01 On Discrete Euclidean Space

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The paper is the first blog post of the blog “Discrete Euclidean Space” at https://www.conceptualframeworks.org. The blog describes research on discrete space. All the titles of the blog posts are numbered and dated.

Introduction

Observable reality is some kind of a 3D phenomenon. There are observable phenomena like objects (shapes) and it shows that all the objects are changing their mutual positions and even transform the properties of their shapes within the volume of the universe.

In practice a transformation is a physical change were one of more properties during the change are invariant. For example, I can deform continuously the shape of a volume while the total amount of volume isn’t affected (a type of homeomorphism in the mathematical field of topology).

The concept of transformation depends partly on the scale size of the transformation. Macroscopic transformations are more “fuzzy” than transformations in the microcosm, the atomic and sub-atomic level of observable reality. That is because an increase of size means an increase of complexity. And complexity corresponds with variance.

If we think about observable reality as a type of a 3D phenomenon we have to admit that all these transformations cannot exist if there is no differentiation within the all-inclusive volume. Local point-like volumes in space with slightly other properties than local point-like volumes somewhere else. So we have to conclude that observable reality must have some kind of a structure.

I can compare observable reality with a LCD display. The 2D display can reproduce nearly every observable reality with the help of a video. But that’s only possible because every point-like pixel of the display can reproduce every colour and brightness that corresponds with the reproduction of observable reality by the stream of video images.

That’s why it is obvious that the 3D phenomenon that represent observable reality must have a basic structure that is comparable with the pixels of the LCD display. Every point-like volume within observable reality must have properties that can create everything we observe. Stars, black holes, planets, rocks, animals and even voids. And of course a blade of grass like the image below.

figure 1

I have drawn “pixels” in a schematic way in figure 1 but the metric of our universe is much smaller. Some theorists have the opinion that the metric of our universe is equal to the Planck length ($\ell_P = 1,616255 \times 10^{-35}$ m). But in the past others have hypothesized that the metric probably corresponds with the size of the minimal wave length of electromagnetic waves and the size of the smallest particles in nature. That means that the proposed metric of our universe will be $\approx 1 \times 10^{-15}$ m.

References


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Points of view

Figure 2 shows the 3D structure of the proposed schematic metric that was drawn on the blade of grass in figure 1. The metric is cubic because $d_x = d_y = d_z$. Actually, I can fill the universe with every geometrical shape that tessellates space but a cube is simple to draw and easy to imagine.

We can observe an object in more than one way because we can choose more than one distinct point of view. Comparable with the way we construct concepts about the mutual relations between everything we can observe.

The consequence is that Newton’s continuum of absolute space and time and Einstein’s concept of relative space and time represent different points of view in relation to the all-inclusive existence of the 3D phenomenon, our universe. Actually, it means that there exists a concept that envelopes Newton’s continuum and Einstein’s spacetime. And without doubt all the other hypotheses about the basic properties of our universe too.

References:

The hierarchy

Theories about the basic properties of our universe do not only differ in relation to their different points of view but also in relation to the scale size of observable reality. The primary subject of quantum theories is the microcosm and not the macrocosm. But Einstein’s theory of General Relativity for example originates from the macroscopic point of view.

Different points of view represent sometimes conflicting interpretations about the hierarchy of observable reality. Some theories are focused on the phenomena itself and suggest that the properties of the distinct phenomena – e.g. matter – are independent from the properties of space around. Unfortunately that is a concept that is conflicting with the general concept of Quantum field theory (QFT). Because in QFT the observable phenomena are thought to be created by the underlying structure of the basic quantum field.

A concept that is not in line with the Standard cosmological model (ΛCDM). A large scale model of our universe that originates from the idea that space itself is expanding during the whole evolution of the universe. An evolution that started with the appearance of a single local event that is termed “the Big-bang”. The single local event enveloped all the energy that is now distributed in space and has cre-
ated stars, galaxies and clusters of galaxies. The foundational problem between the ΛCDM and QFT is that the underlying structure of the basic quantum fields represent all the energy in our universe, so there is no need for “single originating events”.

All these confusing conceptual problems about the right hierarchy of the different point of views disappear if our universe is a 3D phenomenon that is composed by “pixels” that tessellate the whole volume of our universe. A spatial structure that is in rest and creates all the observable phenomena.

![figure 4](image)

However, is there any evidence that observable reality is created by an underlying structure? Because a concept without any relation with observable reality is not really convincing.

Suppose we launch satellite cube into space. Inside the cube is a green laser and the laser beam is directed with the help of mirrors in 4 directions (A, B, C, D). The satellite cube is moving in direction A (see the arrow on top of the cube). If the green laser is switched on for a very short amount of time it shows that the 4 beams of light have travelled exactly the same distance in space. The velocity of a beam of light is the constant speed of light (c) so I can make the conclusion that the 4 beams of light are not influenced by the velocity of the source of the light beams, the green laser inside the satellite cube.

But if the 4 beams of light can move in vacuum space without any influence of the velocity of the source of the light beams I have to conclude that the transfer of the quanta of the light beams in space is directly related to the properties of discrete space itself.

Now I repeat the experiment with the help of 4 beams of free electrons. The result of the new measurements is not the same. It shows that the trajectories of beam C and D are identical but the trajectory of beam A is longer and of beam B is shorter. In other words, the velocity of the satellite cube in the direction of A influences the velocities of the electron beams A and B.

The difference between a light beam and an electron beam is the quantum of energy, Planck’s constant (h). A beam of light is an electromagnetic wave of single quanta and an electron beam is a stream of local compositions of quanta. Concentrations of quanta that have mass, like the satellite cube represents a concentration of energy that has mass.

However, if the constant propagation of single quanta in vacuum space show no influence from the velocity of the source of the stream of quanta, there arises a conceptual problem. Because the 3D pixels of discrete space do not create only the quanta, the 3D pixels create the satellite cube too. So why there is no observable relation between the 4 laser beams (A, B, C, D) and the source of the light beams, the satellite cube?

If I change my experiment in figure 4 and measure the wave length of each individual laser beam the results will show that the velocity of satellite cube has influenced the wave lengths of beam A and beam B (see figure 5), but the wave lengths of beam C and B have not changed in relation to a satellite cube with a very low velocity.

![figure 5](image)
The energy \((E)\) of an electromagnetic wave depends on the frequency \((f)\) of the wave. The velocity of the wave is the constant speed of light \((c)\) thus the periodicity of the light wave determines the wave length \((\lambda)\). Formula:

\[
E = h \cdot f = \frac{h \cdot c}{\lambda}
\]

The equation of the Planck-Einstein relation shows that only the wave length determines the energy of the electromagnetic wave because the speed of light \((c)\) and the quantum of energy \((h)\) are constants. In other words, the velocity and direction of the moving satellite cube influences the energy of the laser beams A and B but not the velocity of both laser beams.

The only reasonable explanation is the hypothesis that the constant velocity \((c)\) of single quanta in vacuum space is determined by the basic properties of discrete space itself.

Reference: