Conceptual FrameWork
Research papers

Is discrete space not isotropic?

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The use of the model of discrete/quantized space sets the focus on mathematics instead of physics. It benefits the interpretation of observed and measured phenomena at the cosmological scale size. It is an approach that simplifies the problems around the understanding of the properties of the basic quantum fields.

Introduction

Quantum field theory (QFT) is the leading theory in theoretical physics. The development started at the middle of the 20^{th} century and the general concept is the idea that the universe is tessellated by a structure that is composed by a limited number of basic quantum fields. These basic quantum fields are responsible for the observable and detectable phenomena in the universe.[1]

There is interaction between the distinct basic quantum fields. The consequence is that the volume of one unit of the structure of *discrete space* represents the unification of the properties of the basic quantum fields. That means that the properties of all the basic quantum fields fit into the volume of one unit of the structure of discrete space.

The transformations of one unit of discrete space are the result of the mutual relations between all the units of the structure.[2] Every unit has the same "power" to transform its variable properties and the result is the synchronization of all the energy changes in the universe ("quanta transfer").[3] The consequence is that quantum time (t_q) is a universal constant – in line with Planck's constant and the constant speed of light – and it is directly related to the topological deformation of the shapes of the units of the structure of discrete space.

However, a hypothesis must be verified by experiments and/or observations. So the question is, will experiments and observations confirm the model?

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1. Art Hobson (2013); "*There are no particles, there are only fields*". American journal of physics 81, 211. DOI: 10.1119/1.4789885. https://arxiv.org/ftp/arxiv/papers/1204/1204.4616.pdf
2. S.E. Grimm (2023); "*Dynamics in discrete space*" https://zenodo.org/record/10443541

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The universal scalar field

The only known true scalar in 3D geometrical space is the sphere. That is why in lectures and articles about the scalar field explanatory images are used that show spheres or a cross section of spheres. Like figure 1, the supposed "tangible" existence of the Higgs field within the dynamical structure of quantum gravity (the Causal Dynamical Triangulations approach).[3]

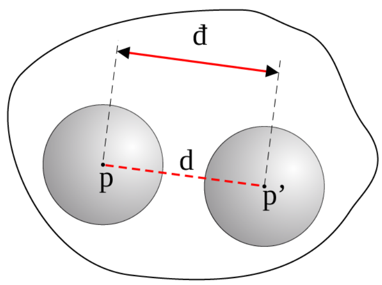

figure 1

All the scalars of the Higgs field have the same magnitude (radius) in nearly the whole universe. There exist only temporally decreased scalars inside rest mass carrying particles and black holes. Because all the "tangible" phenomena are in motion in relation to the rest frame of discrete space.

So if a rest mass carrying particle changes its position, the decreased scalar returns to its previous radius. So what is the mechanism behind this mysterious recovery? Figure 1 isn't helpful at all because it shows 2 scalars of the Higgs field "drifting" within the electromagnetic field.

Nevertheless, one thing is for sure, the energy density of the electromagnetic field around both scalars cannot prevent the scalars from increasing their radius. The only geometrical "law" that prevent both scalars to expand their radii on and on, is the size of all the other scalars around. Actually the creation of a scalar lattice, see figure 2.

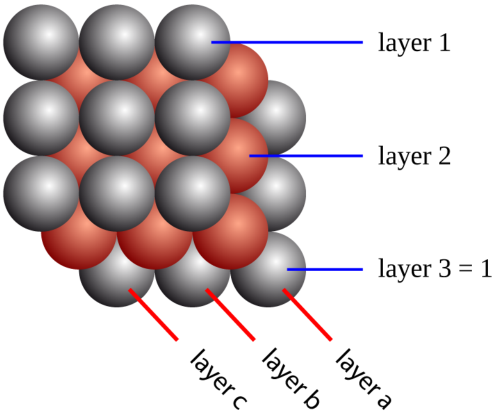

figure 2

This is not a really attractive geometrical "law" for most physicists because it proves that there exists an absolute rest frame in the universe. Moreover, the volume of the scalars is about 74% of the whole volume of the structure of the basic quantum fields so it is geometrically impossible that the structure can "wrap" around rest mass to create gravity, like the favourite model of curved spacetime suggests.[4]

