Discrete space and the scalar lattice

*Sydney Ernest Grimm**

As far as we know the scientific search for the nature of reality in Europe started about 2500 years ago in ancient Greek. It was the ancient Greek philosopher Parmenides who reasoned that observable reality is created by an underlying reality. There are indications that the ancient Greek concept of the atom was (also) related to the proposed units of the structure of the underlying creating reality of Parmenides. However, an invisible underlying creating reality suggests that we cannot determine its existence with the help of experimental physics. This paper describes an experiment that will show that Parmenides concept about an underlying reality is correct.

Introduction

The existence of an underlying reality that is responsible for the creation of the observable and detectable phenomena can be proved with the help of the mathematical model of the underlying reality. A mathematical model that shows the existence of the known universal properties of our universe.[1][2]

The known universal properties of our universe – the universal conservation laws, the universal constants and the universal principles – are the result of experimental and theoretical research during a long period of time. Actually, these universal properties represent concepts that have come about after lengthy research over a large number of years. This in contrast with a single experiment that proves the reliability of a hypothesis.

The concept that space itself has a structure and therefore that the units of the structure tessellate the volume of our universe has consequences in relation to the interpretation of the existing theories in physics. For example quantum field theory.

The present concept of quantum field theory explains the existence of phenomena in our universe as local creations by the basic properties of the universal quantum fields. Basic quantum fields that exist everywhere during the whole evolution of our universe. The consequence is that the universal quantum fields are in rest in relation to the motion of the observable and detectable phenomena. A conceptual framework that is almost in line with Parmenides' concept of an underlying reality that creates all the observable phenomena in our universe.

If we put both concepts together we get a more detailed concept that describes the universe as a spatial structure of units that tessellate the volume of the universe. A spatial structure that shows properties that are known as the properties of the universal quantum fields.

In other words, is it also possible to detect the "hidden properties" of the structure of space itself – discrete space – with the help of a single experiment?

References:
1. S.E. Grimm (2020), "*On the construction of the properties of discrete space*"
DOI: 10.5281/zenodo.3909268
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2. S.E. Grimm (2019), "*Empiricism and empirical information*"
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* City of Amersfoort, the Netherlands
email: segrimm@conceptualframeworks.nl
Orcid: 0000-0002-2882-420X

The universal scalar field

If space itself has a structure that is build up by units with identical basic properties it is possible to determine the mathematical configuration of these units. Just because the shape of a sphere is the dominant shape at every scale size in our universe. Moreover, the sphere is the only true scalar that exists. In QFT space is filled up by a scalar field – the Higgs field – a universal quantum field. Therefore it is reasonable to propose that every unit of discrete space envelopes one scalar of the Higgs field. See figure 1.

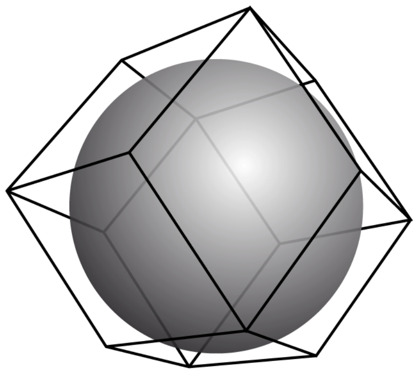

figure 1

The transparent boundary of the unit represent an imaginary symmetrical unit in a static universe. The only purpose of the image is to show the scalar as an inscribed sphere inside one unit of the structure of discrete space.

Vacuum space shows to be homogeneous and isotropic at the macroscopic scale. That means that we cannot observe a clear preferred direction in relation to the direction and energy of the motion of an object. The consequence is that the scalars of the units of discrete space must must have a dense array that is symmetrical from every point of view. Figure 2 shows the lattice of the scalars of the flat Higgs field in vacuum space.

