Motion and forces

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Forces mediate the differences between local amounts of energy in the universe at all scale sizes and determine the direction of the motion of energy configurations. But forces are not always easy to identify and to describe in a comprehensive explanatory model.

Introduction

The model of quantised space describes our universe as a self generating fractal.[1] The concept means that our universe is deterministic. Questioning the reliability of the arguments that advertise an indeterministic universe because of the probability distribution of the outcome of experiments at the quantum level (quantum indeterminacy). But probability shows to be a topological property of the universal electric field and its corresponding magnetic field.[2]

The problem is caused by the conviction that the constant speed of light is the maximal velocity of information transfer. This opinion doesn't correspond with the principle of non-locality and the latest results of quantum tunnelling experiments that show an exceed of the speed of light.[3]

The controversy shows that the correspondence between the transfer of quanta by the universal electric field and the generation of corresponding vectors by the magnetic field is interpreted by some physicists as a kind of property similarity. That means that properties of the corresponding vectors are comparable with properties of the quanta of the universal electric field in relation to velocity.

The conservation of momentum – a universal conservation law – shows the differences between energy and vectors. Energy represents the distribution and transfer of local amounts of energy, while vectors determine the direction of the transfer of the amounts of energy. Unfortunately, forces are related to the motion of matter. In other words, are all known forces vector forces?

References:
1. S.E. Grimm (2019); "*The objective reality of space and time*". https://zenodo.org/record/3593872
2. S.E. Grimm (2021); "The mechanism behind probability". https://zenodo.org/record/5515861
3. Miao Yu et al. (2022); "*Full experimental determination of tunnelling time with attosecond-scale streaking method*". *Light Sci Appl* 11, 215 (2022). https://doi.org/10.1038/s41377-022-00911-8

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Invariance and variance

A universe that is tessellated by dynamical spatial units with identical basic properties can be considered as a mathematical reality. Because tessellation exclude the existence of emptiness. That is why the supposed dynamics have to be described with the help of topology. Figure 1 shows the principle of the topological deformation under invariant volume.[4]

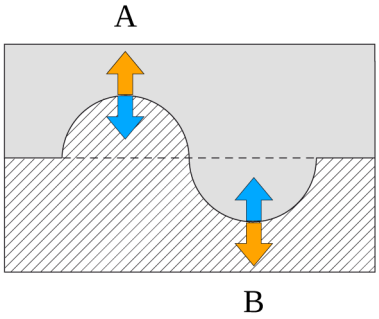


figure 1

The image shows that the surface area of both adjacent bodies is variable. But to create variance, both bodies have to transfer volume inside their boundary in a synchronised way. But energy is the variance of the surface area of the units of quantised space and it raises the question if there is a direct relation between the transferred volume inside the boundary of a unit and the resulting increase and decrease of the amount of surface area of the same unit.

The quantisation of all the energy transfer between the units is the consequence of the invariant volume of every unit. All the alterations of the shape of a unit are synchronised with the alterations of the shapes of all the other units. The unit of quantised space is a (deformed) rhombic dodecahedron – see figure 2 – and I can describe the transfer of volume inside its boundary as $\Delta V_{input} + \Delta V_{output} = 0$.

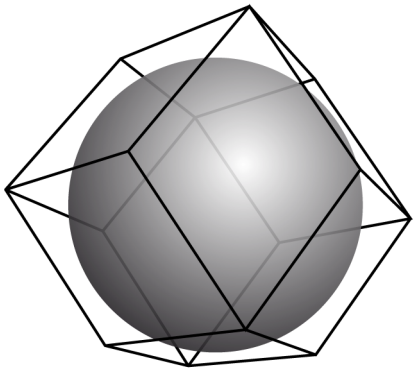


figure 2

The generated deformation by one or more adjacent units is ΔV_{input}. That means that the amount of topological deformation of each unit of the structure of quantised space is limited to ½*h* (ΔV_{output}). In phenomenological physics we focus on the phenomenon itself – the change of a local amount of energy – so the quantum of energy is equal to 1*h* (the Planck constant). Moreover, the quantisation of energy was detectable because of the linear propagation of electromagnetic waves.

If the topological deformation of the shape of a unit decreases, the internal transfer of volume by the unit is still in line with $\Delta V_{input} + \Delta V_{output} = 0$. So I have to conclude that the decrease or increase of the amount of surface area of a unit corresponds in a 1 : 1 relation with the internal transfer of volume.

