*Conceptual FrameWork*
Research papers

# Dynamics in discrete space

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*Our universe shows to be local and non-local. The concept is confusing because in daily live we are not aware of the non-locality of our universe. Actually, in daily live local reality seems to be quite orderly and understandable. But we don't know why everything is in motion and all our theories in physics are still approximations of physical reality. At least that is what they supposed to be.*

**Introduction**

Einstein's famous equation $E = m\ c^2$ about the equivalence of mass and energy describes a static situation. However, the square of the speed of light ($c^2$) "informs us" that we have to apply surface area to every "hidden" quantum of energy of the mass ($m$) to transform this amount of concentrated energy into free energy again (free energy conform Planck's $E = h\ v$).

Although the properties and manifestations of mass are at the heart of modern quantum field theory[1] we cannot state that the equivalence of mass and energy reveals a mechanism that is responsible for all the dynamics in the universe.

In classical physics we argued that matter represents everything in our observable universe. Nevertheless the 2022 Noble prize Physics is awarded to physicists who showed that our universe is not only local, it is simultaneously non-local too. A confusing concept because it implies an all-inclusive causal dynamics.[2] The consequence is that everything influence everything in the universe at exactly the same moment. Unfortunately we cannot interpret non-locality as the origin of all the dynamics. Because non-locality is a result and not the cause of all the continuous synchronous changes everywhere in the universe.

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**Universal conservation laws**

There are only 2 universal conservation laws in physics. These 2 universal conservation laws are the law of conservation of energy and the law of conservation of momentum. Both conservation laws are universal because they envelope the conservation of change of the whole universe. A conservation mechanism that needs the existence of non-locality to be true. Because there cannot exist a universal conservation of change without an all-inclusive synchronization of the change of all the variable properties.

Unfortunately momentum is not a singular property so it rises the question if momentum can represent reality at the smallest scale size. Momentum envelopes an amount of local energy, inclusive the velocity of the motion of the local amount of energy ($p = m\ v$). This in relation to the other local amounts of energy and distinct motion. That is why momentum can be interpreted as a quantification of the hierarchy of mutual influences in relation to local amounts of energy and their related motion. This is reasonable because *every quantum of energy has momentum*.

However, the linear velocity of a quantum of energy in vacuum space is the constant speed of light. And all the other quanta around have the same linear velocity. The quantum of energy is the "building block" of local amounts of energy – e.g. a particle – so at the smallest scale size momentum represents the direction of the motion of the quantum of energy. Actually, a vector.

The conservation of the existing energy is covered by the law of conservation of energy. So if we subtract the conservation of energy from the conservation of momentum, the "left over" is the conservation of the direction of all the energy transfer in the universe. No matter if the energy represents the transfer of a local concentration of energy (e.g. matter) or the transfer of a single quantum of energy.

Although it is confusing that a universal conservation law – momentum – determines 2 different properties. Energy as the quantized changes within a 3D spatial structure, and direction as a corresponding vectorization of the quantized changes. Because in quantum field theory every basic

quantum field is thought to represent elementary field properties, in line with reductionism. That is why the properties of these basic quantum fields are thought to represent physical reality at the smallest scale size.

The 3D field structure that is responsible for the transfer of quanta of energy is the universal electric field. Its corresponding vector field is the magnetic field. Both basic quantum fields together are termed *electromagnetic field*. Now it is reasonable to conclude that the conservation of all the changes in the universe corresponds with the variance of the properties of the universal electric field and its corresponding vector field, the magnetic field. In other words, the two universal conservation laws reflect the elementary properties of these two basic quantum fields.

However, there is also matter in the universe, although the energy of matter is covered by the law of conservation of energy and the direction of the motion of matter is covered by the conservation of momentum. Although the direction of the motion of large scale matter is thought to originate from the influence of matter on the geometry of space itself, described in Einstein's theory of General relativity.[3]

But if all the dynamics in the universe originate from the structure of the universal electric field and its corresponding magnetic field, gravity must be an effect that emerges at the moment the variable properties of the structure of the electromagnetic field creates matter. Actually, the supposed creation of rest mass carrying particles in the early universe under conservation of energy and the *direction* of the motion of the energy (together "momentum").

If all the dynamics in the universe originate from the universal electric field and its corresponding magnetic field I have to conclude that Aristotle's concept of the *unmoved mover* seems to be correct. Because the discovered dipole – Doppler shift – in the cosmic microwave background radiation (CMBR) shows that the electromagnetic field can be interpreted as a rest frame.[4][5]

References:

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**Dynamic physical reality**

The image (figure 1) shows Einstein's hypothetical spacetime in a schematic static way. Of course it must have a structure because it can change its spatial properties and influences quantum phenomena like electromagnetic waves.

