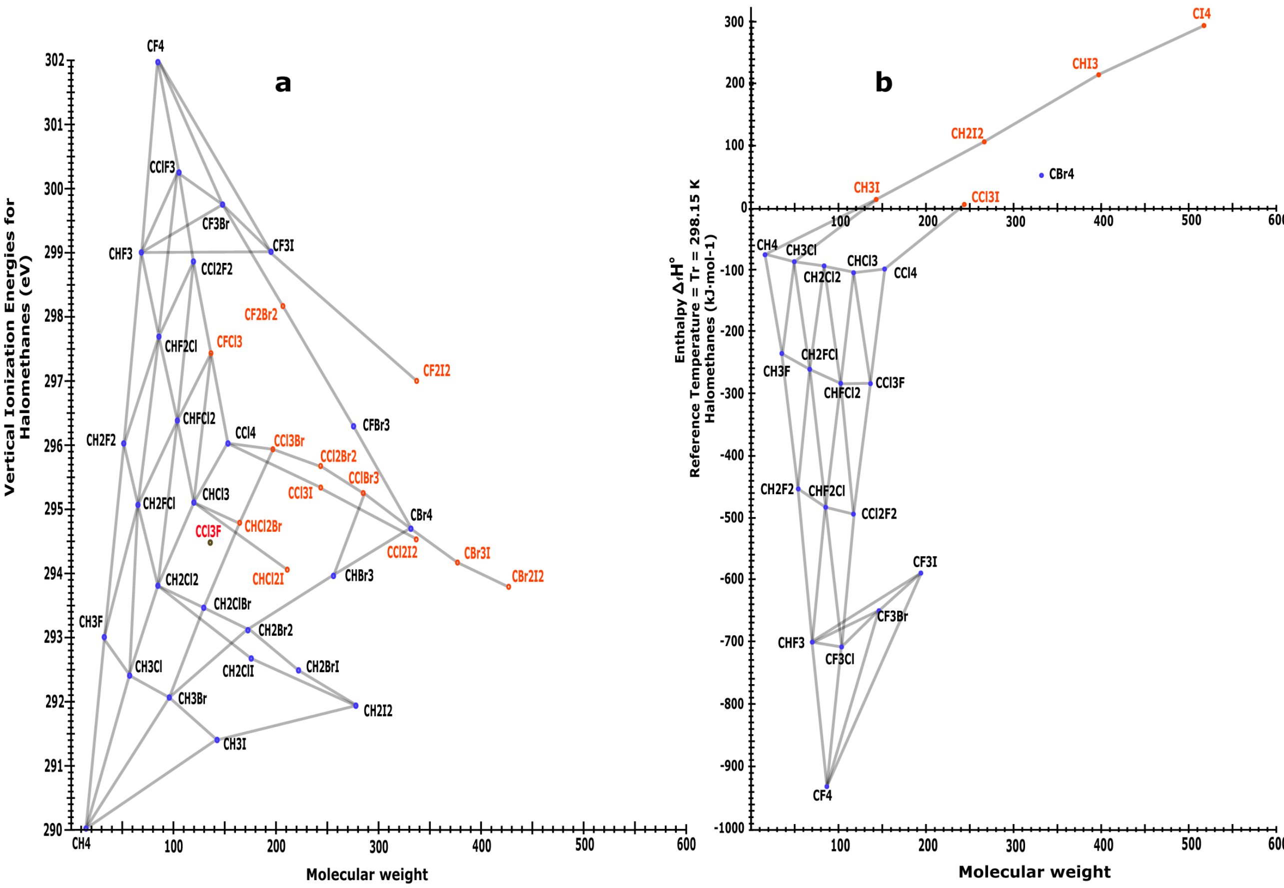

Fig. 3. The distribution of halogenated methane in the spaces of their physic-chemical parameters "1S ionization energy of the electron of carbon atom C - weight molecules" (Fig.3a) and "enthalpy of formation of molecules - molecular mass" (Fig.3b).

Fig. 3a. Black letters and blue dots indicate the compounds listed in [2] (for $I_{VIE)}$. Orange color compounds and their values (VIE), the resulting calculations similar to those of Table 1. Red marked compound CFCl3, which in [2] is erroneous.

Fig. 3b. Black letters and blue dots indicate ΔH_f^o for compounds listed in [3]. Orange color compounds and their values (VIE) is the resulting calculations of ΔH_f^o [4]. The value ΔH_f^o (ClCl3) is the result of calculations similar to those of Table 1.

So the symmetry in the space of physical parameters of the objects (unitary symmetry) means that:

- it is considered a set of objects formed by one or more combinatorial operations over a number of homologous elements

- the original elements and the final formation of which are dealt with under the force fields and the corresponding hierarchy of energy interactions between all the elements of objects.
- symmetry is manifest in the form of conservation of certain relationships between combinatorial objects if we replace one element of the original homologous series ("ligand") to another member of the same series.
- invariants are approximate, but almost always more accurate in comparison with the experimentally measured.

We can change the name of the physical space as you like. Hyperobject elements will change their location relative to each other. But compensatory ratios will remain the same. This is a remarkable property is the basis of unitary symmetry.