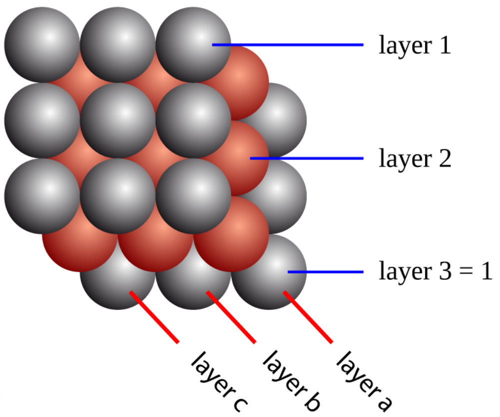

figure 2

The configuration of the identical scalars in figure 2 – a lattice – is known as Kepler's conjecture.[3][4] I can draw the points of contact of 1 scalar with the 12 adjacent scalars around and figure 3 shows the result.

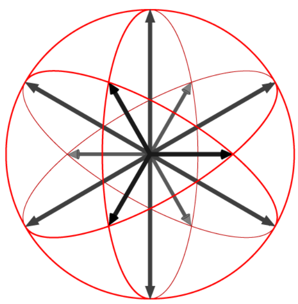

figure 3

The distribution of the 12 points of contact between the scalars seems to be symmetrical. But figure 2 shows that the square array of the scalars on top of the lattice – layer 1 and 2 – create a triangle array of scalars if we look at the lattice from aside (layer a, b and c). The not drawn next layer d has the same position as layer a.

The consequence is that the lattice in figure 2 is not symmetrical from every direction although the mutual distance between all the scalars is 2r (r = radius scalar in vacuum space). If I calculate the height between the layers of the square array (the layers 1 and 2), the result is $r\sqrt{2}$ (see figure 4). The same calculation in relation to the triangle array (layers a, b and c) results in a mutual distance of $r\sqrt{8/3}$ (see figure 5).

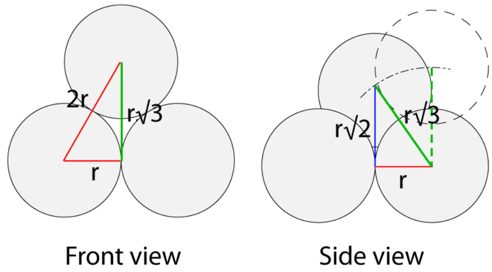

figure 4

The outcome is that the mutual distance between the layers with the square array of scalars is 1,414.213 r. And the mutual distance between the layers with the triangle array is 1,632.993 r. The consequence is that discrete space is not homogeneous in relation to the direction of the motion of a phenomenon at the macroscopic level.

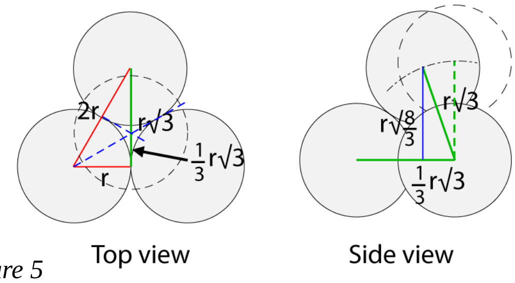

figure 5

References:
3. Kepler, Johannes (1611), *"Strena seu de nive sexangula"* (The six-cornered snowflake), ISBN 978-1-58988-053-5, MR 0927925
4. Hales, Thomas C.; Ferguson, Samuel P. (2006), *"A formulation of the Kepler conjecture", Discrete & Computational Geometry, **36** (1): 21–69*, https://arxiv.org/abs/math/9811078

The propagation of light
The origin of the existence of the constant speed of light are the basic properties of the units of the structure of discrete space. It means that the constant speed of light is the result of an underlying causation that is directly related with the identical basic properties of the units.

If the spatial configuration of the units of the structure of discrete space isn't 100% symmetrical in every direction the detectable velocity of an electromagnetic wave is partly determined by the local configuration of the units of the structure of discrete space. Although Planck's constant is the quantum of energy and the speed of light is the linear pass on of a quantum within the electromagnetic field.

