Qualitative and quantitative set cardinal

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Abstract— Mathematics is a science that models almost anything and everything in the real nature. Mathematics has been called the language of the universe. The paper introduces the concept of the sets containing only two types of elements, classified "matter and/or antimatter" natural elements. It is about expanding the universal set by including in it all the "antimatter elements" rather than the "matter elements" which context have in consequence. "Matter elements" and "antimatter elements" are posed to be clearly denoted as elements of a different type in a set. The paper introduces the idea of the signed cardinal of the set. When a set A contains only matter elements or when the number of matter elements is higher than the number of antimatter elements than the cardinal of the set A is denoted +card(A). When the set contains only antimatter elements or when the number of antimatter elements is higher than number of matter elements than the cardinal of the set A is denoted -card(A). The introduced signed cardinal denotes the matter-antimatter qualitative property (+ or -) of the elements and the number of elements denotes the quantitative property (card(A)) of the elements in a set.

Index Terms— Matter - antimatter, Set elements, Elementary set theory, Natural numbers, Cardinality, Integers, Whole number.

1 Introduction

SET theory begins with a fundamental binary relation between an object x and a set A. If x is a member (or element) of A, we write x ∈ A. Since sets are objects, the membership relation can relate sets as well. An element, or member, of a set is any one of the distinct objects that make up that set. A universal set that does not contain itself is an object which contains all objects, but not including itself [1]. In a well defined context, a universal set is all the elements, or members, of any group under consideration. All other sets in that framework constitute subsets of the universal set, which is denoted as an uppercase italic letter U. The objects themselves are known as elements or members of the U. A typical universal set in mathematics is the set of natural numbers as shown below: N = {1, 2, 3, 4,...} [2].

Some philosophers have attempted to define the universal set as the set of all objects (including all sets, because sets are objects). The rough set philosophy is based on the concept that there is some information associated with each object in the universe. The set of all objects of the universe under consideration for particular discussion is considered as a universal set. So, there is a need to classify objects of the universe based on the equivalence relation among them. In reality, an element is anything that has been (or could be) formally defined. Let's define an abstract notation as "anti element" which in fact is the reason of why one object or element can disappear or the reason for which the object can't longer exist. This anti element is considered the anti element of the same form as the element. The element and the anti element of the same form can exist together in one stage, but they can wipe out in a second stage, let's say after a collision process of the "element" with the "anti element."

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2 A little philosophy

When an object exists, we say it is a concrete physical think embodied in this object. We defined what "Matter" is and it is natural to say that it exists the concrete natural element or the natural object. When the same object does not longer exist, we say it existed but not anymore. The reason why the object is vaporized is as much important as the object itself. When an object exists, then together with it exist the reason why this object can disappear forever or not forever. As abstraction we can define the reason why the object can vaporize as a concrete thing. This concrete thing we can name as the "anti element" of the same form of the existing element. It is obvious that all existing objects in the universe have a reason to no longer exist.

Nothing is what never existed or something that existed, but no longer exists. The notion of "Nothing" is an absolute-permanent missing of elements or "Nothing" can be performed from "elements" and "anti elements" of the same form in collision with each other.

By treating the empty set we can say that we are treating mathematically the notion of nothing. Nothing is something which is included inside into the empty set. But this nothing can be whatever never existed, or it can be something which existed before but not anymore.

i.e. the empty set can be a set of nothing at all or a set performed after a "collision" process of each two elements to each other in a nonempty set which contains only pairs of elements (Object and Anti object) annihilating all the elements.

On the other side it is very possible (at least conceptually) to have in the future some not current existing objects which their anti element currently exists before the object itself existed. So "Nothing" can be created from existing "anti element" and the element of the same form coming after as a reason to replicate with the anti element.

Philosophically speaking, the universe is made of as a synthesis of the opposite elements. The notion of the "Unity of opposites [3]" was developed in ancient times and shows how the natural balance is a product of the opposite elements.

Coincidentia oppositorum is a Latin phrase meaning coincidence of opposites. It is a term attributed to the 15th century. The doctrine of coincidentia oppositorum, the interpenetration, interdependence, and unification of opposites has long been one of the defining characteristics of mystical (as opposed to philosophical) thought. [4].