References:
3. Renate Loll (22-01-2019), "*Rethinking spacetime*". Symposium "The road to reality", IAS, University of Amsterdam. Video of the presentation: https://www.youtube.com/watch?v=PRyo_ee2r0U
4. S.E. Grimm (2024); "*Resultant motion in discrete space*" https://zenodo.org/record/11193931

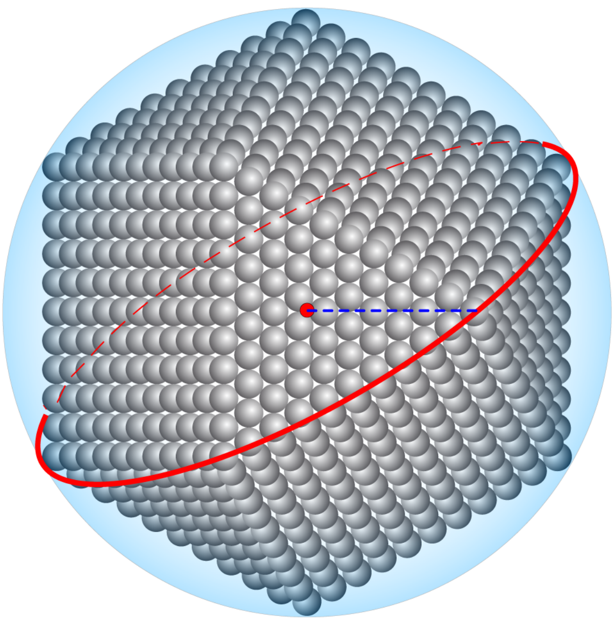

figure 3

The scalar lattice

Figure 2 shows that the configuration of the scalars of the Higgs field doesn't represent an isotropic configuration. There is a clear difference between the layers of the scalars in relation to the density of the arrangement. For example layer 1, 2 have a rectangle array of scalars and layer a, b, c have a triangle array. That is why the lattice density of both different type of scalar arrays has a ratio of about 1,414 **:** 1,632.[5]

Electromagnetic waves propagate within the electromagnetic field with a constant velocity, the speed of light. The universal constant represents the linear pass on of one quantum of energy – actually a fixed amount of topological deformation – within the units of the structure of the basic quantum fields. In general it must be the density of the scalar lattice that determines the velocity of light.

Suppose that I can draw an imaginary blue, partly transparent sphere with a radius that has a metric that is independent of the structure of the basic quantum fields. So I know that the distance between the centre of the sphere and every position on its surface is identical. Figure 3 shows the blue transparent sphere and inside (top view) layers of scalars in such a way that the outward scalars touch the surface of the blue sphere (red circle).

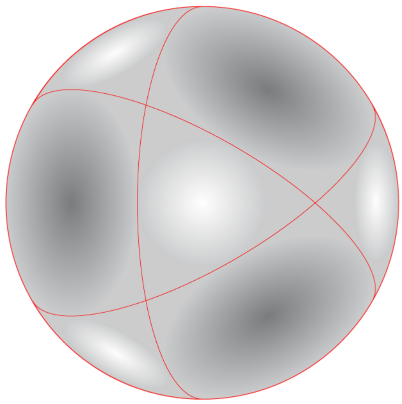

figure 4

If I fill the whole sphere with scalars the number of scalars that "fit" the radius of the sphere will depend on the point of contact of the radius with the surface of the sphere. Figure 4 shows the result. A surplus of scalar density is dark grey (rectangle array) and a deficit of scalar density is light grey (triangle array). The curved red circles show all the positions where the distance between the centre of the sphere and the scalar lattice is exactly the same. In other words, will the anisotropy of the scalar lattice influences the time of arrival of electromagnetic waves by emitters everywhere in the universe?

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5. S.E. Grimm (2021); "*Discrete space and the scalar lattice*" https://zenodo.org/record/5771124

Instantaneous influence

The linear pass on of the quantum of topological deformation within the structure of the basic quantum fields is the speed of light. The quantum is part of the continuous redistribution of energy everywhere in the universe. But in vacuum space – the flat Higgs field – the quantum of energy generates a corresponding vector within the magnetic field.

Vectors are 1-dimensional mathematical objects that correspond with the 1D points of contact between the scalars of the Higgs field in vacuum space. The magnitudes of these vectors correspond with the energy changes within the universal electric field.[6] The consequence is that a local concentration of energy – e.g. a nucleus – generates huge vectors in relation to the vector(s) of one quantum of energy. The concentration of energy of a celestial body in turn is huge compared to the energy of a nucleus. Etc.