Figure 2 shows that every unit envelopes a scalar. The universal scalar field is called the Higgs field. Actually, the "power" of every unit to change its shape originates from the internal spherical shape forming mechanism. That is why we can interpret a unit as a deformed sphere – surrounded by other deformed spheres – because of the tessellation of the volume of the universe by the units of quantised space.[4]

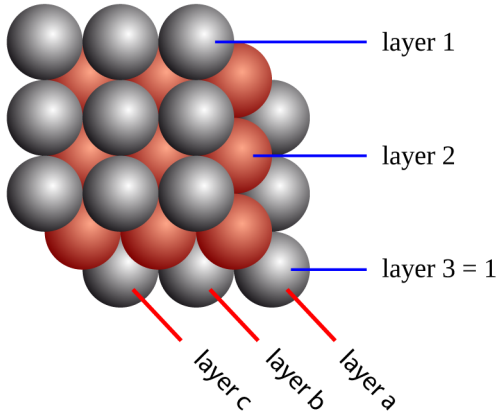


figure 3

The linear propagation of the quantum of energy is the constant speed of light. The consequence is that the linear pass on of the topological deformation of 1 quantum of energy by 1 unit has a duration of 5,99 x 10^{-23} second over a distant of 0,5 x 10^{-15} m (diameter of a unit). However, all the units transform their shape synchronously. Thus the cause behind the motion of local configurations of energy – e.g. an atom – is the "power" of every unit of quantised space to change its shape. That is why phenomenological physics fails as reliable explanatory model.

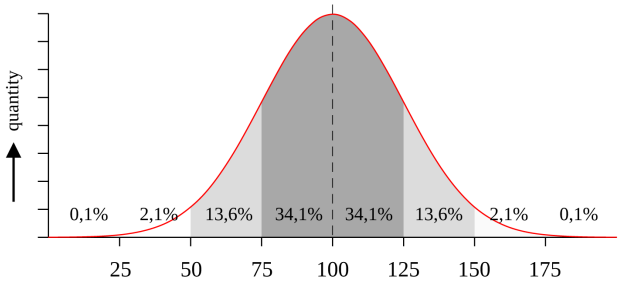


figure 4

It also shows that the ongoing deformations of a unit are the cause behind probability (figure 4).[2] It is obvious that most of the time a unit has an average topological deformation in relation to the units around (termed probability distribution).

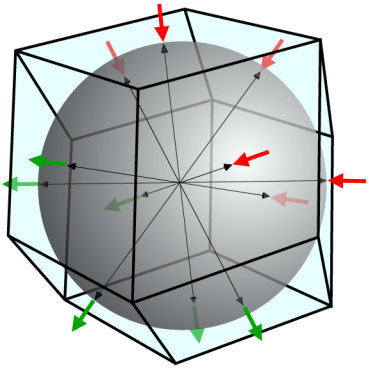


figure 5

In vacuum space all the scalars of the Higgs field have exactly the same magnitude. So I have to interpret the scalars of the Higgs field as an extremely rigid structure. All the scalars together form a lattice and figure 3 shows the configuration of the lattice (Kepler's conjecture). Figure 5 shows the consequence: the 12 points of contact of every scalar within the flat Higgs field will mediate the "dynamics" of the unit because of the continuous changing shape. The points of contact are 1-dimensional spots, thus the scalars of the flat Higgs field are mediating vectors. Actually, "stress vectors". The green and red arrows represent a random topological deformation of the 12 faces of the unit.

Figure 6 shows the result of the “push” of the unit at the right against the scalar of the unit at the left. The dark blue in the cross section is volume, involved in the transfer of some volume within the boundary of each unit.

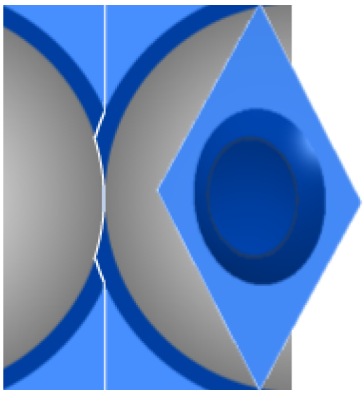


figure 6

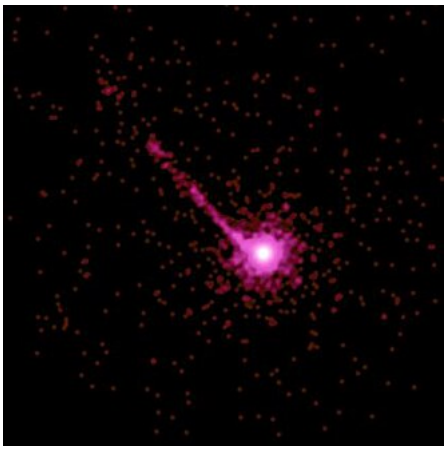
In other words, every change of the shape of a unit that is part of the flat Higgs field creates an alteration of the magnitudes of the vectors within the enclosed scalar (inscribed sphere of the internal scalar mechanism). But also the opposite is true: every vector within the flat Higgs field influences the topological deformation of the units. Actually the energy redistribution within the universal electric field (topological field). A decreased scalar interrupts the propagation of local vectors.

