Conceptual FrameWork
Research papers

Discrete space and the wave-particle duality relation

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Suppose we can develop a measurement instrument that isn't build up by matter. Now there arises an intriguing question. Can this new instrument detect electromagnetic waves? To say it in a different way: "Are there electromagnetic waves to be find in a universe without matter?"

Introduction
The idea that reality is created by a couple of underlying quantum fields – the modern concept of quantum field theory[1] – does not explain the existence of electromagnetic waves. The reason is simple, in QFT the mechanism behind the creation of matter by the properties of the underlying basic quantum fields is not understood. In other words, if we don't know the origin of the creation of matter – rest mass carrying particles – it is impossible to understand the mechanism behind the exchange of energy between matter.

The statement that rest mass carrying particles are excited states of the local basic quantum fields doesn't elucidate the "tangible" relations between the underlying basic quantum fields, the "excited" particles en the mediation of electromagnetic waves between matter.

To solve this problem I will use the concept of discrete space.[2] Discrete space (or "quantized" space) is the hypothesis that space itself has a geometrical structure. The structure itself is not easily detectable[3] but we know the existence of the underlying structure because of the properties of the observed basic quantum fields. It is proposed that discrete space is in rest[4], and all the detectable and observable phenomena are in motion in relation to the structure of discrete space. A concept that is comparable with the general concept of quantum field theory.

References:
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.pd
2. S.E. Grimm (2020); "*On the construction of the properties of discrete space*" DOI: 10.5281/zenodo.3909268 https://zenodo.org/record/3909268
3. S.E. Grimm (2021); "*Discrete space and the scalar lattice 3.0*". DOI: 10.5281/zenodo.5771124 https://zenodo.org/record/5771124
4. 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, Volume 931, No 2. iopscience.iop.org/article/10.3847/2041-8213/ac6f08

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The concentration of energy
In vacuum space there is a continuous change of the amplitudes of the electromagnetic field.[5] These changes represent topological deformation of the invariant volumes of the units of the structure of discrete space. Obvious because if we apply energy to a rest mass carrying particle the volume of the particle doesn't expand to enormous proportions if the velocity of the particle nears the speed of light. In line with the square in the equation $E = m\,c^2$.

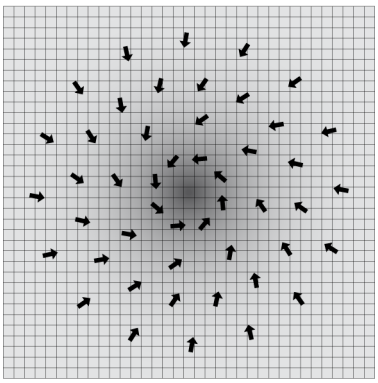

figure 1

The image above shows in a schematic way the structure of space – discrete space – and the resultant motion of the continuous topological deformation by the units of the structure, in physics termed quanta of energy (h).

The transfer of fixed amounts of topological deformation with a constant velocity – the speed of light – will result in a loop-like resultant motion around the centre of the concentration because concentrations of topological deformation cannot move with the speed of light. The velocity of a concentration of topological deformation is directly related to the amount of concentrated fixed amounts of deformation for each unit of the structure.

A particle is a local concentration of energy and the consequence is that the amount of energy of the emerging particle is supplied by the electromagnetic field in vacuum space around the particle (figure 1). The energy is supplied and continuously maintained concentrated by the involved units of the structure of discrete space.