In other words, the rigid scalars within the lattice of the Higgs field in vacuum space are traversed by vectors that are generated by energy because every quantum of energy has momentum too.[2] Energy concentrations create force fields like the vectors of Newtonian gravity as a push force from vacuum space around (see figure 5). However, vectors don't transfer energy and that is why the influence of vectors everywhere in vacuum space is instantaneous.

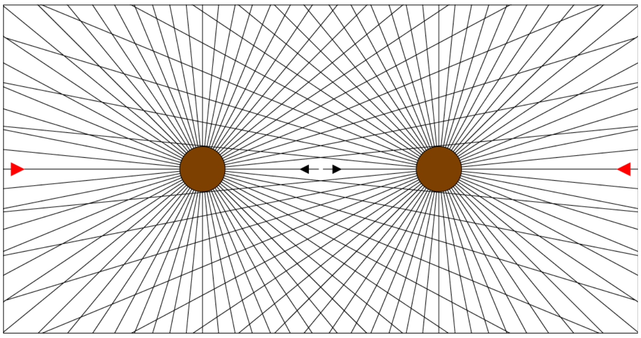

figure 5

The consequence is that the motion of local matter is determined by the energy propagation within the universal electric field. But the corresponding vectors of the magnetic and gravitational field[6] act instantaneous and are immune for the variance of *the density of the scalar lattice* of the Higgs field. Because the range of a vector in vacuum space is determined by the opposite vector(s).

Suppose that the surface of figure 4 is covered with emitters that all point in the direction of the centre of the sphere. One should expect that the recorded time of the arrived individual electromagnetic waves will reflect the anisotropy of the structure of the basic quantum fields in correspondence with the position of the scalar lattice. We cannot perform such an experiment but we have detected black body radiation from everywhere around the universe: the Cosmic Microwave Background radiation (CMB) with the help of a couple of satellites (Cobe; WMAP; Planck).

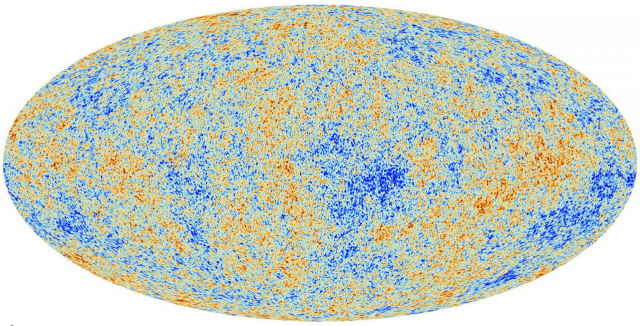

figure 6

Although figure 6 shows a lot of (forced) contrast the frequency of the CMB radiation from everywhere around is nearly identical. The data of the map shows a Doppler effect – the CMB dipole[7] – but the whole differentiation does not correspond with figure 4. Unfortunately, the interpretation of the origin of the CMB rely on the Standard Cosmological model (ΛCDM), inclusive the big-bang hypothesis). However, the observations of the James Webb Space Telescope set doubt about the reliability of the conceptual framework and it seems to affect the interpretation of the origin of the CMB too.[8]

So it is difficult to draw conclusions if the origin of the CMB is uncertain. Especially because the big-bang hypothesis is build on 2 observations; the non-Doppler red shift of the light of distant galaxies and the CMB radiation. Unfortunately the CMB radiation is advertised as the evidence that the non-Doppler red shift is caused by the expansion of space itself.

References:
6. S.E. Grimm (2020); "*On the construction of the properties of discrete space*" https://zenodo.org/record/3909268
7. Jeremy Darling (2022): "*The Universe is Brighter in the Direction of Our Motion: Galaxy Counts and Fluxes are Consistent with the CMB Dipole*". The Astrophysical Journal Letters, Vol 931, No 2. iopscience.iop.org/article/10.3847/2041-8213/ac6f08

8. Stacy S. McGaugh (2024); "*Discord in concordance cosmology and anomalously massive early galaxies*" Universe 2024, 10, 48. https://doi.org/10.3390/universe10010048

Non-Doppler red shift

Matter represent local concentrations of energy ($E = m\,c^2$). To concentrate energy there must exist a surplus of energy around in vacuum space, actually a surplus of surface area of the joint faces of all the units of the structure of the universe. The average surplus of energy in the universe is unknown, but it is conserved. Thus if the units of the structure of discrete space have the shape of a rhombic dodecahedron, there is no energy available in the whole universe because the volume of every unit is invariant (figure 6).[6]