References:

4. S.E. Grimm (2020); “*On the construction of the properties of discrete space*”. https://zenodo.org/record/3909268

The universal electric and corresponding magnetic field

Some aspects of all the changes in the universe are difficult to understand. For example the velocity of phenomena and the supposed forces that are responsible for the motion.



There are detailed observations of the 2 jets of enormous black holes in the centre of galaxies in the early universe. Galaxies that are termed *quasars*. The image below (left column) shows the quasar PKS 1127-145 at a distant of about 10 billion light-years from Earth (source Chandra X-ray telescope).

To interpret the mechanism behind the black hole jets in relation to the direction of its motion, it is important to know the motion of the galaxy. Not every galaxy moves perpendicular to the galaxy plane but neither some planets in relation to the solar plane. For example the rotation axis of the planet Uranus has an axial tilt of 82,23°. Anyway it is reasonable to suppose that galaxy PKS 1127-145 is undisturbed and moves in the direction of one of its jets.

The jet in the image has a length of at least one million light years from the quasar. The jets are visible because of the accelerated matter by the jets. But if there is no matter available the “swirl” of the electromagnetic field at both sides of the black hole isn’t vanished at all.[5] The consequence is that a galaxy can be considered as an enormous magnetic dipole (see the schematic figure 7). The red circle symbolize the resultant motion of all the quanta transfer in vacuum space around the black hole/galaxy under influence of the gravitational vectors.

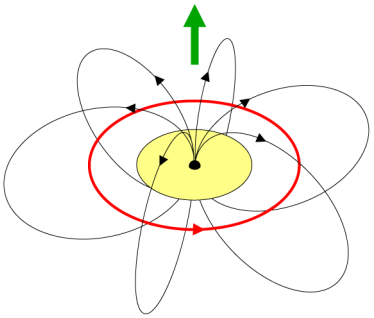


figure 7

In other words, the direction of the rotating resultant motion of the quanta of the universal electric field generate the magnetic field around the galaxy (and visa versa) and the direction of the motion of the galaxy (green arrow). Be aware there exists no flat Higgs field within the boundary of a black hole, so there is no internal generated magnetic field (vectors) either.

The magnetic field lines in figure 7 are a consequence of the gravitational vectors. Because the topological deformation of the units increases towards the black hole/galaxy. However, relative there is not much transfer of quanta in the direction of the black hole/galaxy.[5] Most of the transfer of the quanta is “circular” (red circle in figure 7).

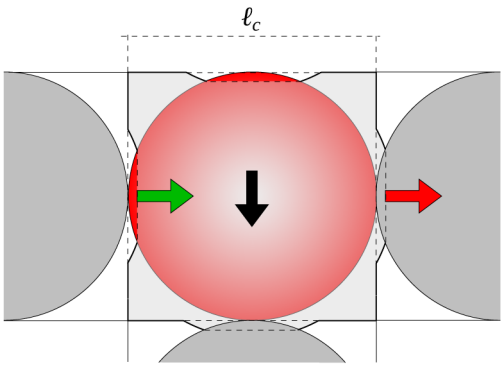
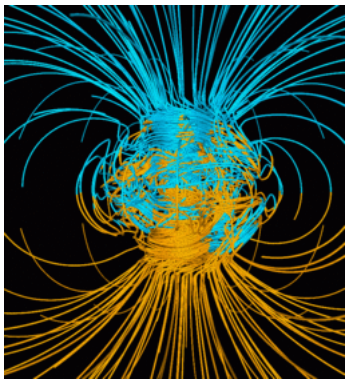


figure 8

The *schematic* image above (figure 8) shows the situation in more detail. The green and red arrows represent the topological deformation of the red circle in figure 7 (green arrow is input deformation and the red arrow is output deformation). But because of the gravitational vectors the unit in the centre is also deformed in the direction of the black hole (direction of the black arrow). If the black hole passes along the unit the gravitational vectors increase till the unit is at the same position as the plane of the black hole. Afterwards, the gravitational vectors decrease because the black hole gets "out of sight".