3 Physics and Chemistry

The modern theory of matter dates from the work of John Dalton at the beginning of the 19th cent. The atom is considered the basic unit of any element, and atoms may combine chemically to form molecules, the molecule being the smallest unit of any substance that possesses the properties of that substance. An element in modern theory is any substance all of whose atoms are the same (i.e., have the same atomic number), while a compound is composed of different types of atoms together in molecules [5]. The general properties of matter result from its relationship with mass and space. Because of its mass, all matter has inertia (the mass being the measure of its inertia) and weight, if it is in a gravitational field (see gravitation). Because it occupies space, all matter has volume and impenetrability, since two objects cannot occupy the same space simultaneously.

Another area which perhaps needs some additional explanation is the concept of antimatter, and why our universe consists almost entirely of matter and hardly any antimatter. According to theory, the Big Bang should have produced matter and antimatter in equal quantities. Thus, for every quark produced in the early stages of the Big Bang, there would also have been an antiquark; for every electron, a positron (the antiparticle of the electron); etc. The apparent asymmetry of matter and antimatter in the visible universe is one of the greatest unsolved problems in physics.

The idea of negative matter appears in past theories of matter that have now been abandoned. Using the once popular vortex theory of gravity, the possibility of matter with negative gravity was discussed by William Hicks in the 1880s. Between the 1880s and the 1890s, Karl Pearson proposed the existence of "squirts"[6] and sinks of the flow of ether. The squirts represented normal matter and the sinks represented negative matter. Pearson's theory required a fourth dimension for the ether to flow from and into [7].

At CERN, physicists make antimatter to study in experiments. The starting point is the Antiproton Decelerator, which slows down antiprotons so that physicists can investigate their properties. [8]

Almost all matter observable from the Earth seems to be made of matter rather than antimatter. If antimatter-dominated regions of space existed, the gamma rays produced in annihilation reactions along the boundary between matter and antimatter regions would be detectable [9].

If mathematics models everything in the universe, then it must have in consideration also the antimatter as a very natural thing in the universal and contextual consequence.

4 Classification of the Elements of the "Universal Set"

The idea of the paper is to expand the universal set with the abstract elements, called in this paper, “anti elements” which are clearly different from other “normal elements” of the universal set.

Let’s take a contextual consequence which has in consideration a universal set U with n elements as shown below:

Let be n=3 and

If the context has in consideration the elements a, b and c, then why not are in consideration the reason of annihilations or vaporization of elements a, b and c? Let's classify the elements a, b and c, as "matter" elements. Let’s create another set with elements clearly different from the existing elements a, b and c, which have the abstract property that in a collision to respectively a, b and c they annihilate themselves and the other element of the same form. Let's call them Anti mater elements. Let's rename the set and call it. Now, by making the union of the two sets, we perform a new set which has 2n elements but both of two different types.

The introduced "universal set" example has two stages. The first stage is. The cardinality of the set in the first stage is 2n where n is the number of matter elements. It does not exclude the possibility that the universal set might have a different number of matter and/or anti matter objects. In this universal set example the number of matter and antimatter elements is same (three matter and three antimatter elements of the same form. Being the same form means that the elements have the ability that if we perform a collision between of all pairs to each other, the collision process of element a with element a^-, b with b^- and c with c^-, all of them are annihilated. The paper introduces the idea that it is possible to have in a set with matter objects, anti matter objects of the same form. The paper introduced that any set is the subset of the universal set made by matter objects and the antimatter objects of the same form or not. So, the second stage of our example "universal set" is the stage after collision. Of course, the second stage of our sample set is another set, it is the empty set. Of course the cardinal of our example "universal set" in a second stage after collision is 0.

Going back into the philosophical discussion, one can say: Our example universal set with 6 elements is everything on the first stage and nothing on the second stage..!

Some sets might have more elements of the Matter type than the anti matter type. Some other sets might have more elements of the anti matter type than of Matter type. But, the

ISSN 2229-5518

universal set can be constructed with the objects and anti objects of the same form or not.

Let's define the universal set in the new introduced prospect of classified elements of sets in matter and anti matter type as in real nature might really exist.

The universal set is: the set that contains all the elements or objects involved in the problem under consideration together, which can be either matter type or anti matter type objects; all other sets are subsets of the universal set.