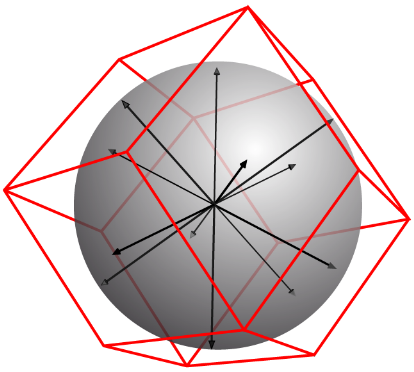

figure 6

If energy concentrate under influence of the basic properties of the basic quantum fields – because of the internal scalar mechanism of every unit – the result is the synchronous creation of a region with a corresponding deficit of energy.[9] Figure 7 shows the schematic "picture".

The surplus of the energy (the particle) is in the centre (*1*), the deficit of energy is around the particle (*2*) and the average energy density in vacuum space is region *3*. There is a diagram of the local energy density as an overlay (red, blue and green lines a, b, c).

The consequence of energy concentration – the emergence and further increase of matter everywhere in the universe – is the decrease of the average energy density in vacuum space during the evolution of the universe. The result of the density decline is a slow drop of the frequency of electromagnetic waves during the evolution of the universe. How earlier the electromagnetic wave is emitted, the more red-shifted. Like the detected non-Doppler red-shifted light from the far away galaxies in the early universe by the James Webb Space Telescope.

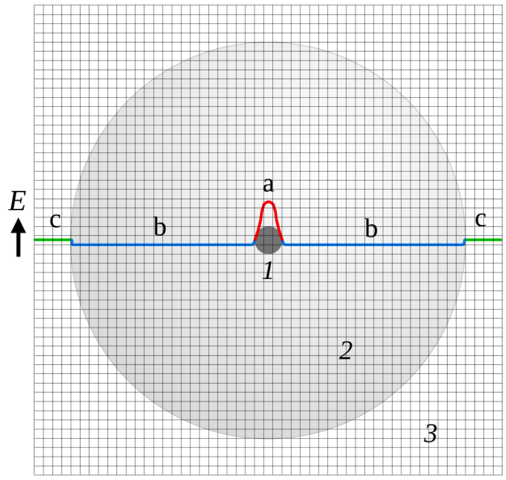

figure 7

References:
9. S.E. Grimm (2022); "*Discrete space and the wave-particle duality relation*" https://zenodo/records/7157306

Dark energy

Newtonian gravity as a vector force – a push force from vacuum space in the direction of the matter – is only active from the moment that the local concentration of energy forces one or more scalars of the flat Higgs field to decrease its magnitude. Before the scalar field gets involved in the creation of rest mass, there is only energy concentration by the universal electric field and its corresponding magnetic field.[2] Without energy concentration in vacuum space gravity cannot emerge.

The gravitational field as a vector field concentrates matter (figure 5). But that doesn't mean that the influence of the universal electric field to concentrate energy has stopped. The internal scalar mechanism of the units of the structure in vacuum space are going on to reduce their surface area.

The local available surplus of surface area of the units plays an important role how this influence will affect the redistribution of energy in vacuum space. The transfer of quanta everywhere in the universe is conserved and synchronized.[10] Therefore it is the average surplus of surface area of the units of the structure that determines the intensity of the energy transformations during the evolution of the universe.[11]

The diagram in figure 8 shows the evolution of the universe at the moment rest mass is created. The volume of the universe is invariant – horizontal dotted black line –

and the minimal surface area is the vertical dotted line. At the moment the first matter is created in the universe the average energy density starts to split in regions with increasing high energy density (blue arrow) and an all-inclusive "back ground" with decreasing low energy density (green arrow). The back ground with low energy density is of course vacuum space.