The different descriptions of spacetime and quantum fields can be compared with two mathematical sets that influence each other so both descriptions must have a shared property, because these 2 sets are actually subsets. The shared property between Einstein's spacetime and the basic quantum fields isn't known but it is for sure that both subsets must have a shared structure. In line with the ongoing search for a theory of quantum gravity.

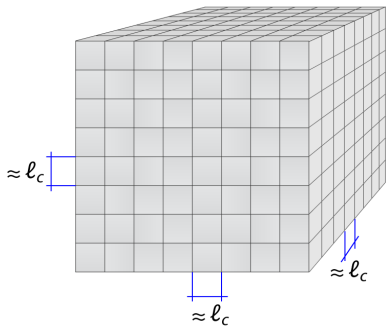


*figure 1*

Physical reality is dynamical reality so all the spatial units of Einstein's spacetime in figure 1 – termed discrete space or quantized space – interact with each other. The structure tessellates the universe so there are only 3 geometrical mechanism to create the mutual dynamics: changing the volume and the surface area of the units, changing only the volumes or changing only the joint surface areas.

Change in physical reality means in the first place a change of local energy. So if we supply a lot of energy to a nucleus – actually accelerating the nucleus – we can observe if the supply of energy will increase the volume of the nucleus. But experiments show that the amount of volume is unchanged, only the shape of the nucleus gets deformed.[6] So we have to conclude that the dynamics in Einstein's spacetime are limited to the deformation of the shapes of the units of the structure of discrete space *under invariant volume*. In line with the square of *c* in Einstein's formula

about the equivalence of energy and mass ($E = m\ c^2$). Because spatial units with identical basic properties that tessellate the volume of the universe and deform under invariant volume correspond with the homeomorphic transformation of 3D topological spaces that fit metric Euclidean space. See $\ell_c$ in figure 1.

However, if every unit of the structure is a geometric object that fluently transforms into a new shape under invariant volume, the structure of the units cannot curve at all. In line with the existence of the universal scalar field – one of the basic quantum fields – that shows to be a flat field everywhere in vacuum space. That means that every scalar of the Higgs field in vacuum space has exactly the same magnitude (radius).

The consequence is that curved spacetime only mimics the force of gravity. An emerging effect that is part of – and mediated by – the dynamics of the electromagnetic field. In other words, Einstein's theory of general relativity describes a macroscopic model in phenomenological physics that cannot be "translated" into a corresponding quantum theory of gravitation.

Fortunately the spatial structure in figure 1 also represents in a schematic way the general structure of the basic quantum fields.[7] I only have to add the scalars of the Higgs field to the units in figure 1 to get a schematic picture of the conceptual framework of the basic quantum fields. Figure 2 shows the result although I have replaced the cube with a more realistic rhombic dodecahedron. Because the lattice of the scalars of the Higgs field are packed in arrangement with Kepler's conjecture.[8][9]

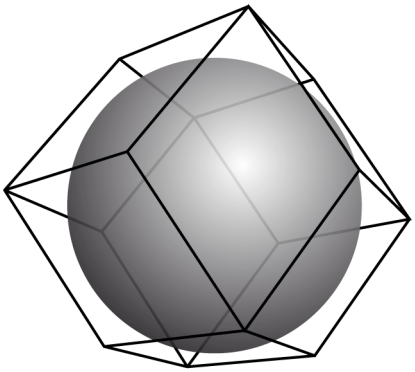

*figure 2*

If I draw the inscribed sphere in every unit of the structure in figure 1 the drawing represents the universal scalar field, the universal electric field and its corresponding vector field, the magnetic field. The Higgs field and the electric field can exchange volume, termed the Higgs mechanism. That is why the universal electric field and the Higgs field are different internal configurations of the same spatial unit. For example the scalar of a unit can be described as a build up of closed concentric shells. Now the volume of the electric field around the scalar can be described as an extension of the scalar by *open* concentric shells. See figure 3, unit III. The "cubic cross sections" I, II and II are actually rhombic dodecahedrons because at a certain angle the outline of a rhombic dodecahedron shows as a square.

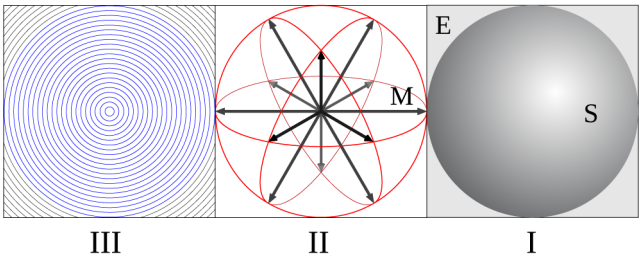


*figure 3*

The 3 adjacent units in figure 3 represent different "pictures" of a unit. Unit I shows in a schematic way the scalar (S) and the volume of the electric field (E) around. Unit 2 shows the vectors (M) that are the result of the internal scalar mechanism that pushes against all the other adjacent scalars at their mutual points of contact.

