On geometrical relations in discrete space

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A description of a geometrical model of the structure of the volume of the universe has to clarify the existence of universal conservation laws, universal constants and universal principles (like the principle of non-locality). But the model envelopes observable and detectable phenomena too, so it is reasonable to expect calculated relations too.

Introduction

In phenomenological physics we measure the mutual relations between the observable and detectable phenomena and next we theorise about the distinct causal mechanisms. But in phenomenological physics there is no rest frame, so every measurement determines its own point of reference.

The underlying structure of the universe is the rest frame of the model of quantised space. Related to the structure of the basic quantum fields in quantum field theory (QFT). In practise a rest frame complicates calculations. Not at least because vectors have no "tangible" causality. The velocity of a vector is undetermined (> *c*) and its position too.

In macroscopic reality the lack of calculated relations is not a big problem because there are observations an measurements that provide some substitute relations. But if there are hardly observations and/or supporting data – e.g. at the sub-atomic level – the model of quantised space can not describe these processes in a convincing way.

Topological deformation

The universal electric field represents the deformed part of every unit of quantised space. It is a topological field under invariant volume (homeomorphism). The not-deformed part is the universal scalar field, the Higgs field. Actually, every unit of quantised space is a deformed scalar because all the units together tessellate the volume of the universe.

Topological deformation of all the units of quantised space is synchronised and quantised. The latter is known as the quantum of energy, Planck's constant (*h*). The synchronisation of the change of all the shapes of the units of quantised space is not known in phenomenological physics because its conceptual framework doesn't recognise a universal rest frame, thanks to the concept of relativity.

Topological deformation under invariant volume can be described in different ways. For example, if I focus on the mutual deformation of 2 rectangle objects I and II – see the cross section in figure 1 – the principle shows that deformation is impossible without a corresponding symmetry. The symmetry can be distributed over a number of changes (the transfer of parts of the volume of each rectangle body) but the general symmetry is that every transfer of volume must be compensated with the synchronous transfer of an equal amount of volume (green or blue arrows). But the amount of volume that is transferred for the deformation is not determined. In other words, the height of h_a and h_b is "free" if $h_a = h_b$.

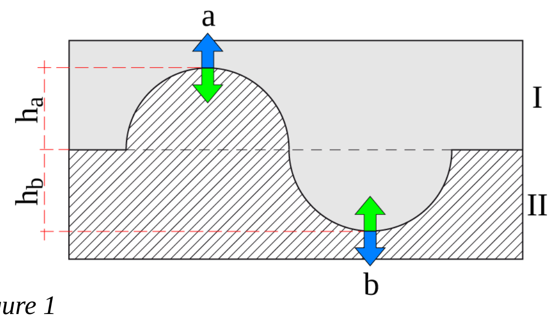

figure 1

That is why the deformation of a topological object with an invariant volume can be described as:

$$\Delta V_{input} = \Delta V_{output} = 0 \quad \text{for each body.}$$

If every unit of quantised space has an equal and invariant volume, all the deformations of all the units are synchronised. That means that during the same period of time the total amount of topological deformation of each unit is the same. We can compare the deformation of a unit at a certain moment with unbalance. Actually the unbalance represents an amount of asymmetry in relation to the internal "power" of each unit to rearrange its shape. The "power" is the internal scalar mechanism (the force to transform the whole volume into a sphere).

Phenomenological physics is about the mutual relations between phenomena. Mutual relations manifest themselves as local differences. That means local differences in energy and local differences in force. In line with the law of conservation of energy and the law of conservation of vectors (the force-part of momentum).[1] So it is inevitable to focus on the mutual relations between the units of quantised space in order to “mimic“ the observations and measurements in phenomenological physics. That is obvious because the motion of matter is generated by quantised space as the universal rest frame and the generated mutual relations are known as quantum field theory, although the force of gravity isn’t part of it in the text books.