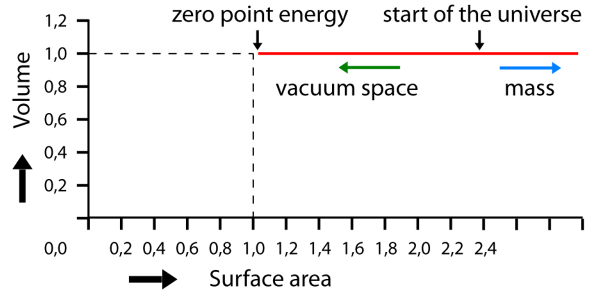

figure 8

It is not so speculative to expect that the influence of the universal electric field at the cosmological scale size – the concentration of topological deformation in vacuum space – will result in the creation of voids, large regions in vacuum space where all the units of the structure share a reduced energy density.[12][13][14]

Figure 8 shows that during the evolution of the universe the non-Doppler red shift of the light of distant galaxies cannot be linear. The non-Doppler red shift will increase in correspondence with the decline of the average surplus of surface area of the units of the structure in vacuum space. In line with the observation that "the expansion of space" is accelerating.

If there are "easy" explanations for the non-Doppler redshift of the light of distant galaxies and the supposed expansion of space it is reasonable to question the origin of the CMBR too.

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10. S.E. Grimm (2024); "*The Box without walls*"
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13. Bonny Y. Wang et al (2023); "*Machine-learning Cosmology from Void Properties*"
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Dark matter

The concentration of "free" energy in vacuum space depends on the local energy density. If locally there is much free energy available the process to concentrate energy in vacuum space needs less volume to "accumulate" the energy for the concentration. So it is reasonable to expect that in the early universe (> 13,8 billion years ago) the creation of primordial black holes – actually enormous rest mass carrying particles – dominated the evolution.[15][16]

Figure 9 shows a joint face between 2 units. The transformation of the shape of a unit is only possible if the unit transfers parts of its volume within the boundary. Thus if a unit transfers volume to a joint face the surface area increases (0,0 → I). At point I the radius of the scalar of the unit starts to decrease. Adding more volume (I – II) results in a stable situation around V = 1,0 because the surface area in II is a bit lower than the surface area in I (energy well). But from II → III and further there is an increase of energy. But there is no stability (energy well) so without a steady supply of energy the mass of a Black hole "vaporises" (return from III → II).

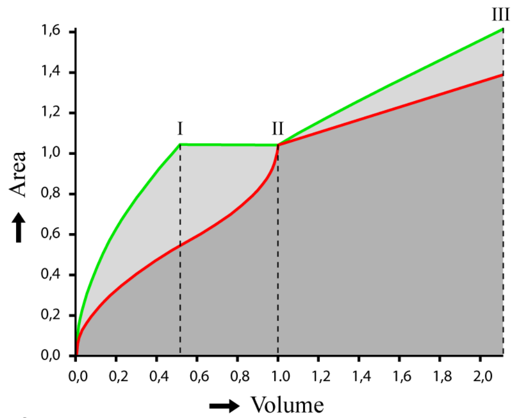

figure 9

Unfortunately, Dark matter as a local surplus of energy in vacuum space doesn't increase the gravitational force. In general it accelerates the pass on of matter in vacuum space. That is why the existence of Dark matter increases the rotational velocity at the outskirts of galaxies in relation with the resultant motion and created magnetic field under influence of gravitational vectors.[4]

So it is really difficult to imagine that there is a direct link between Dark energy and Dark matter – see page 3 – in relation to the "missing" anisotropy of the CMB.

References:
15. Akos Bogdán et al (2023); "*Detection of an X-ray quasar in a gravitationally-lensed z = 10.3 galaxy suggest that early supermassive black holes originate from heavy seeds*" https://arxiv.org/abs/2305.15458
16. Joseph Silk et al (2024); "*Which came first: supermassive Black holes or galaxies? Insights from JWST*" The Astrophysical Journal Letters, 961:L39 (8pp), 2024 February 1 https://doi.org/10.3847/2041-8213/ad1bf0

The CMB

Without a "big-bang" and the hypothesis of cosmic inflation it is difficult to trace back the origin of the CMBR. The present hypothesis that the CMB originates from the emergence of Hydrogen atoms is plausible because the CMBR data shows the radiation has black body characteristics and a nearly homogeneous distribution in vacuum space. But the CMB data shows no anisotropy, in spite of the anisotropy of the scalar lattice (Higgs field).

In the past the CMB radiation was predicted by C.E. Guillaume and A.S. Eddington, long before the CMB was detected in 1965.[16] The origin of the "early CMBR" was not related to the radiation of Hydrogen atoms in the early universe but related to the temperature of interstellar space under influence of stellar and other electromagnetic radiation.