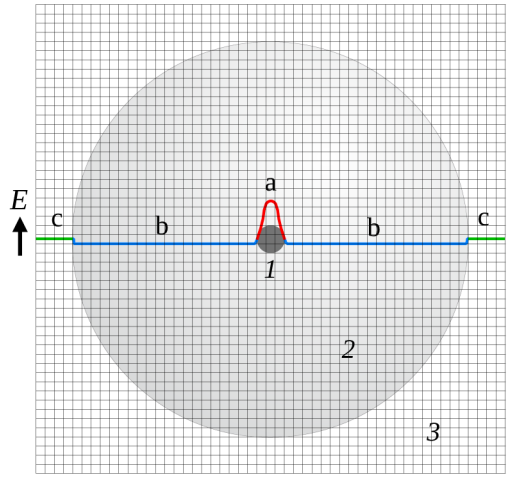

figure 2

Figure 2 shows in a *schematic* way the local surplus of energy, the particle (*1*), the volume around (*2*) with a deficit of energy and vacuum space with an average amount of energy (*3*). The cubic structure represents discrete space in a schematic way (like figure 1). Figure 2 shows an overlay diagram too: the surplus of energy of the particle (red line; a), the deficit of energy within volume *2* (blue line; b) and the average amount of energy in vacuum space (green; c). The surplus of energy of the particle (a) is equal to the deficit of energy (b) around.

Figure 3 shows in cross section the topological deformation of 2 rectangle bodies with a joint plane. The volume of each body is invariant. I can describe the smooth topological deformation with the help of the increase or decrease of the surface area of the joint plane. But I can also describe the topological deformation with the help of the transfer of identical small volumes from A to B or visa versa inside each body.

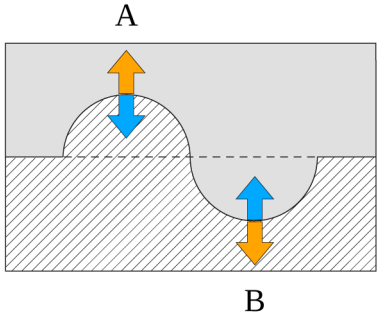

figure 3

In other words, increasing the surface area of the joint plane needs the transfer of identical small volumes from B to A (orange arrows) and decreasing the joint surface area needs the transfer of these identical small volumes – actually a flux of volume – from A to B (blue arrows).

Figure 2 represents the same topological principle. If the surplus of energy of the particle (a) decreases, the deficit of the energy within the volume (b) around decreases too, and visa versa because the volume of every unit of discrete space is invariant. The consequence is that the increase or decrease of the energy of a particle isn't possible by the transfer of a surplus of energy, representing a single quantum or a sequence of quanta of energy.

Figure 4 shows the schematic image of an electromagnetic wave. The wave form itself shows the electric (E) and magnetic (B) influence of the electromagnetic wave on the electromagnetic amplitudes of the electromagnetic field in vacuum space around.

However, the topological "size" of one quantum of energy (*h*) cannot have the geometrical proportions of the wave form because the influence of te "cross section" of an electromagnetic wave is half the wave length.[6] Therefore it is reasonable to conclude that the wave form is the result of the influence of the alternating existence of a local surplus and a local deficit of 1 quantum of energy.

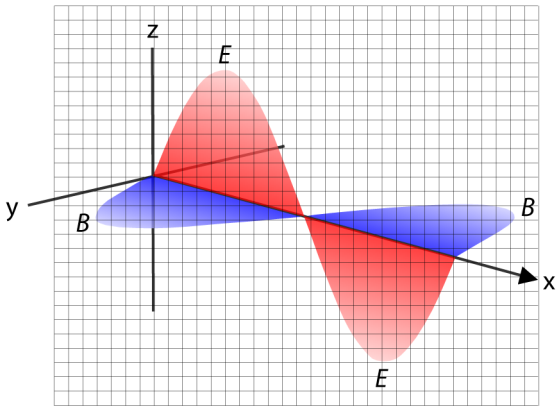

figure 4

The consequence is that the wave form is caused by the "adoption" of the surplus *and* deficit of 1 quantum of energy by the *amplitudes* of the electromagnetic field. Actually the topological deformation of every involved unit of discrete space around.

In other words, if we can measure the topological deformation of every involved unit we will discover that a certain percentage of the deformation is caused by the existence (at that moment) of the surplus or deficit of 1 quantum of energy. Therefore, the "tangible" existence of the surplus and deficit of 1 quantum within one unit of the structure is restricted to 2 units in between the wave length of a single electromagnetic wave (figure 4). These units will be found

on the trajectory of the linear motion (x) and in between half the wave forms.