An increase/decrease of topological deformation of a unit is equal to the increase/decrease of the surface area of the unit. But figure 2 shows that *all* the surface area that is created with the help of topological deformation originate from the invariant volume of the bodies I and II. Because at $h_a = h_b = 0$ there exists no topological deformation under invariant volume at the joint plane of the bodies I and II.

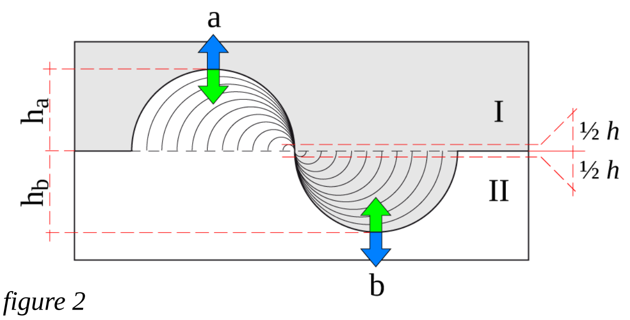

figure 2

Every unit has exactly the same internal scalar mechanism and exactly the same amount of invariant volume. Therefore we have to conclude that the total amount of joint surface area of all the units of quantised space is a constant (invariant amount of surface area). It means that amounts of surface area can be passed on between units but the total amount of surface area in the universe is conserved. In line with the law of conservation of energy and in line with the equation $E = m\,c^2$ about the equivalence of matter and energy. The equation shows that “free” energy (E) is equal to surface area.

The consequence of the identical volume of every unit – volumes that tessellate the whole universe – is a synchronisation of all the changes of the shapes of the units. But the smooth deformation of a unit has a duration that is directly related to the amount of volume that is transferred inside the boundary of the unit. Because no unit can change this flow of volume inside its boundary independent from all the other units. That is why all the topological deformation in our universe is quantised. In between the start and the end of the flow of volume everything is synchronised so it is impossible to determine the position or time of a local concentration of energy (Heisenberg’s uncertainty principle). The smallest amount of synchronised volume transfer inside the boundary of a unit is known as the quantum of energy, Planck’s constant (2 x ½ h). The duration of the linear propagation of 1 quantum of energy from 1 plane of a unit to the opposite plane is ≈ 5,99 x 10^{-23} second. The duration is derived with the help of the constant speed of light (c) and the diameter of a unit (≈ 0,5 x 10^{-15} m). So there exists a constant of quantum time (t_q).

In other words, in relation to a unit of quantised space the quantum of energy can be expressed as *a fixed amount* of:
- “power” (internal scalar mechanism);
- internal transferred volume;
- surface area of the boundary.

Figure 1 and 2 show that the length of h_a and h_b is directly related to the amount of topological deformation. That is why h_a and h_b can be interpreted as the magnitude of vectors that determine the *amplitudes* of the topological deformation. The consequence is that all the vectors in the universe are conserved because the total amount of energy is conserved (the correspondence between the energy of the universal electric field and the vectors of the magnetic field). In line with the law of conservation of momentum because momentum represents an amount of energy, inclusive the direction of the motion of the amount of energy in relation to (the motion of) the other energy configurations around. All the energy in the universe is conserved, so all the vectors are conserved too.[1]

References:

1. S.E. Grimm (2023); “*Dynamics in discrete space*”. https://zenodo.org/record/10443541

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The unit of quantised space

Figure 3 shows the unit of quantised space. Drawn is undisturbed volume of the unit as the inscribed sphere – the scalar of the Higgs field – and the surface area of the deformable part of the unit. The latter under the imaginary condition $h_a = h_b = 0$.

In reality the surface area of each of the planes of the dodecahedron will hardly equal the minimal surface area of a flat rhombus because the quantum of energy (h) represents the sum of the fixed amount of topological deformation of the whole unit. Every scalar has 12 points of contact with the scalars of the 12 adjacent units. Each vector touches a point of contact if the local Higgs field is flat.

