The “renormalization” of Discrete space

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The concept of discrete space can be termed as “the external mathematical reality hypothesis”. The concept was already known among the ancient Greek philosophers (≈ 500 BC). Unfortunately the phenomenological point of view has dominated science during more than 2000 years and it is only recently that the concept of discrete space gets “tangible” attention again in philosophy[1] *and theoretical physics.*[2][3] *Although the model describes the existence of the universal conservation laws, constants and principles in a convincing way,*[4][5] *the relation between phenomenological reality and the geometrical description of discrete space is difficult to imagine for everyone who is only familiar with phenomenological reality. The purpose of this paper is to describe some easy to imagine properties of discrete space.*

Introduction

Space itself is an all-inclusive volume. Discrete space is exactly the same volume but it is proposed that the volume has an internal structure. That means that the volume of the universe is build up by small volumes and all these units together tessellate our universe. Not because we like the idea but because all the phenomenological hypotheses to understand the observations have failed. Thus if space is the creator of reality, it must have a structure.

The basic properties of the units of discrete space are directly related to the detected and deduced properties of the basic quantum fields, fields that are existent during the whole evolution everywhere in the universe. Therefore, phenomena like particles are thought to represent local concentrations of one or more of the basic properties of the units of discrete space ($E = m\,c^2$).

The concept of discrete space and the related dynamical transformations have mathematical consequences. These make it possible to construct the basic properties of the units of discrete space.[6] However, the translation of the geometrical description of the properties of discrete space into a realistic concept that fits phenomenological reality is hindering the conception of the ideas. In the next chapters I will try to clear some misinterpretations.

References:
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2. J. Ambjørn, J. Jurkiewicz and R. Loll (2006). "*Quantum Gravity, or The Art of Building Spacetime*". Cambridge University press. https://arxiv.org/abs/hep-th/0604212v1
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4. “*On the concept of (quantum) fields*” (2019) DOI: 10.5281/zenodo.3585790
5. “*On mathematics and discrete space*” (2021) DOI: 10.5281/zenodo.5457368
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The minimal length scale

If the volume of the universe is build up by small volumes (units) and the basic properties of these units are responsible for the creation of phenomenological reality it is hard to imagine that the observable and detectable phenomena have no direct relation with the spatial properties of the units of discrete space.

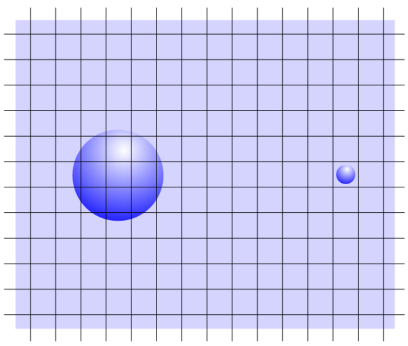

figure 1

I can draw in a schematic way the structure of discrete space and 2 particles that differ in size (figure 1). Now the question is: "*Is it possible that discrete space can configure particles smaller than the volume of 1 unit?*"

Particles have a spin and spin is an "inside" rotation of energy. Therefore it is impossible that 1 unit of discrete space can create a particle because the configuration of a particle is the emergence of a local difference of one or more variable properties of the involved units in relation to the properties of the other units around.

The conclusion is there exists a minimal length scale in our universe.[7] The minimal length scale has a direct relation with the size of the "tangible" phenomena and not with mutual influences like the force of gravitation.[8] In other words, the proposed Planck units have no direct relation with the minimal length scale, the spatial properties of the structure of discrete space. The minimal length scale will be ≈ $0{,}5 \cdot 10^{-15}$ m (derived from the particle at the left in figure 1).

References:

7. Sabine Hossenfelder (2013), "*Minimal length scale scenarios for quantum gravity.*"
   DOI: 10.12942/lrr-2013-2
   https://arxiv.org/pdf/1203.6191.pdf
8. M. Planck. "*Naturlische Masseinheiten*".
   Der Koniglich Preussischen Akademie Der Wissenschaften, p. 479, 1899

Relative and absolute motion

Figure 2 shows an imaginary unit of discrete space. Inside the unit I have drawn a partly transparent scalar of the Higgs field and the vectors that are created by the points of contact with the scalars of the adjacent units around. The coloured arrows represent the direction of the topological deformation of each face of the unit. The proposed configuration of the topological deformation in figure 2 is just an arbitrary example.

Each unit of discrete space has 12 adjacent units, see figure 3, the lattice of the identical scalars of the Higgs field in vacuum space. All the units of discrete space tessellate the volume of the universe thus the green arrows are red arrows and the red arrows are green arrows for the adjacent units around. Because of the invariant volume of every unit the "output deformation" (green arrows) is equal to the "input deformation" (red arrows).