References:
5. C. Riek et al. (2017); "*Sub-cycle quantum electrodynamics*". Nature 541, 376-379 (2017). https://doi.org/10.1038/nature21024
6. 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

Corresponding vectors

It is self evidently that the concentration of energy of a particle in experiments that manifest wave-like properties of "tangible" particles cannot be described by the transfer of energy of the electric part of the electromagnetic field alone. The universal electric field and the magnetic field are corresponding fields thus the transfer of a quantum generates corresponding vectors and visa versa. Diagram 5 shows the "build up" of the quantum of energy and its corresponding vector(s) in vacuum space. In between the duration of the start and end of a quantum of energy – the constant of quantum time – there is no observable change possible (Heisenberg's uncertainty principle).

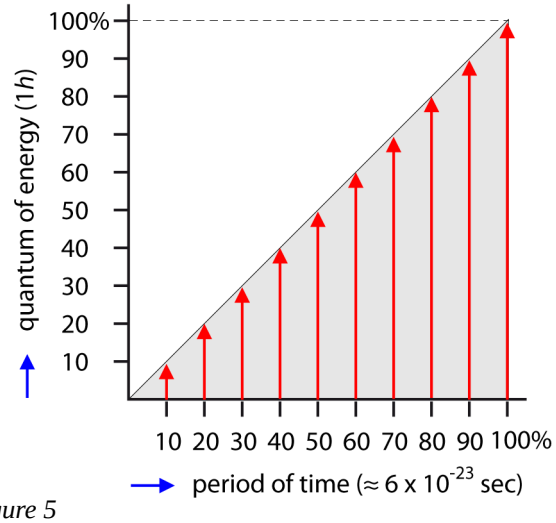

figure 5

The corresponding 1-dimensional vector(s) of the quantum of energy are not part of the universal electric field because these vectors of the magnetic field are mediated by the scalars of the Higgs field in vacuum space. In vacuum space each scalar of the Higgs field has exactly the same magnitude and together these identical scalars form a rigid lattice, configured like Kepler's conjecture[7][8] (figure 7).

The magnitude of a scalar is determined by its radius. Because the only geometrical scalar is the sphere. The existence of rest mass is the result of the transfer of energy from a local scalar to the local electric field. But after a very short period of time the rest mass carrying particle has changed its position in relation to the structure of discrete space.[4] That means that the decreased scalar becomes part of vacuum space again and retains the same magnitude -actually the same radius – like all the other scalars in vacuum space.

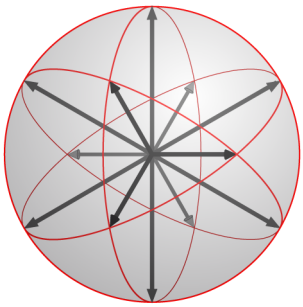

figure 6

The only reasonable explanation is that the magnitude of a scalar is determined by an internal spherical shape forming mechanism ("scalar mechanism"). An internal mechanism that "blows up" the size of the decreased scalar till its radius becomes equal to all the other scalars in vacuum space. Figure 6 shows a half transparent scalar and the drawn vectors correspond with the points of contact of the scalar with the 12 adjacent scalars around. Showing the origin of the existence of 1-dimensional vectors of the magnetic field.

The drawn transparent scalars in figure 7 elucidate that vacuum space is pervaded by a network of vectors (also termed "vector space"). Vectors that change their magnitude under influence of the topological deformation of the deformed part of the volume of the unit of the structure of discrete space in vacuum space (see page 9, reference [2]). All these continuous deforming parts of the units of the structure of discrete space form together the magnetic field in vacuum space. Because reduced scalars cannot mediate 1-dimensional vectors because there are no points of contact between the reduced scalar and the non-reduced scalars around.

