Bijective Analysis of Symmetry in Physics

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Abstract
Bijective Analysis of 4D Minkowski space-time model confirms that 4D space-time where time would be 4th dimension of space does not exist. In 4D manifold, time is the duration of a physical event which runs in space. An event does not have the duration in time, duration itself is time. It means that any given physical phenomena can only be symmetric in space; not in time.

Keywords: symmetry, time, space, entropy, bijective analysis, supersymmetry

1. Introduction

At first, before focusing the light towards the bijective analysis of symmetry in Physics, we have a short look towards - the 'Bijective methodology which is based on the concept of 'Bijective correspondence'. In set theory, a mathematical relation- Bijectivity, is a correspondence between two elements of any two sets. And the said correspondence is said to be 'Bijective' if there exists both the one-one and onto mapping. Literally saying, it is the correspondence between the elements of two sets, where each element of one set is paired with exactly one element of the other set, and each element of the other set is paired with exactly one element of the first set. There are no unpaired elements.
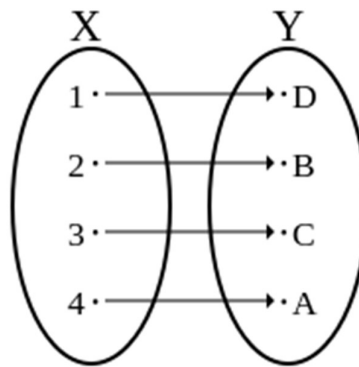

Figure-1 (Bijective mapping between two sets X and Y)

The correspondence is said to be 'Bijective' if the followings hold:

- each element of X must be paired with at least one element of Y,
- no element of X may be paired with more than one element of Y,
- each element of Y must be paired with at least one element of X, and
- no element of Y may be paired with more than one element of X

And by applying this concept of 'Bijective mapping', we have introduced a new methodology based on the idea : "*Let's consider the set of all physical equations to be X (You may take it as Physics), and the set of all physical realities to be Y (you may take it as the real world). And the 'bijectivity' refers that each element of X should have exactly one paired element in Y''*. Literally saying, each physical equation should have its counterpart in the real physical world and vice versa.

2.   Symmetry in timeless space where time is the duration

20th-century physics has understood that entropy increases in time as the 4th dimension of space. The bijective analysis confirms that all physical phenomena are running only in space; time is just their duration [1]. This insight is very fundamental for the further development of physics and also understanding of symmetry. A given phenomenon can only be symmetric in space and never in time. The SUSY should be examined as a potential supersymmetry which exists only in space. The Standard model is based on the proposition that all forces are carried by different particles and each of these particles has its corresponding antiparticle as is predicted by SUSY. In particle physics, supersymmetry (SUSY) is a theory that proposes a relationship between two basic classes of elementary particles: bosons, which has an integer-valued spin, and fermions, which has a half-integer spin. The Higgs mechanism has its origin in supersymmetry (SUSY), which is an extension of the Standard Model: "Supersymmetry predicts a partner particle for each particle in the standard model, to explain why particles have mass. At first sight, the Standard Model seems to predict that all particles should be massless, an idea at odds with what we observe around us. Theorists have come up with a mechanism to give particle masses that require the existence of a new particle, the Higgs boson"[2]. SUSY is not confirmed yet fully by experimental evidence. For example, there would be a particle called a *"selectron"*, a bosonic partner of the electron which was not discovered yet. In this article, we will propose a new kind of supersymmetry which is not between particles and antiparticles, it is between knowing particles and 4D timeless space in which these particles exist.

3.   'Particles – space' supersymmetry

The idea of 'empty space' does not pass through bijective analysis [1]. The 4D timeless space, in which the physical particles exist, also has physical properties and is in active relation with the particles. Every particle has a given structure of space energy and diminishes its energy density accordingly to the amount of its energy. This idea is not new, it was proposed by Ervin Schrodinger: *"What we observe as material bodies and forces are nothing but shapes and variations in the structure of space"* [3].

Every massive particle, massive body, or stellar object has its origin in the diminished energy density of space ρ_{SE} in the center of a given physical object, which causes the outer higher pressure of space with Planck energy density ρ_{PE} towards the center of given physical object and it is expressed as:

$$\rho_{SE} = \rho_{PE} - \frac{mc^2}{V} \qquad (1)$$

where m is the mass of the object, c is the light speed and V is its volume.

We can rearrange formula (1) and we get:

$$m = \frac{(\rho_{PE} - \rho_{SE}) \cdot V}{c^2} \qquad (2).$$

The inertial mass m_i and gravitational mass m_g of a given massive particle with mass m have its origin in the diminished energy density of space in its center. The value of inertial mass m_i is equal to the value of its mass m:

$$m_i = m_g = m = \frac{(\rho_{PE} - \rho_{SE}) \cdot V}{c^2} \qquad (3).$$

Actually, we define the amount of mass m of a given physical object by measuring its gravitational inertial mass.

Formula (3) shows a given physical object with mass m diminishes the energy density of space exactly according to the amount of its energy E. We can express this by multiplying the formula by c^2 and we get:

$$E = mc^2 = (p_{PE} - \rho_{SE}) \cdot V \qquad (4) \ [4].$$

Equation (4) is in accord with Einstein's "mass-energy equivalence" principle which is one of the pillars of physics: "Mass of a body is a measure of its energy-content" [5].

Two physical objects are creating the common area of a diminished energy density of 4D space which is causing the higher pressure of external space towards inner space. This difference in pressure is the origin of inertia and gravity.
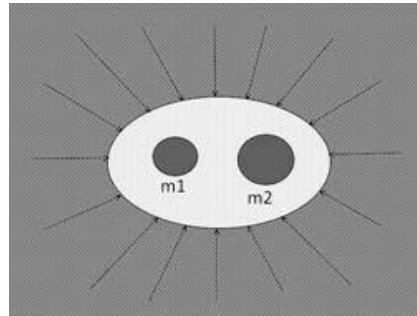

Figure 2: Area of space with diminished energy density
is the origin of inertia and gravity

Famous Einstein formula $E = mc^2$ was missing the part which relates a given physical object with mass m and energy E with the space in which given physical object exists. The missing part tells us the origin of inertial mass and gravitational mass as we can see in the figure below:

3

origin of inertial mass and
gravitational mass

$$E=mc^2=(p_{PE}- p_{SE})\times V$$

energy   mass

Figure 3: Supersymmetry formula

The formula is also valid for relativistic physical objects by adding Lorentz factor γ on the right side of the equation:

$$E = mc^2 = \gamma \cdot (p_{PE} - \rho_{SE}) \cdot V \qquad (5)\ [6].$$

4. Discussion

The progress of physics is mainly based on experimental facts and secondary on theoretical prepositions. As we do not have a single experimental data which confirms that physical events run in time, so we should drop the idea of possible "symmetries" in time.

Here in this article, by introducing physical properties of space, the original solution for supersymmetry is proposed. This supersymmetry is the origin of both inertia and gravity. We have proposed in this article that there is essential to distinguish between the "inertial mass", "gravitational mass" of a given particle which has the origin in diminished energy density of space, in which given particle exists and between "mass" of the given particle which has the origin in its energy content. This notion is feasible w.r.t the Einstein's "mass-energy equivalence" principle.

This article is suggesting the "paradigm shift" jump from "space-time" to "timeless space of Now" where time is merely duration of an event running in space, in which it is always Now. This jump is fulfilling the Einstein vision on time: "Time has no independent existence apart from the order of events by which we measure it…there is something essential about the NOW which is just outside the realm of science. People like us, who believe in physics, know that the distinction between the past, present, and future is only a stubbornly persistent illusion". The symmetry between timeless space and a given physical object from micro to macro level is the fundamental symmetry of the universe. In interstellar areas, space has maximum Planck energy density and is flat; in black holes space has maximum curvature and minimal energy density which is below the required value for the stability of atoms which causes atoms are falling apart back into the energy of space. The energy density of space is determining "gravitational motion" of physical objects. More space is dense less is its curvature and opposite, less space is dense higher is its curvature [6].

The idea of the relation between the curvature of space and its energy density is not new, firstly it was presented by Wolff: "The reader may be inclined to disbelieve this strange result. But there are several confirmations, one of which is Einstein's General Relativity (GTR) which contains the same feedback loop: Reduced to basics, GTR calculates the density of space-time at each point in space using the density of matter and energy everywhere in the universe. A varying density is referred to as curvature of space. This space density is then used to determine the paths of moving matter and of light which follows the curvature [3].

Noether's theorem states that every differentiable symmetry of the action of a physical system has a corresponding conservation law. A given physical system is symmetric in time if its entropy remains unchanged [7]. Here we give the advanced understanding of Noether's theorem, namely: a given physical system is symmetric only in space (never in time) if during its duration its entropy remains the same.

In physics, we experience the increase of entropy and run of physical changes through the linear psychological time of "past-present-future". That's why we see changes are running in some linear time. The conscious observer is aware of linear time; he experiences changes directly as they run in timeless space without the interference of psychological time. Symmetry in time is wrong imagination based on our experience of material changes via psychological time. With our elementary perception, we can only confirm material changes run in space.
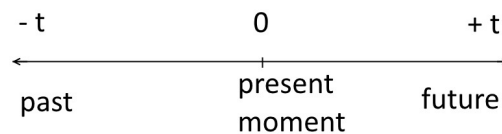
```
  - t                    0                    + t
   <---------------------|--------------------->
  past                present              future
                        moment
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Figure 5: Symmetry in time is based
on experiencing through psychological time

Considering that universal space is timeless, the universe runs only in this timeless space and not in time. With clocks we measure the duration of events in Now [1]. As we do not have a single experimental data that some linear physical time exists, the model of the timeless universe where with clocks we measure internal relations between different physical changes is entering mainstream physics [8]. Also, the idea that gravity does not require time and is encoded in a timeless configuration space (as we have shown in this article) is entering mainstream physics [19. Time in its intrinsic nature is numerical order of events running in timeless space, it has exclusively mathematical existence. We named it "fundamental time". When the observer measures this fundamental time duration as the emergent time enters existence. Without measurement from the part of the observer, there is no duration [10]. Material changes are running in timeless space without having the particular duration on their own. The duration becomes actual when measured by the observer which again confirms the importance of the observer in physics. Time as the duration is the creation of the observer.

Timeless space is the direct information medium of entanglement by EPR type phenomena [11]. For a century entanglement was difficult to understand because of the wrong image, namely, that space-time (where time is a 4^{th} physical dimension of space) is the fundamental arena of the universe. The bijective analysis confirms the fundamental arena of the universe is 4D space where time is the duration of physical events after they have been measured by the observer [1].

5. Conclusions

"Time symmetry" is something seems does not exist as time is not the 4th physical dimension of space. The fundamental symmetry proposed in this article is the symmetry between particles, massive bodies, stellar bodies and diminished energy density of 4D timeless space which is the fundamental arena of the universe. This fundamental symmetry is the origin of inertia and gravity.

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