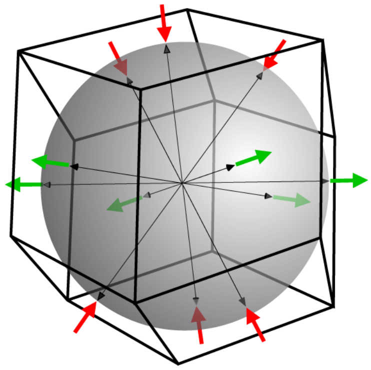

figure 2

Planck's constant is determined with the help of experiments. That means that the constant represents mutual relations between phenomena. The motion of the phenomena is determined by the direction of the changes of the topological deformation of the involved units of discrete space. That means that in figure 2 one or more faces with an inwards deformation (red arrows) change into an outward deformation (or the opposite). So there is a "universe wide synchronized switch" of the direction of the flow of infinite small amounts of volume within the boundary of all the units of discrete space.

The consequence is that the motion of the observable and detectable phenomena is mutual relative and quantized although the underlying reality (discrete space) is in rest and transforms fluently. (Newton's axioms about absolute space and absolute time).

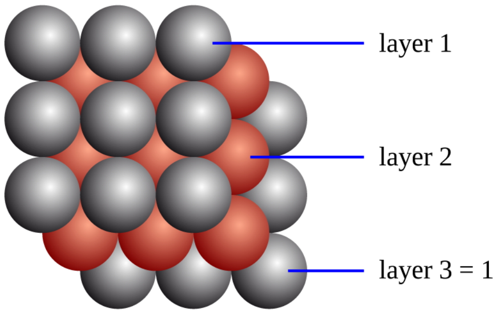

figure 3

Topological deformation

Figure 4 shows a diagram and it shows half the topological deformation of the 12 faces of the unit in figure 2 during the constant of quantum time (≈ $6 \cdot 10^{-23}$ sec). Because the output deformation (green arrows) is the input deformation of the involved adjacent units around.

The flux of infinite small amounts of volume within the boundary of a unit during the constant of quantum time changes the shape of the unit (in relation with the change of the shape of all the other units in the universe). This synchronous addition and subtraction of volume around the points of contact between the scalars at the involved faces of the unit is – besides the decrease of local scalars – the only “visible” alteration of the configuration of the units of the structure of discrete space.

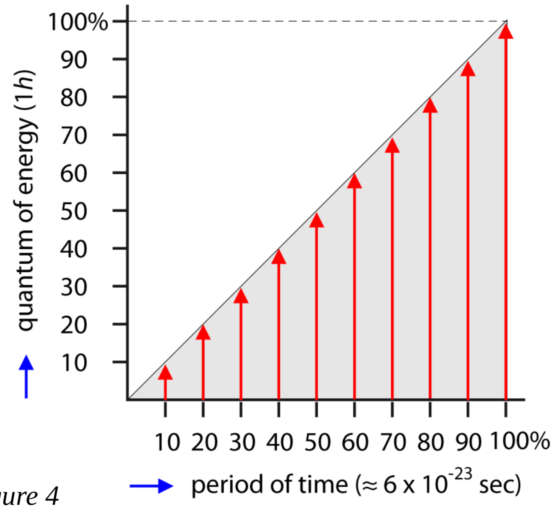

figure 4

Therefore, our concept of motion – the transfer of an object from position A to position B – is the result of a subtraction. Actually it can be interpreted as a kind of a “renormalization”. Only the pass on and mutual influence of topological deformation determines “physical reality”. Although there exists a background of quantum fluctuations that are “invisible” for our instruments too.

The mutual influences at the boundary of every unit create a continuous differentiation of the “pressure” of the scalar mechanism in the points of contact between the scalars of the units (figure 3).[6] A type of influence between the units that we know as the vectors of the magnetic field inside the scalars of the flat Higgs field, the red arrows in figure 4.

In phenomenological reality – “renormalized” reality – every *change of position* is quantized. But figure 4 shows that the vectors of the magnetic field change fluently during the constant of quantum time. The transfer of 1 quantum (*h*) of topological deformation within the boundary of the unit is a flux of infinite small amounts of volume. That is why the differentiation between the magnitudes of the vectors is infinite too.

The magnetic field and the electric field (topological field) are corresponding fields. The scalar vectors of the magnetic field determine the direction of all the quanta transfer in vacuum space during the next “switch” but the influence of the individual scalar vectors is not restricted to the size of one unit. The reach of the influence of the scalar vectors – the severally magnitudes – depends on the differences between the amount of topological deformation of the involved units (e.g. the enormous influence of a black hole on vacuum space around in comparison with the small influence of a proton).

Conservation of topological deformation

Figure 2 shows an imaginary symmetrical unit. The volume of every unit is invariant and related to observable reality – the minimal length scale – so it is possible to calculate the number of units inside a volume of 1 m^3. If I know the number of units I can calculate the total amount of surface area of all the boundaries of the involved units.

However, all the units of discrete space share their surface area with the adjacent units around. Thus I have to know the total number of units in the whole universe to determine the average amount of surface area. Unfortunately, figure 2 shows how easy it is to increase or decrease the surface area of the whole unit.

If the average amount of surface area in the universe can decrease and increase it can only be done by the deformed part of the volume of every unit. But it shows that the surface area of the deformed part of every unit is invariant.[5] One more argument to trust the reliability of the law of conservation of energy and the corresponding law of conservation of scalar vectors.

Maybe it is a bit disappointing but it cannot be excluded that there exists no non-speculative mathematical causation for the surplus of conserved topological deformation in our universe.