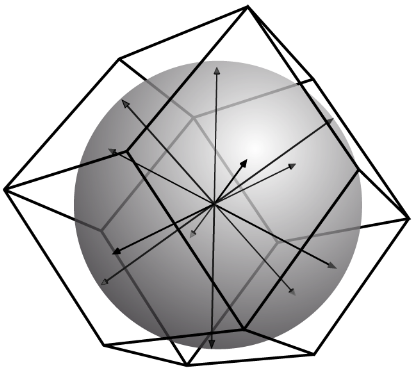

figure 3

The internal scalar mechanism of every unit is partly deformed by the undistorted scalars of the units around. That is why the internal scalar mechanism of every unit tries to “expand” the radius of the inscribed sphere (scalar) around the points of contact with the scalar of an adjacent unit.

Figure 4 shows the cross section of a joint plane between 2 adjacent units and the face of the plane of the unit at the right (deformed rhombus). The dark blue colour represents all the internal volume that was involved (transferred) in the deformation of the joint plane.

The image shows that the surface area of the deformed part of the right unit is in direct contact with a part of the surface area of the left unit (a push). That means that there is a small unbalance in relation of the identical vectors of the scalar in figure 3. The cause behind the unbalance is the accumulation of topological deformation in the joint plane by the unit at the right. But this doesn’t mean that the sum of all the transferred internal volume to the joint plane is a multiple of the quantum of energy (*h*). The total amount of topological deformation of a unit during 1 t_q (≈ 5,99 x 10^{-23} second) represents the distribution of the quantum of energy (*h*) at the surface area of the unit.

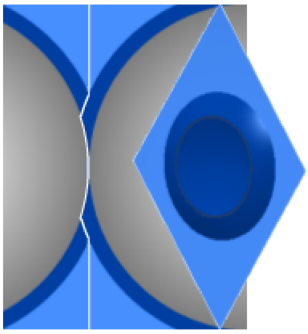

figure 4

The consequence is that the motion of a concentration of energy – e.g. a particle – is not forced to totally align to the grid of the minimal length scale ($\ell_c \approx 0{,}5 \times 10^{-15}$ m). So it is easier to think in terms of propagating energy densities.

The constant speed of light

The linear propagation of a quantum of energy within the structure of quantised space (vacuum space) shows to be a constant, the constant speed of light (*c*). The quantum of energy propagates in vacuum space because every unit of discrete space has exactly the same basic properties. So if we ask why a specific quantum of energy propagates in vacuum space we have to start a sequence of causalities that – in the opposite direction – is called “evolution”.

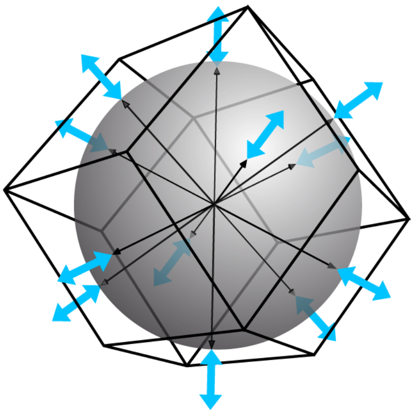

figure 5

Without matter the universal scalar field – the Higgs field – is perfectly flat. The units of quantised space however still deform their shapes and the results are electromagnetic amplitudes. Actually local energy density variances. Figure 5 shows in a schematic way the 12 planes of a unit and the blue arrows symbolise the topological deformation of each plane (see figure 4).

All the units around deform their shape in a corresponding way because every unit has exactly the same internal scalar mechanism. It means that after a period of time the shape of the unit is nearly the same as its shape at the start of the period of time.

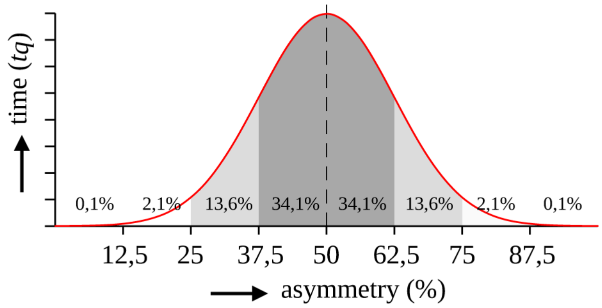

figure 6

Not every deformation of the shape of the unit during the period of time is exactly the same. If we measure the actual deformation of the unit in a sequence synchronous to the constant of quantum time (t_q) we get a diagram of the asymmetry distribution (figure 6). It is termed probability distribution and it manifests itself as the topological amplitudes of the electromagnetic field in vacuum space.