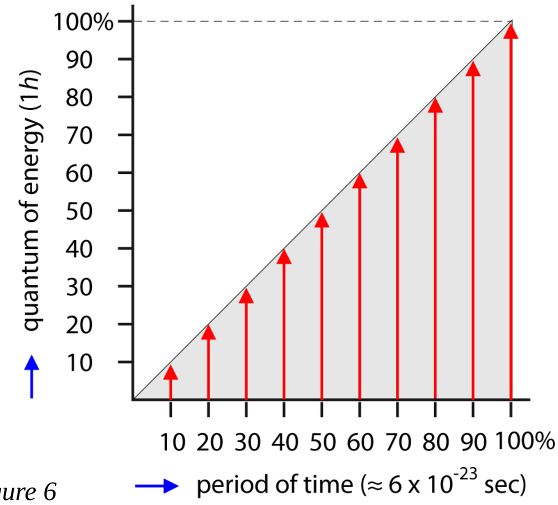

figure 6

Figure 6 shows a diagram of the linear transfer of 1 quantum from one side of a unit to the opposite side of the unit. The red arrows represent the increasing magnitude of the corresponding vector of the magnetic field during the transfer of the quantum. All the units of discrete space tessellate space thus every unit transfers the same amount of energy at exactly the same moment and with exactly the same duration. Actually it shows that the topological deformation of the units of discrete space is only possible if all the quanta transfer in the universe is synchronized.[1]

The lattice of the scalars in vacuum space (figure 2) shows that the mutual distance between the layers of the square array and the mutual distance between the layers of the triangle array is like 1,414.213r : 1,632.993r.

However, the wave length (λ) of an electromagnetic wave is determined by the Planck-Einstein relation:

$$E = hv = \frac{hc}{\lambda}$$

But the formula is meant for phenomenological physics. In discrete space the units of discrete space represent the minimal length scale ($\ell_c \approx 0{,}5 \times 10^{-15}$ m) thus the wave length (λ) is a multiple (n) of the minimal length scale:

$$E = hv = \frac{hc}{n\ell_c}$$

The consequence is that we cannot measure a difference in the wave length of identical electromagnetic waves that propagate in different directions.[5] For example 1 electromagnetic wave at right angles to the square array of the layers of scalars and the other electromagnetic wave at right angles to the triangle array of the layers of the Higgs field. Although both identical wave lengths are respectively n x 1,414.213r and n x 1,632.993r. In other words, we cannot measure “tangible” differences if both electromagnetic waves are a creation of an underlying reality.

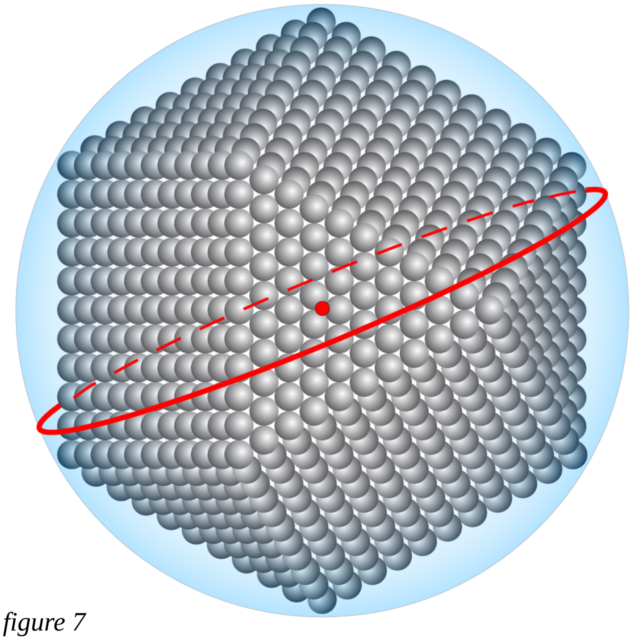

figure 7

Figure 3 shows the distribution of the points of contact of one scalar with the 12 adjacent scalars around. I can draw the same view for a large number of scalars, figure 7. If we move around along a circular trajectory (red line) we pass these 2 types of scalar layers on and on. The transparent blue sphere has the same centre as the lattice of scalars. But if I count the number of scalars in a straight line between the centre and a point at the surface area of the blue sphere the outcome is determined by the array of the scalars between the centre and the surface area.