A hypothesis that needs a universe in dynamical equilibrium, actually the dynamical equilibrium of the electromagnetic field. In line with the universal conservation laws (energy and momentum).[2] The interpretation of the origin of the CMBR as the temperature of vacuum space does not violate the existence of the detected CMB dipole.[17]

References:
16. A.K.T. Assis and M.C.D. Neves (1995); "*History of the 2.7 K temperature prior to Penzias and Wilson*" APEIRON Vol. 2 Nr. 3 July 1995 Page 79 – 87 https://researchgate.net/publication/2938670
17. Jeremy Darling (2022): "*The Universe is Brighter in the Direction of Our Motion: Galaxy Counts and Fluxes are Consistent with the CMB Dipole*". DOI: 10.3847/2041-8213/ac6f08 iopscience.iop.org/article/10.3847/2041-8213/ac6f08

The Hubble tension

It is reasonable to speculate that the anisotropy of the lattice of the scalars of the Higgs field must have a direct relation with the Hubble tension.[18][19] To get some insight we have to analyse the consequences of the anisotropy.

Figure 10 shows an "open" image of figure 4 (the 6 square areas are drawn transparent). The surface on the inside of the sphere represents the sky at a certain distance from the centre of the sphere. For example the sphere has a radius of 5 billion light years.

The constant speed of light represents the linear pass on of quanta by the units of the structure of discrete space. So if we emit an electromagnetic wave from the centre of the sphere the time of arrival of the electromagnetic wave at the surface of figure 10 is determined by the density of the units of the structure all along it's trajectory. The consequence is that an electromagnetic wave that arrives in the centre of a triangle seems to propagate with a higher velocity than the electromagnetic wave that arrives at the centre of a square at the surface of the sphere. Ratio about 1,414 **:** 1,632 (see page 2).

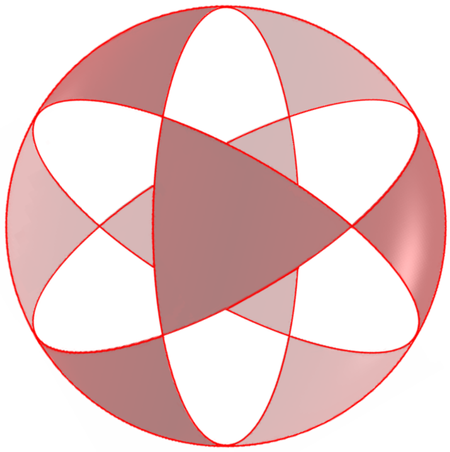

figure 10

Without the existence of the non-Doppler red shift the observer in the centre of the sphere can only determine the radius of the sphere with the help of the mean brightness of the radiation. At least when he is aware of the anisotropy of the units of the structure. Without this insight he will assume that an equal brightness of standard candles like Cepheids and supernovae Ia from every direction means a nearly perfect sphere, a shared radius.

Non-Doppler red shift originates from the decrease of the energy “density” in vacuum space during the evolution of the universe. The consequence is that light from the centre of a triangle is less red shifted than light from the centre of a square. In line with the brightness.

The sphere is not a phenomenon, because the Higgs field is part of the rest frame of the universe. So we cannot speculate that during the emission of the light from the surface area of figure 10 and its arrival in the centre of the sphere – 5 billion light years – the lattice has changed position. It is the observer at the centre of the sphere who has changed position during the emission and absorption of the light wave. That is why the trajectory of the light that is detected by the observer – e.g. light from the centre of the triangles and squares – is not at right angles to the layers of the scalars of the Higgs field (see figure 2 and figure 3).

The consequence is that the ratio between the square arrangement and the triangle arrangement of the layers of the scalars of the Higgs field is less clear. So the position of the observer in relation to the lattice of the scalars (figure 10) cannot be retrieved in an easy way with the help of measuring the non-Doppler red shift and/or the brightness of the light of distant galaxies. But it shows that the measured distances of the galaxies in the universe are not really accurate. The mean variance is about 7% (half the ratio) but because the detected light is not at right angles to the layers of the lattice of the Higgs field the detectable variance will be only a small percentage.

Conclusion: the anisotropy of the lattice of the scalars of the Higgs field cannot be determined with 100% certainty with the help of astronomical observations

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18. Cervantes-Cota, J.L.; Galindo-Uribarri, S.; Smoot, G.F. “*The Unsettled Number: Hubble’s Tension*” Universe 2023, 9, 501. https://doi.org/10.3390/universe9120501
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