The result is a vector change that seems to be circular. Like the next image (source Wikipedia) shows. It is a computer simulation of the Earth's magnetic field. It shows to be similar to the "environment" of the black hole/galaxy.



The motion of the stars of a galaxy around the black hole in the centre shows as orbital motion. But its real motion in relation to the rest frame is a spiral motion. Like the motion of a person at the surface of the planet Earth shows to be a 24 hours spiral and it is also part of a much larger spiral of the Earth around the Sun during the year. In other words, why do celestial bodies move in a direction perpendicular to the plane?

The scalar mechanism of every unit tries to minimise its surface area. But the enormous amount of topological deformation of a celestial body cannot be stopped. Moreover, at the other side of the moving celestial body the units push the topological deformation in the direction of the motion of the celestial body. In other words, a celestial body propagates within the structure of quantised space. Just like a quantum of energy propagates in vacuum space.

Actually, because all the quanta transfer in the universe is synchronised and conserved during the constant of quantum time (t_q) the smooth propagation of properties of a macroscopic phenomenon in motion is standard. The plane perpendicular to the direction of the motion is the spatial "disk" (part of a helix) where de local conditions of the units are "in rest" for a short moment. It is the transition between the increase of energy and the decrease of energy by the moving macroscopic phenomenon.

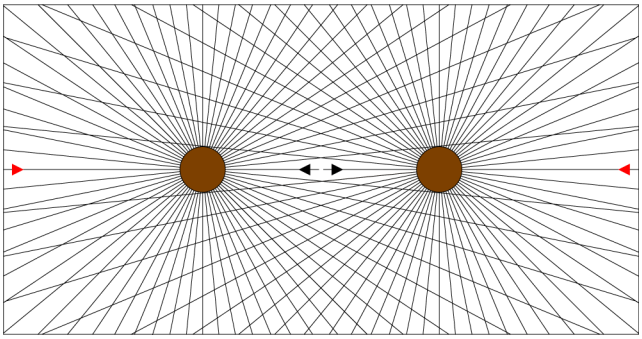


figure 9

The propagation of motion doesn't mean that there is no push force – e.g. by gravitational vectors (see figure 9) – but it shows that motion is determined by the structure of the units of quantised space. In other words, the *direction* of the motion is the result of vectors, the "power" to propagate properties is generated by the scalar mechanism of the units of quantised space. However, is this also true for the photon of electromagnetic waves?

References:

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

The propagation of a photon

The amplitudes of the propagating electromagnetic wave show the interaction of the quantum of energy with the electromagnetic field around.[6] Actually it is the interference of a fixed amount of topological deformation – the quantum of energy (1 h) – within a volume with other synchronous changing fixed topological deformations (the changes within the electromagnetic field).

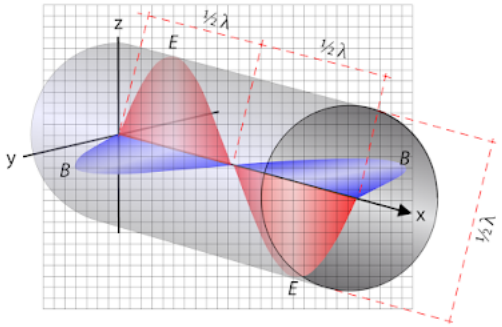


figure 10

The drawn *schematic* transverse oscillating amplitudes of the electric field (*E*) and the magnetic field (*B*) represent arrows that point outwards (figure 10). That is a bit confusing because the electric field (*E*) is not a vector field. Anyway, the maximal amplitude of the electromagnetic wave is half the wave length (½ λ).[7] In line with the constant velocity (*c*) of the propagation of the quantum of energy in the x, y and z direction.

Unfortunately, in physics there is no consensus about the real "picture" of the quantum of energy (photon). In spite of this, a recently published paper (14-11-2024) claims that the problem of the unknown geometry of the photon is solved.[8] Maybe the "picture" is correct but it doesn't clarify the geometrical mechanism that is responsible for the electric and magnetic amplitudes of a propagating photon in vacuum space.

