Application of Bijective Function of Set Theory in Physics

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Abstract

To think about mysterious connection between physics and mathematics we need first to understand what mathematics is and what physics is. I see mathematics as a reflection of universal hidden order (in the meaning proposed by David Bohm) in the human rational mind. Physics is the model of the universe created by the human rational mind. The subject of this essay is how to use realize Einstein vision on completeness theorem according to which each element of the physical universe corresponds exactly to the one element of the model. To realize this vision of we apply bijective function of set theory. We build a model the universe in which each mathematical element represents exactly one element of the physical universe.

Key words: bijective function, set theory, physics

1. Introduction

According to Einstein's definition of completeness of a physical theory, a theory can be considered complete if every element of physical theory has a counterpart in the physical reality. We apply bijective function of set theory in order to see if a model of space-time where time is considered to be 4^{th} dimension of space has a correspondence in physical universe.

In the physical universe the following five elements are perceived directly by senses (as well as by enhanced senses): matter, energy (all types of electromagnetic energy), space, change and time as a sequential numerical order of changes with its duration, running in space; sequential numerical order means change $n+1$ is following change n, change $n+2$ is following change $n+1$ and so on. Material change $n+1$ is "after" material change n equivalently as natural number 2 is "after" natural number 1. "Past", "present" and "future" exist in space only as a numerical order of material changes. Changes that exist in human mind (as for example flow of thoughts) have origin in neuronal activity and can be as such considered "material" too. In the light of this fact we consider time is a numerical order of changes in general. Matter, energy, space, change and time as a sequential numerical order of changes (with its duration) are perceivable elements of the set "universe X". The sixth element of the set universe X is the observer, who perceives the other five elements. Using a bijective function, these six elements of the set universe X can be transformed into six elements of set "model Y" as shown in Figure 1.

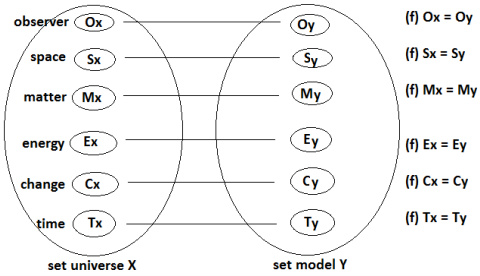

Figure 1: Between set universe X and set model Y there is a direct epistemological correlation

Observer has experimental evidence that matter can transform in energy and that matter is made out of energy. Furthermore, according to contemporary quantum field theories, particles spontaneously appear from space and disappear back in it. This lead to the conclusion that also space can be considered as a type of energy (named the energy associated with a fundamental quantum vacuum). Element of matter M_x, element of space S_x and element of energy E_x in the universe set X can be considered as elements of the subset EX (Energy subset of the universe set X). Element of matter M_y, element of space S_y and element of energy E_y in the model set Y are elements of the subset EY (Energy subset of the model set Y). In the Universe set X we have four fundamental elements. In the model set Y we also have four fundamental elements, observer, energy, change and time:

$$\begin{aligned} X: &\ O_x, C_x, T_x, \ EX \\ Y: &\ O_y, C_y, T_y, \ EY \\ EX: &\ E_x, S_x, M_x \\ EY: &\ E_y, S_y, M_y \end{aligned} \qquad (1).$$

In this model space and time are two different elements in the set "universe X" and two different elements in the set "model Y". Time T_x does not enter energy subset EX and time T_y does not enter energy subset EY[1]. This confirms that observer cannot exist in time as time has no attribute of energy and so no physical existence.

Observer exists and changes run in space; time t is a numerical order of a given change. Fundamental unit of numerical order (which is fundamental time) is Planck time and duration (which is emergent time and requires measurement of the observer) is a sum of a numerical order of a given change:

$$t = t_{P1} + t_{P2} + \ldots + t_{PN} = \sum_{i=1}^{N} t_{Pi} \qquad (2).\ ^{2}$$

Time has only a mathematical existence, past, present and future are only a mathematical realities. From this point of view it is impossible that observer could exist in time, because past, present and future have only a mathematical existence. From this perspective also

"arrow of time" has only a mathematical existence and is pointing into direction of numerical order of changes which run in space:

$$t_{P1} \rightarrow t_{P2} \rightarrow ... \rightarrow t_{PN} \qquad (3).$$

2. Space, time and observer in the light of bijective function of set theory

Application of bijective function of set theory on Einstein completeness theorem confirms time has only a mathematical existence. This shows how adequate use of mathematics brings a new light into understanding of relations between space, time and observer. Barbour and collaborators recent research speculates observer exists in time which is composed out of past, present and two bifurcation futures [3]. It seems their idea is not valid because time is not physical reality in which observer could exist.

Time travels are out of question [4], one can travel in space only and time is duration of its motion. There is no more "twin paradox" [5], twin in a fast space ship is aging with lower velocity as his brother on the earth. Both are aging only in the space and time is duration of their aging.

Time as mathematical parameter confirms also that time cannot have origin in quantum entanglement as is recently proposed by Ekaterina and collaborators [6]. Observer and quantum entanglement both exist in space and time has merely a mathematical existence [7,8].

Universe is timeless as proposed by Kurt Gödel [9]. This view allows superluminal motion particles [10] which move in space only and time is duration of its motion. A particle moving with speed above light speed will not move backward in time as time is only a mathematical parameter of its motion in space.

3. Bijective function and introduction of negative energy in physics

According to bijective function energy in the universe is not positive and is not negative. We have for example positive electric field and negative electric field but this does not mean that energy of the field is negative or positive, "positivity" and "negativity" is just our description of field characteristic. Energy as such has no attribute of being positive or negative. The idea that energy could be positive and negative comes from mathematic where we have positive and negative numbers. According to bijective function this "mathematical thinking" cannot be always applied in physics.

A classic example of "mathematical thinking" is how the English physicist Stephen Hawking explains inflation phase of the big bang theory. In his book "Brief History of Time" he explains that the energy of matter E_m in the universe is positive, therefore the gravitational energy E_g is negative. The sum of both energies of the universe is always zero, which can be written as:

$$E_m + E_g = 0 \qquad (4).$$

In inflation phase this two energies are multiplying but their sum always remains zero [11], similar as:

$$\begin{aligned} &1 + (-1) = 0 \\ &2 + (-2) = 0 \\ &X + (-X) = 0 \end{aligned} \qquad (5).$$

According to bijective function we cannot apply this fundamental arithmetic rule in physics because is in contradiction with the law of energy conservation.

4. Conclusions

Mathematics is the useful tool of physics. However out of pure mathematical laws we cannot deduce physical laws. Bijective function is a helpful tool which allows us to see the degree of correspondence of a given mathematical element or process in the model with correspond element or process in the physical world.

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