The linear propagation of a quantum of energy has the constant speed of light. Actually it is the pass on of the fixed amount of topological deformation from one plane of the unit to the opposite plane ($0{,}5 \times 10^{-15}$ m during $5{,}99 \times 10^{-23}$ second). However if the quantum of energy is distributed over more planes of the unit, its "velocity" is still the speed of light. Because if one plane of a unit is the input side of the fixed amount of topological deformation and the output is distributed over 3 planes the only difference with a linear propagation of the quantum of energy is that we cannot measure the pass on, like the linear propagation of an electromagnetic wave ($E = h\,f$) in vacuum space.

That is why we only experienced the universal propagation of topological deformation with the help of electromagnetic waves. Like we only experienced the existence of non-locality with the help of entangled photons. But the velocity of the motion of a rest mass carrying particle is still dictated by the speed of the propagation of the quantum of energy (c) because of the synchronisation of all the quanta transfer in the universe. That is why the motion of a local amount of concentrated energy (mass) along a fixed point in space will last a multiple of the constant of quantum time (t_q). Actually there exits only one linear velocity in the universe in relation to the energy transfer by the universal electric field: the constant speed of light (c).

Angular momentum

If a particle or a celestial body propagates in vacuum space the nearby units of quantised space have to adapt to the concentration of energy that closes in. Figure 7 shows a *schematic* image of a particle in vacuum space. The big black arrow shows the direction of the motion (top) and the other black/white arrows represent the vectors of the strong nuclear force. In reality all the scalars of the units are vectorised in the direction of the particle, because of the decreased radius of the scalar in the centre of the particle.

The deformable part of the units in vacuum space nearby the particle are deformed "around" the particle because of the "push" of the dominant vectors of the strong nuclear force. Actually a local deformation of the electric field. In Einstein's theory of General relativity the topological deformation of the units of quantised space around matter was interpreted as the curvature of space "itself". The amount of curvature at the macroscopic scale size was directly related to the mass of the object/celestial body and the gravitational influence. But the origin of gravity is the vectorisation of the scalars of the Higgs field in vacuum space under influence of a local concentration of energy that forces the decrease of a scalar of the Higgs field in the centre of the concentrated energy. So Newtonian gravity as a push force from vacuum space around still stands. Gravitational vectors are super-positioned on the vectors of the magnetic field so they influence the direction of photons.

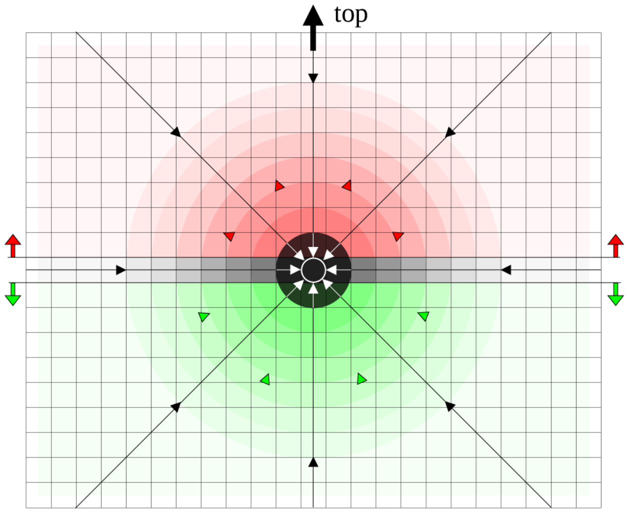

figure 7

In front of the moving particle (red) the units are forced to deform more and more because of the high concentration of energy of the approaching particle. At the other side of the particle (green) the internal scalar mechanism of the units try to get rid of all the topological deformation above the average deformation in vacuum space if there is no particle around.