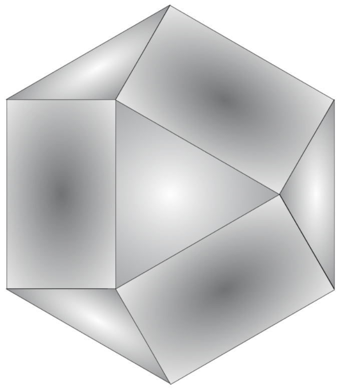

figure 8

There are more layers of scalars if the straight line from the centre is at right angles to layers with a square array. I can visualize the number of scalars between the centre and the surface of the lattice by changing the grey colour in relation to the number of scalars. More scalars is dark grey, less scalars is nearly white. Figure 8 shows the result.

Unfortunately we don’t know our position in relation to the triangle and square arrays of the layers of the scalars of the Higgs field. We only know that at every point in space we can draw a sphere around us – no matter how large its radius – so we are always at the centre of the sphere. Nevertheless, if we connect every position on the surface area of the sphere with the centre of the sphere we know that there are “points” with a different *scalar layer density* (figure 9).

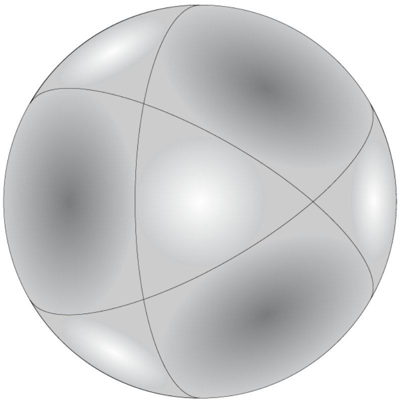

figure 9

What will I observe if I emit at exactly the same moment single electromagnetic waves with the same wave length from the centre of the sphere in figure 9 in every direction? Observers at the surface of the sphere will measure that the speed of light – related to the length of the radius of the sphere – isn’t exactly the same in every direction. They will detect differences between the distinct times of arrival of the single electromagnetic waves.

References:

5. Montie, E., Cosman, E., 't Hooft, G. *et al.* *“Observation of the optical analogue of quantized conductance of a point contact”*. *Nature* 350, 594–595 (1991) https://doi.org/10.1038/350594a0

Measuring layer density

Figure 9 shows the imaginary sphere from the outside (top view). But if I am at the centre of the sphere it is easier to draw the same sphere from the inside. So I am looking at the bottom on the inside of the sphere (see figure 10). In other words, figure 9 is the top half and figure 10 is the bottom half of the same sphere. I can also draw the imaginary sphere like an empty “box” to make it easier to imagine. Figure 11 is the result.

Without observers on the surface area of an imaginary sphere I can measure the different times of arrival of electromagnetic waves with the help of a coax cable and a direct current with a fixed super positioned frequency (figure 10). The length of the coax cable is the radius (r).

If I rotate the cable 360 degrees around, the divergence between the number of amplitudes of the electric current must show the variance of the density of the scalar layers at the surface area of the sphere all along the trajectory of the coax cable (red dotted circle). But this is only possible if the frequency of the electric current of the coax cable can be compared with the same fixed “clock frequency”.