If we would be really interested to imply the notion of the universality in a universal set, then we must include always in that universal set the antimatter elements of the matter existing elements and all the matter elements of the antimatter existing elements of the contest consequence of the consequence. In this prospect the universal set must have an even number of elements, exactly like our sample universal set E. Nevertheless, if we must have only such a finite universal sets with only even number of elements or not might be a matter of future discussions.

Although, we for secure can say that, the universal set has always a number of elements of the first stage and possible different number of elements in the second stage, after "collision", which make it another set. So, any set, even the universal set has another set in relation, which is the second stage of the set after collision.

The inclusion of the "opposite" elements of each element of the "old" universal set transforms the universal set in a "new" version of the universal set, which is a better representation of the notion of the universality.

Nevertheless the Physics are interested of matter and antimatter particles the mathematicians are interested of mathematic models. Since the Physicists are trying to find particles and antiparticles, mathematicians have the right to pose an axiom:

Axiom - For each Object we have the Anti Object(s), which represents an abstract notation, symbolizing the reason why the object annihilates in collision with it.

It happens that some set includes objects of matter types, antimatter types, or a combination of both. Sometime we have sets containing the matter object without the antimatter object and sometime we have the antimatter object without the object, but sometimes we have them both.

5 CARDINALITY OF THE UNIVERSAL SET IN TWO STAGES

In mathematics, cardinal numbers, or cardinals for short, are a generalization of the natural numbers used to measure the cardinality (size) of sets. The cardinality of a finite set is a natural number: the number of elements in the set. The transfinite cardinal numbers describe the sizes of infinite sets. The notion of cardinality, as now understood, was formulated by Georg Cantor, the originator of set theory, in 1874–1884. Cardinality [10] can be used to compare an aspect of finite sets; e.g. the sets {1,2,3} and {4,5,6} are not equal, but have the same cardinality, namely three (this is established by the existence of a bisection, i.e. a one-to-one correspondence, between the two sets; e.g. {1->4, 2->5, 3->6}). So, the number of elements in a particular set is a property known as cardinality; informally, this is the size of a set. An n infinite set is a set with an infinite number of elements, while a finite set is a set with a finite number of elements. The paper suggests that which such set must attain a collision process of all elements with each other and then to see the cardinality of the set. There are two stages of the set, before and after collision. Conceptually, it can be called transformation of the set. A set A before collision we will call it A^C after collision process.

In the first stage (before collision), in the above examples the cardinality of the set U_M and U_A is 3, while the cardinality of the set E is 6. The two sets are qualitatively different. The set U_M has matter elements since the set U_A has the anti matter elements. The cardinality of the sets U_M and U_A is denoting just the quantities property of the two sets. If it is decided to imply into the cardinality abstraction for the set the new qualitative classification, than it is needed to put some notation signs into the cardinals. Let's put (+) before the cardinal number of the set U_M. Let's put (-) before the cardinal number of the set U_A.

Every set with two types of elements can be expressed as the union of the subset with just Matter elements with the subset with just Anti Matter elements. So, a set contains "Matter element" and/or "Antimatter element".

Let's have a finitely or infinitely many, nonempty set of elements. For example, let us take a finite set of two elements and let us name it A2. Based on the of equivalence relation "Is equivalent with", defined in the set of all sets U which doesn't contains itself, this set is member of the equivalence class defined from this A2 set of two elements. This equivalence class usually is named $\overline{A_2}$. We know that the cardinality of the set A2 which is usually denoted by $\left|A_2\right|$ is the natural number 2. But, 2 might be the cardinality of some other sets (i.e the set $X_1 = \{a, b, c, c^-\}$), in the second stage as it is introduced in this paper. So on first stage the cardinal of X_1 is 4 but, in the second stage it is another set performed $X_2^c = \{a, b\}$ derived from $X_1 = \{a, b, c, c^-\}$.

In the new perspective of object classification, it is possible to express any set as the union of two sets, respectively, of the mater and anti mater elements of the same form or not. Let's have $S = \{a, b, c, c^-, d^-\}$. This set can be represented as union of:

$S_M = \{a, b, c\}$ with $S_A = \{c^-, d^-\}$

So:

$S = \{a, b, c, c^-, d^-\} = S_M \cup S_A$.

The set $S_M = \{a, b, c\}$ has the cardinality +3 and the set $S_A = \{c^-, d^-\}$ has the cardinality -2.