That is why vectors are 1-dimensional mathematical objects because vectors don't exist without a rigid medium (the flat Higgs field). The consequence is that every fixed topological deformation of the shape of a unit results in an asymmetry of the "push" by the internal vectors of the scalar. The resultant small vectors represent what we have termed the magnetic field.

An increase or decrease of the surface area of a unit with a fixed amount of topological deformation (Planck's constant *h*) results in an increase or decrease of the corresponding vectors mediated by the scalar of the unit. Actually the magnetic field in vacuum space. In line with the universal conservation laws (energy and momentum).

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**Mathematical consequences**

There exists no theory in physics that describes in an accurate way what is really going on at the smallest scale size of quantum reality.[9] In other words, every measured force and every local configuration of energy represent **resultant** properties that manifest the mutual relations between all the detectable and observable phenomena, inclusive Einstein's hypothetical macroscopic geometrical model of the influence of gravity on matter.

Anyway, figure 1 doesn't show phenomenological reality, it represent absolute reality in a schematic way. That means that the existence of the fixed amount of topological deformation – Planck's constant *h* – can be derived from the basic properties of the units of the structure.

If 1 unit of the structure changes its shape – actually transferring a flux of infinite small "grains" of volume within its boundary – all the other units must change their shape synchronously otherwise the tessellation of the volume of the universe by the units of the structure is broken. But the existence of a universal synchronisation of all the transformations of the shapes of the units under invariant volume has consequences. Because the transfer of a flux of infinite small "grains" of volume within the boundary of a unit has a duration. If the transfer of topological deformation is linear within the structure the pass on of a sequence of topological deformations has a constant velocity, the constant speed of light (*c*). A linear propagation of the topological deformation that fits Planck's formula $E = h\,\nu$.

The consequence is that there exists a constant of time ($t_c$) that represents a fixed amount of transferred volume within the boundary of every unit of the structure. In between the constant of time no unit can change the direction of the internal flow of volume that changes its shape (and therefore its surface area). In line with Heisenberg's uncertainty principle.

Figure 4 shows the increase of surface area (grey) by one quantum of topological deformation. The red arrows represent the increase of the vectors of the unit (magnetic field).

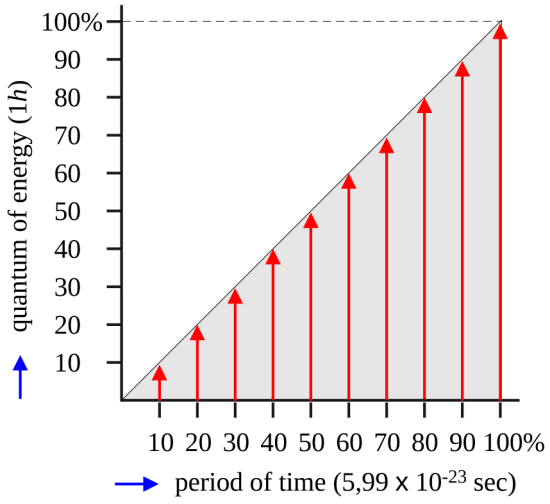


*figure 4*

The magnitudes of all the vectors in the universe are changing continuously because of the smooth topological deformation of the whole structure. That means that the magnetic field has no quantization on its own like the universal electric field. Therefore the vector field isn't part of Heisenberg's uncertainty principle. Vectors don't transfer volume within the boundary of a unit and the consequence is that the influence of a changing vector on all the other vectors around is instantaneous.

The metric of discrete space ($\ell_c$)[10] is about 0,5 x $10^{-15}$ m (⅓ diameter proton).[11] The velocity of the speed of light in vacuum is 299.792.458 $ms^{-1}$, so every unit of the structure "transfers" about 5,99 x $10^{23}$ fixed amounts of topological deformation (quanta of energy) during 1 second. That is why it is possible to calculate the available energy within a certain volume during 5,99 x $10^{-23}$ second if we multiply the involved number of units with ½ *h*.

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**Conclusion**

The origin of all the dynamics in the universe is the internal scalar mechanism of every unit of the structure of discrete space. We experience these continuous changing topological deformations of the units at the macroscopic scale size by what we have termed “basic quantum fields”.

Although Einstein’s concepts about relative time and the curvature of space under influence of local concentrations of energy are widely accepted, these concepts don’t match the basics of quantum theory. So we have to admit that Newtonian gravity – although attracting forces cannot exist – is a more realistic description of physical reality than the theory of general relativity. Instantaneous influence isn’t a fantasy any more – Noble prize physics 2022 – so we cannot argue that Newtonian gravity violates the speed of light.

Causality originates from classic physics and it represents the phenomenological point of view. A natural way to interpret the world around because the human senses are actually measurement instruments that can only detect the mutual relations between the phenomena. But it is hard to reject that all the synchronized changes everywhere in the universe show to be in line with the 2 universal conservation laws and are expressed by the dynamics of the universal electric field and its corresponding magnetic field.