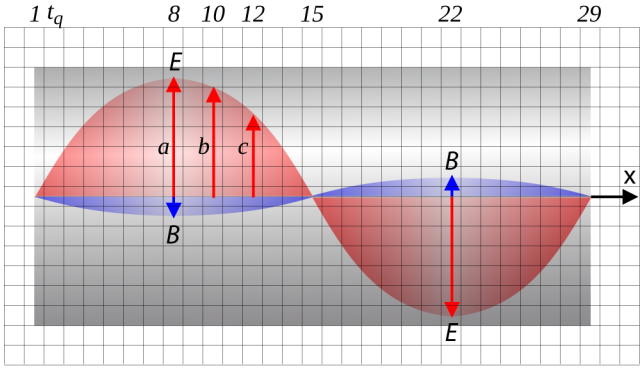


figure 11

In the image above – figure 11 – I have drawn one wave length (λ). The electric and magnetic amplitudes are a bit rotated (y and z-axis) to get a recognisable picture.

The photon represents a local increase of energy. It represents the quantum of energy of 1 unit of quantised space. So the quantum propagates during $t_q = 1 \rightarrow t_q = 29$ from left to right. Its length in the direction of its motion = $1\ell_c$ (the minimal length scale). So if I make photographs of the photon along its trajectory I get picture *a* at $t_q = 8$, picture *b* at $t_q = 10$, etc., etc. The amplitude of the electric field (*E*) starts at $t_q = 1$ and increases till $t_q = 8$. Next the amplitude start to decrease and at $t_q = 15$ the picture of the photon is similar to $t_q = 1$. At $t_q = 22$ the amplitudes are at 180° in relation of the first amplitude ($t_q = 8$).

Suppose that the waveform in figure 10 and 11 is not real? That the waveform is only a possible construct with the help of Maxwell's equations (classical physics)? Because figure 12 shows a more realistic picture; energy as local density variances of the universal electric field. In other words: A = the average energy density in vacuum space; B and D = a local surplus of energy density and C and E = a local deficit of energy density. The concept is in line with experiments that show that the energy transmission by an electromagnetic wave is always half its wave length (½ λ). That means that if a phenomenon absorbs a local surplus of energy (B) the related deficit of energy (C) disappears, and visa versa.

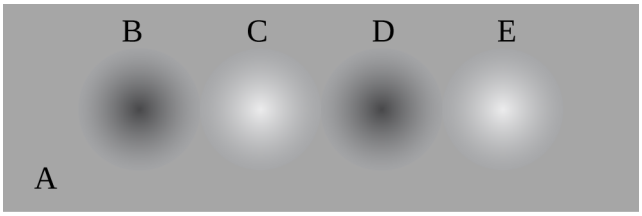


figure 12

But there is a problem. Because what does figure 12 show? Is it the propagating photon in vacuum space or is it the adaptation of the electromagnetic field around the incoming propagating photon? If the constant speed of light is the linear pass on of the quantum of energy (photon) it is hard to imagine that the quantum itself generates local density variances.

The energy of an electromagnetic wave is expressed by the formula $E = h\,f$. The frequency (*f*) multiplied with the wave length (λ) is the speed of light (*c*). So the energy (*E*) represents the duration of the transformation of a local surplus (B) into a local deficit of energy (C) and visa versa (figure 12). In other words, if the average energy density of vacuum space changes over time a propagating electromagnetic wave will decrease its frequency (non-Doppler redshift of the light of distant galaxies because of the creation of more and more matter during the evolution of the universe). But this effect hardly influences experiments with electromagnetic waves in a laboratory. That is why the frequency of the electromagnetic wave reflects the geo-

metrical properties of the emitter of the electromagnetic wave. But it also confirms that the electromagnetic wave is not the incoming propagating photon, it represents the adaption by the electromagnetic field.

The universal electric field (E) cannot adapt instantaneous. That is why the increasing amplitude ($1t_q \rightarrow 7t_q$) in figure 11 reflects the adaption to the energy of the photon with the speed of light by the units around. The local changes of the universal electric field generate corresponding vectors by the magnetic field perpendicular to the changes of the electric field. Because the mechanism is comparable with the situation in figure 8. Although the involved amounts of energy changes are really small ($< h$).

Figure 11 doesn't represent the correct "picture" of the photon. Not at least because the generated vectors of the magnetic field represent the same units as the energy changes of the universal electric field. In other words, figure 11 is no more than a schematic model.

References:

6. C. Riek et al. (2017); "*Sub-cycle quantum electrodynamics*". Nature 541, 376-379 (2017). https://doi.org/10.1038/nature21024
7. 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
8. B. Yuen, A. Demetriadou (2024); "*Exact quantum electrodynamics of radiative photonic environments*" Physical review letters 133, 203604 (2024) https://doi.org/10.1103/PhysRevLett.133.203604