Unfortunately, the equipment that generates the fixed clock frequency will also be influenced by the variable density of the layers of the scalars. Therefore to get real fixed amplitudes I have to position the frequency generator at a trajectory where we cannot measure any difference between the density of the triangle and square arrays of the scalars of the Higgs field. Figure 3, figure 9, figure 10 and figure 11 show these circular trajectories.

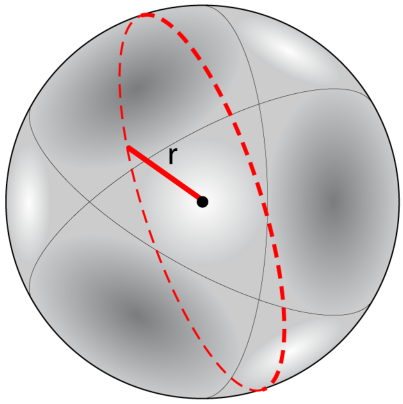

figure 10

The distance between two adjacent scalars at the surface area of a scalar in vacuum space is identical for all the adjacent 12 scalars (see figure 3). That means that if I use 2 cables in such a way that one cable points to the trajectory without any variance – the faint lines in figure 9 and 10 – and the other cable at 90 degrees where the variance is maximal – in the centre of the “triangles” and squares” – I only have to change the position of my whole equipment to determine the maximal difference between both “scalar layer densities”. Figure 11 explains the setup (view from above the sphere, like figure 9).

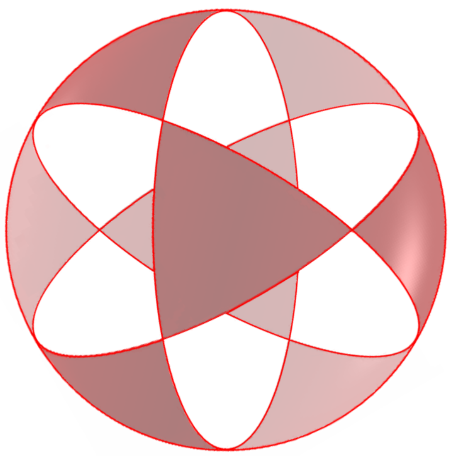

figure 11

In other words, the *red* dotted circle in figure 12 crosses the maximal and minimal density of the layers of the scalars and the *green* dotted circle in figure 12 – see figure 3 and figure 11 – is the trajectory where there is no difference between the density of the scalars with a triangle and a square array.

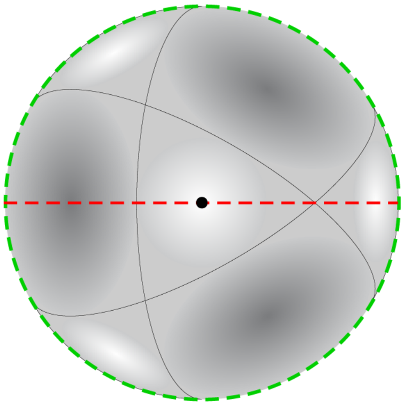

figure 12

The diagrams in figure 13 show the relation between the 2 planes – the red and the green circles in figure 11 – at 90 degrees of each other. The bottom diagram shows the right orientation of the measurement equipment that corresponds with the red and green circles in figure 12.

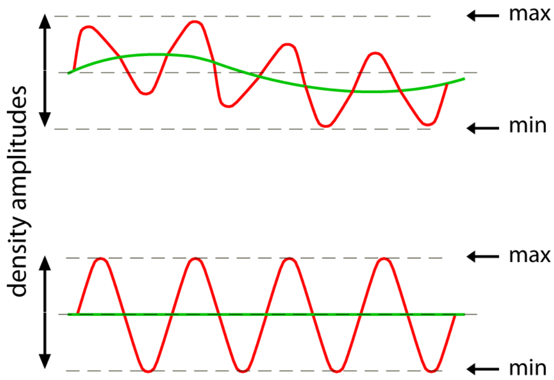

figure 13

Actually, we detect the alignment of the equipment of the measurement in relation to the position of the configuration of the scalar lattice of the universal Higgs field.