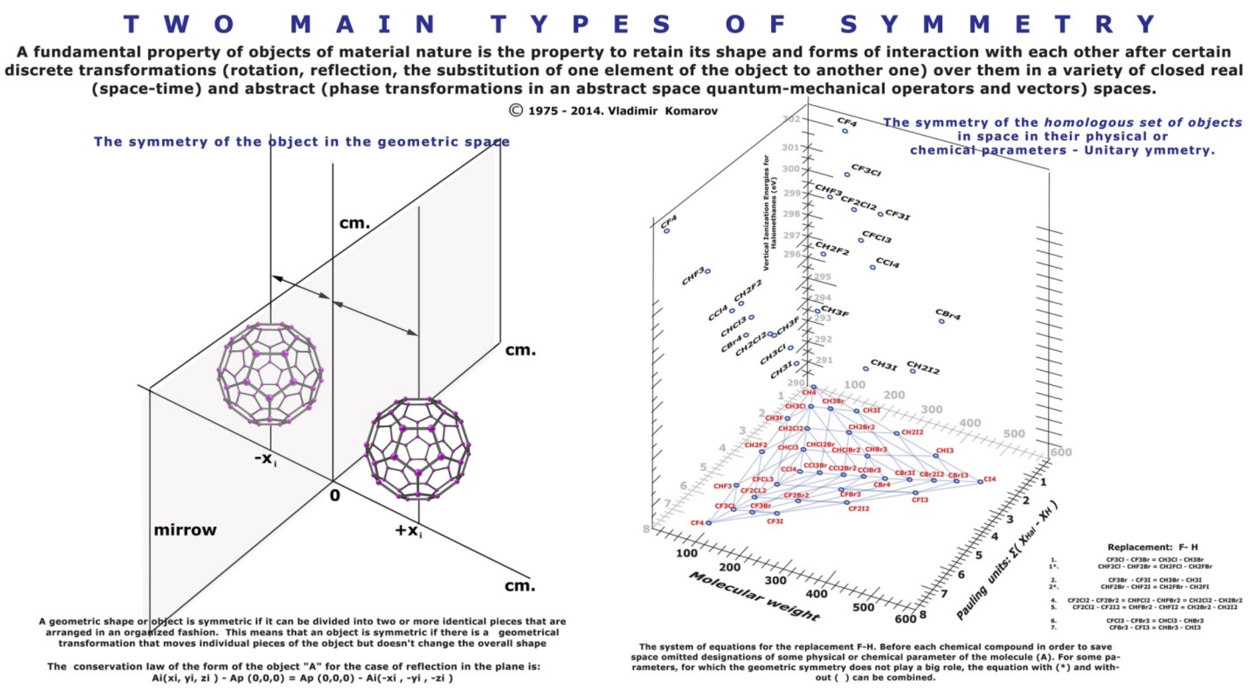

Fig. 4. In the case of geometric symmetry, object (a geometric shape) is regarded as something consisting of multiple (same or different) pieces (left). Object is symmetric if there is a geometrical transformation that moves every individual pieces of the object but does not change the overall shape. In the case of the unitary (parametric) symmetry all combinatorial objects (on the right are not shown) are arranged in this space " I_{VIE} - M - P". They are linked by compensatory ratios (see. right at the bottom; shows 1/10 part).

4. Conclusion

In this article, the first time (finally, since 1964 - Gell-Mann [5]) is given a simplified interpretation of the unitary symmetry (without the involvement of the theory of groups). A theoretical analysis of unitary symmetry was first published by me together with Vladimir Lyakhovskii in [6].

This is done in order the chemists:

- have learned that there is a unitary symmetry,
- understood the essence of the unitary symmetry,
- learned to use the laws and regularities that follow from the concept of unitary symmetry.

This is done in order the physics:

- have learned that every theoretical elaboration needs a simple interpretation of the physical sense,
- understood the importance of parallelism in the natural sciences - combinatorics and homology of quarks differ little from combinatorics and homology of atoms and molecules,
- accounting of weak interactions in the chemistry by introducing into physical models of various disturbances have a primitive ideological way - these disturbances typically are unmeasured parameters that are essentially the adjustable values.

In addition, the concept of combinatorics and true homology are extremely fruitful for many applications.

Firstly, trivial interpolating acquire natural look when any object can be represented as the intersection of the true homologies (see. Figure 10) in the space of physical parameters.

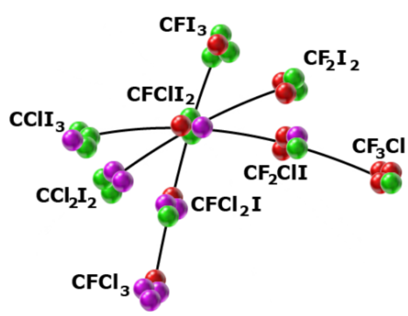

Fig. 5 The method of cross homologies to determine certain parameters of molecule $CFClI_2$

Secondly, it is clear that in considering the entire class of combinatorial objects, built by the scheme halogenated methanes must obtain reliable experimental parameter values for only a few representatives of this class. All other values are obtained by solving the system of equations (see Table 1).

Thirdly, the database physical and chemical properties of molecules (NIST) needs a complete check on the accuracy of the available data and reformatting taking into account obtained invariants.

Acknowledgments

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