In one of the two classified sets we can change elements without changing the cardinality quantity and quality of the set (sign and number) in order to perform an equivalent set with the opposite elements of the same form in two different class type sets. So, i.e. we can perform $S_A^1 = \{b^-, c^-\}$ equivalent to $S_A = \{c^-, d^-\}$, but with the same cardinal -2. The union of sets $S_M = \{a, b, c\}$ with $S_A^1 = \{b^-, c^-\}$ constructs the set $S = \{a, b, c, b^-, c^-\} = S_M \cup S_A^1$ which in the second stage $S^C = \{a\}$ has the cardinal denoted by the symbol +1.

6 The Use of classified sets

In the new perspective of sets with classified objects it is very easy to construct a set with "natural" negative, "natural" zero and "natural" positive numbers denoted by N^{-0+} using so the signed cardinal representing qualitative and quantitative properties of sets with antimatter, and/or none and/or matter objects.

$N^{-0+} = N^- \cup \{0\} \cup N^+$ where N^- is the set of the cardinals of the sets with more antimatter objects than mater objects and N^+ is the set of the cardinals of the sets with more matter objects than antimatter objects.

The formal definitions such are the Peano axioms [11], Constructions based on set theory, von Neumann construction [12] and the other constructions of the set of natural numbers can be used in the same way, in the new prospective of the classified sets to construct the set N^{-0+}, which contains negative natural numbers, zero and positive natural numbers which in fact is algebraically equivalent with the set Z of the whole numbers. , exactly in the same way how is constructed the structure of natural numbers N.

We can construct the algebraic operations in this set, by using the set stages of the classified sets. Exactly in the same way as are defined in N, by using the cardinality concept, it is possible to define in the set N^{-0+} such are: Addition, Multiplication, Relationship between addition and multiplication, Order, Division, Algebraic properties satisfied by the "new natural" numbers.

It is clearly possible to construct i.e. a structure (N^{-0+}, +) which can be algebraically the same structure as (Z,+).

7 Conclusion

By classifying objects of e set in matter and anti mater objects, one not only can model mathematically the new perspectives of the natural things in the reality, but create the prospect to simplify the construct and definition of the set of the integer numbers. The set of the integer numbers can be constructed exactly as natural numbers by using the sets introduced herewith. There is no need to expand the set of the natural numbers in order to perform the set of the integer numbers. The set of integer numbers can be constructed by using the sets with classified objects. The set of signed cardinals is the set of the integer numbers itself by using exactly the new sets in the same way as are used the traditional sets for construction of the set of the natural numbers.

References

[1] Church, Alonzo. "Set theory with a universal set." Proceedings of the Tarski symposium. Vol. 25. Proc. Symposia Pure Math. XXV, AMS, Providence RI, 1974.

[2] Forster, Thomas E. Set theory with a universal set: exploring an untyped universe. 1995.

[3] Heraclitus of Ephesus: “The Doctrine of Flux and the Unity of Opposites”, 535-475 BC.

[4] Sanford L. Drob, The Doctrine of Coincidentia Oppositorum in Jewish Mysticism, A series of articles by Sanford Drob pertaining to Jewish mysticism and other topics of Jewish interest, 2000, pp 14. (www.NewKabbalah.com)

[5] Cohen, Andrew G., Alvaro De Rújula, and Sheldon Lee Glashow. "A matter-antimatter universe?." The Astrophysical Journal 495.2 (1998): 539.

[6] Pearson, Karl. "Ether squirts." American Journal of Mathematics 13.4 (1891): 309-362.

[7] Kragh, Helge. Quantum generations: A history of physics in the twentieth century. Princeton University Press, 2002.

[8] Cohen, Andrew G., Alvaro De Rújula, and Sheldon Lee Glashow. "A matter-antimatter universe?" The Astrophysical Journal 495.2 (1998): 539.

[9] Sather, Eric. "The Mystery of the matter asymmetry." Beam Line 26 (1996): 31-37.

[10] Bancerek, Grzegorz. "Cardinal numbers." Formalized Mathematics 1.2 (1990): 377-382.

[11] Kennedy, Hubert C. "Life and works of Giuseppe Peano." D. Reidel Publ. Co, Dodrecht (1980).

[12] Brainerd, Charles J. "Mathematical and behavioral foundations of number." The Journal of General Psychology 88.2 (1973): 221-281.