The experiment questions the influence of the configuration of the scalars – layers of triangle or square arrays – on the proposed homogeneous and isotropic structure of space itself. The speed of light – the velocity of the transfer of 1 quantum from one side of a unit to the opposite side – is a constant because every unit has identical basic properties and all the quanta transfer in the universe is synchronized. But in spite of this discrete space itself is not homogeneous in every direction because of the existence of the lattice of the scalars of the Higgs field.

The experiment

Figure 9 and figure 10 (bottom half and top half of the sphere) show that there are 6 "*square array regions*" on the surface of the sphere and 8 "*triangle array regions*".

Therefore, the density amplitudes on the trajectory of the coax cable along the *red* circle during 1 rotation are not equal to a symmetrical wave form, because the red circle crosses 4 "*triangle array regions*" and 2 "*square array regions*". Figure 14 shows the density variance if the red circle (the coax cable) crosses the centres of the square and triangle regions as drawn in figure 12.

If I want to express the difference in density of both type of layers of the scalars of the Higgs field I can divide the difference between 1,414.213r and 1,632.993r in 2. Now the square array means an increase of the lattice layer density with 7,18% and the triangle array a decrease of the lattice layer density with 7,18%. Quite a lot.

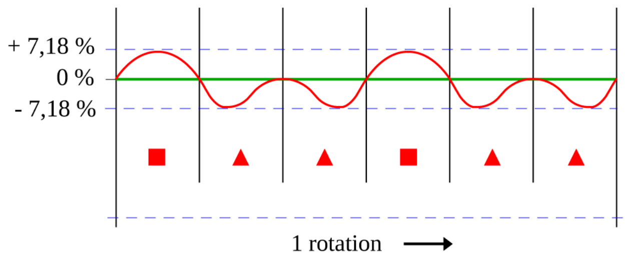

figure 14

If I rotate in figure 12 the red dotted circle 90 degrees – see figure 15 – the diagram in figure 14 changes into figure 16 although the trajectory of the green dotted circles doesn't change.

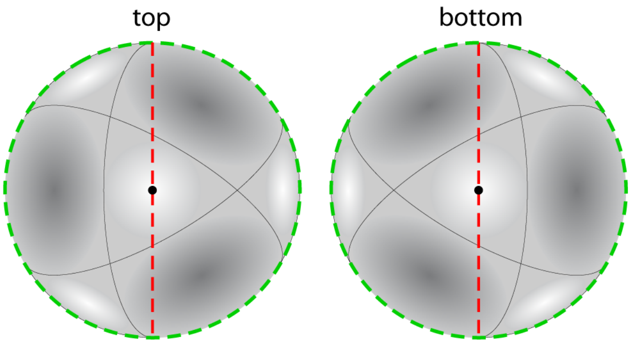

figure 15

Figure 14 shows that during 1 rotation along the red trajectory there are no density amplitudes along the green trajectory. This questions the need for a full rotation along the green circle because if the measurement of the density along the red trajectory matches the graph in figure 14 the height of the amplitudes at the green trajectory is flat.

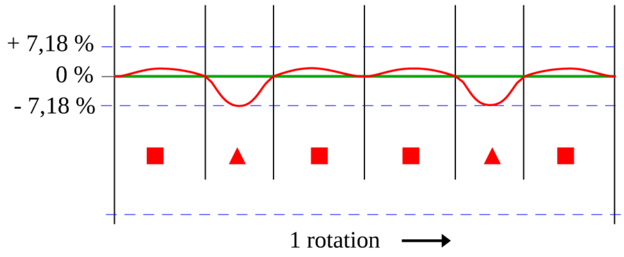

figure 16

The paper "*The absolute meaning of motion to the optical path*" by Hanna Edwards[6] shows a method to measure the timing of 2 identical electromagnetic frequencies with the help of a timing comparator of amplitudes.