There is a transitional phase where the evolving increase of topological deformation (red) ends and the decrease of topological deformation (green) starts. It is comparable with a disk-shaped region around the particle, perpendicular to the direction of the motion of the particle. So we find the moving electron of a Hydrogen atom somewhere within this disk-shaped plane. Like we find planets around a star in the orbital plane, perpendicular to the direction of the motion of the star. And the stars of a galaxy move in a orbital plane around the central black hole, perpendicular to the direction of the motion of the galaxy. Just because our universe is a self generating fractal and it repeats its geometry at every scale size. Although an electron cannot have an axial tilt of 82,23° in relation to the orbital plane like planet Uranus in the solar system. And planetary orbits cannot "wobble" like the distorted disk of a spiral galaxy.

Figure 5 shows the schematic image of a unit and the blue arrows symbolise the deformation of the boundary of the unit (the 12 joint planes with the adjacent units). Without dominant vectors the unit will transform its shape in every direction and after a period of time I can state that the result of all these transformations is nearly zero.

But if the unit is part of vacuum space around the particle in figure 7 its freedom to deform its boundary in 12 directions is limited by the dominant vectors of the strong nuclear force. The diagram in figure 8 shows the influence of dominant vectors (strong force/gravitational force) on the freedom of a unit to deform in every direction. It isn't by accident that Kepler's diagram of the mean velocity and mean distant of the orbits of the planets of the solar system shows a comparable graph.[2]

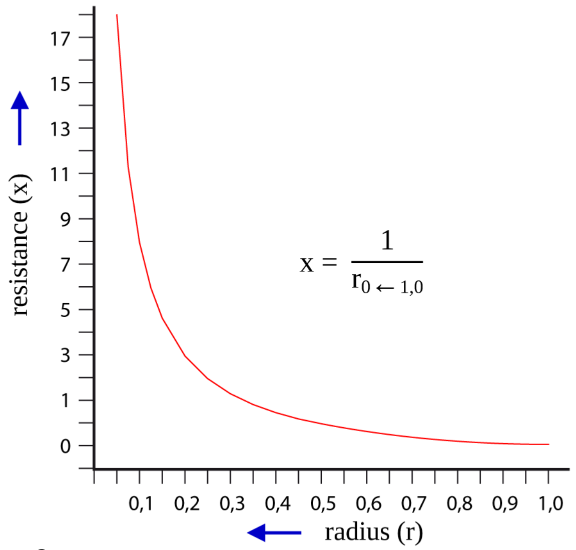

figure 8

The constant speed of light is the only universal velocity of the quantum of energy. In other words, if the freedom to deform in every direction is forced in mostly one direction the result is a propagation of quanta that nears the speed of light. But the causation is not the increase (red) or decrease (green) of the topological deformation in figure 7, the causation is the influence of the dominant vectors.

The consequence is that circular-like motion of energy can only show itself in the disk-like plane perpendicular to the motion of the rest mass carrying particle. Like the horizontal grey rasterised section in figure 7.

So there is no angular momentum without dominant vectors. And last but not least, motion is only circular from a certain point of view. If the structure of quantised space is the reference frame (rest frame) circular motion is always helical motion. Like the motion of the planet Earth within the solar system is a co-moving helical orbit around the linear motion of the sun.

The relations between the observable and detectable phenomena – the world of the appearances (Doxa) – are determined with the help of measurements (phenomenological physics). Unfortunately the results of the measurements are interpreted without the use of the concept of a universal rest frame. Although the existence of a universal creating rest frame is a well known ontological concept that was already described by the ancient Greek philosopher and mathematician Parmenides of Elea and his student Zeno of Elea (about 500 BC).

References:

2. S.E. Grimm (2024); "*On resultant motion in discrete space*" https://zenodo.org/record/11193931