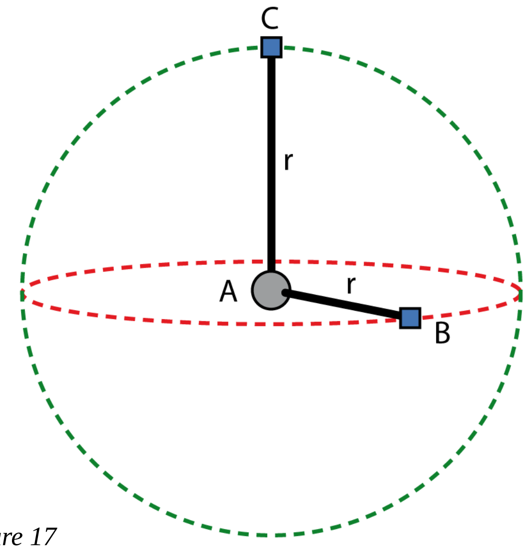

figure 17

Figure 17 shows a nearly equal setup. Two frequency generators B and C produce an electromagnetic frequency along 2 coax cables and the moment of arrival of the amplitudes are measured by frequency comparator A.

In other words, the variance in density of the scalar lattice all along the red trajectory is compared with a "fixed" frequency at the moment the red trajectory is in the right position similar to figure 12 and diagram 14.

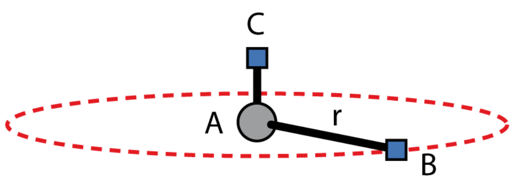

figure 18

However, what is the purpose of the coax cable with length r between the frequency generator C and comparator A? If frequency generator C is at right angles with the red circle and in the centre of the rotation along the red trajectory the length of the coax cable between C and A is not importance because both frequency generators have a fixed frequency. If the sensitivity of the amplitude comparator is high the length of the coax cable between C and A can be reduced (see figure 18).

Theoretically the setup of the measurement to determine the density of the layers of the Higgs field in figure 17 must be capable to show a result that is equal to the graph in figure 14 (or figure 16 or another easy to determine trajectory of the red dotted circle in figure 12 and figure 15).

References:

5. Hanna Edwards (June 2019), "*The absolute meaning of motion to the optical path*".
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Non-locality

If we construct an imaginary sphere with the help of a fixed radius we are not sure if the sphere is a perfect sphere at all. Because the units of the structure of discrete space create observable reality. Therefore if the structure of the units of discrete space isn't 100% equal in every direction it is reasonable to expect that the length of the radius is influenced by its position in relation to the layers of the lattice of the Higgs field.

The same problem exists in relation to the fixed length of the coax cable between frequency generator B and comparator A. Is there any certainty that the real length of the coax cable isn't influenced by the variable density of the scalar layers of the Higgs field? An influence that can cross the reliability of the outcome of the measurement. Although there is a fundamental difference between matter and electromagnetic waves ("light").

Electromagnetic waves are a stream of quanta ($E = hv$) and every quantum has the constant speed of light. The quanta itself influence the units around and the result is known as a wave like influence by the local electric and corresponding magnetic field.

However, an object like a rest mass carrying particle has no constant velocity. It can be influenced to change the ratio between the internal transfer of quanta (spin) and the transfer of all the involved "stored" quanta in space (velocity). At the speed of light all the internal transfer of quanta is transformed into linear motion.

The mutual relations between all the rest mass carrying particles are ruled by the non-locality of our universe. A non-locality that envelopes the universal conservation laws (energy and the direction of the transfer of energy) and the velocity of the influence (the speed of light and the instantaneous influence by vectors).

The consequence is that the velocity of rest mass carrying particles isn't determined by the structure of the scalar lattice but by the mutual influence we have termed non-locality. In other words, the length of the coax cable isn't influenced by its position in relation to the structure of the scalar lattice.

One can argue that an electric current with a fixed frequency – used to create a detectable metric – is basically a stream of free electrons. However, an electron has no rest mass and it is difficult to distinguish between the wave nature – the transfer of quanta – and the particle nature of the electron.

The solar system
Stars are emitters of electromagnetic waves. The emission of electromagnetic radiation by a star is in every direction. Therefore it is reasonable to assume that the emission of electromagnetic radiation by the sun is affected by the trajectory of the sun around the centre of the Milky Way. A circular trajectory within the structure of the layers of the scalars of the Higgs field. For example like the red dotted circle in figure 10.

The velocity of the sun around the centre of the Milky Way influences the wave length of the radiated electromagnetic waves because of the Doppler effect (see figure 20). The wave length of the emitted radiation in the direction of the motion of the sun is blue shifted and the wave length is red shifted in the opposite direction (see figure 19). However, if the direction of the motion of the sun is at right angles to the square array of the layers of the scalars of the Higgs field the number of layers is increased with 7,18% in relation to a position where there is no detectable effect between both types of layers. Like the green dotted trajectory in figure 12.

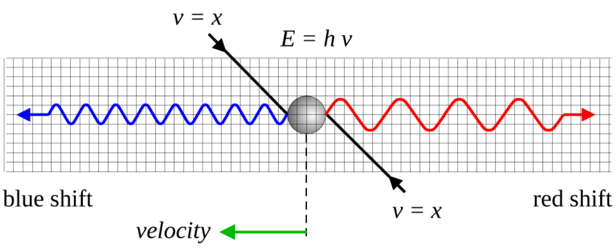

figure 19

If the sun moves at right angles to the triangle array of the layers of the scalars of the Higgs field the number of layers is decreased. Nevertheless, the radiation of the electromagnetic waves is the same because the transfer of quanta is created by the units of discrete space. The consequence is that the electromagnetic density is decreased. And if the sun moves at right angles to the square array of the scalar lattice the electromagnetic density for the same volume is increased. And 14,36% difference between both radii is not negligible.

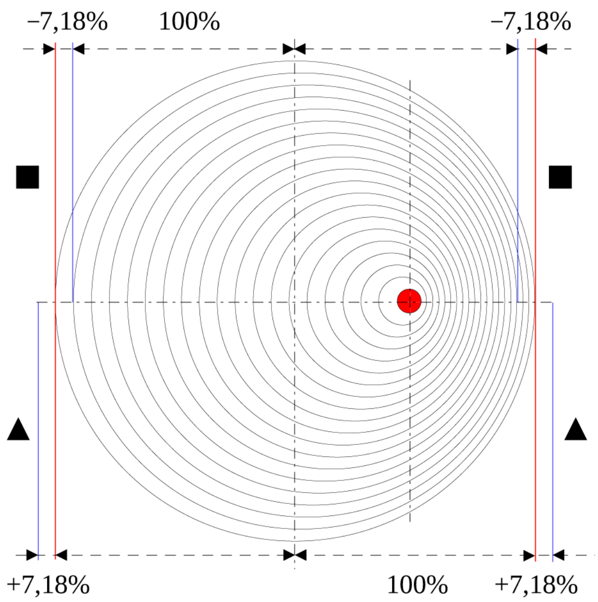

figure 20

It isn't difficult to imagine that the orientation of the orbit of the sun around the centre of the Milky Way in relation to the structure of the lattice of the Higgs field will cause variances in the emitted radiation by the planets of the solar system.

Nevertheless, it takes the sun approximately 225-250 million years to complete one rotation around the centre of the Milky Way.

Conclusion
If we detect the structure of the Higgs field with the help of the described experiment we cannot neglect that space itself is discrete and in rest in relation to all the observable and detectable phenomena in the universe.