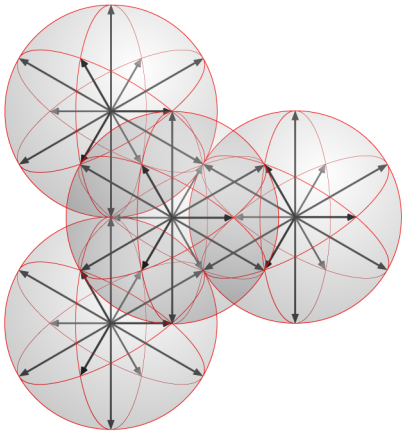

figure 7

Mostly if we think about vacuum space we imagine some kind of a volume that is pervaded by continuously changing waves, the local amplitudes. But vacuum space is also the domain of the generated vectors by the local changes of the universal electric field and these vectors are mediated by the scalars of the Higgs field. Vectors that represent the local amount of topological deformation.

Local concentrations of energy like rest mass carrying particles represent much more topological deformation than a single quanta transfer between the amplitudes of the electric field. The consequence is that every particle has dominant vectors around. Vectors that change their local "position" in correspondence with the motion of the particles in respect to the electromagnetic field that is in rest[4].

However, a rest mass carrying particle has a reduced scalar within its boundary (local concentration of energy) and the decrease of a local scalar in vacuum space results in the vectorization of all the scalars around because of the disappearance of 1 point of contact of every adjacent scalar. And all these long range vectors "point" towards the reduced scalar of the rest mass carrying particle, the origin of the existence of these long range vectors.

The result is that these long range vectors – generated by rest mass carrying particles (matter) – are super positioned on the short range vectors of the magnetic field. Showing evidence that Newtonian gravity is an emerging push force from vacuum space around and not a pull force between matter objects like Newton proposed.[9][10]

The consequence is that Einstein's theory of General Relativity is a macroscopic model that has no "tangible" relation with physical reality at the microscopic scale size.

References:
7. Kepler, Johannes (1611), "*Strena seu de nive sexangula*" (The six-cornered snowflake), ISBN 978-1-58988-053-5, MR 0927925
8. 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
9. Louis Rancourt and Philip J. Tattersall (2015), *"Further Experiments Demonstrating the Effect of Light on Gravitation".* Applied Physics Research; Vol. 7, No. 4; 2015 http://dx.doi.org/10.5539/apr.v7n4p4
10. Eric Verlinde (2011). "*On the origin of gravity and the laws of Newton*". Journal of High Engery Physics **4**, april 2011. DOI: 10.1007/jhep04(2011)029 https://arxiv.org/abs/1001.0785

Experiments

If we try to understand the nature of electromagnetic waves and the nature of single particles like electrons, we use experiments like the "double path" experiment[11].

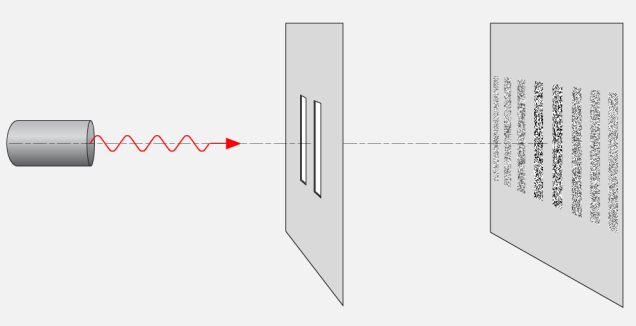

figure 8

The drawing represents physical reality as we observe it with our eyes. We are not aware of the network of vectors that determine the direction of the topological transformations of the units of discrete space. The short range vectors of the magnetic field and the long range vectors of the field of gravitation (Newtonian gravitation).

But the mechanism behind the concentration of energy in vacuum space that results in particles and their mutual exchange of energy by electromagnetic waves doesn't "expire" at the moment a particle is created. Moreover, we can demonstrate the existence of the mechanism with the help of experiments, for example the double slit experiment.

If the 2 slits are equal and close together and an electromagnetic wave or a particle is forced in the direction of the slits, the path of the distinct phenomenon already exists within the network of vectors in vacuum space. Because the influence of vectors is instantaneous, inclusive the influence of the vectors that are related to all the matter objects around. Take away the double slit and there is no "quantum strangeness" at all.

It is obvious that it is the double slit that creates a local change within the vector network of the scalar lattice of the Higgs field. It influences the common correspondence between the electric field and the magnetic field that is responsible for the well known spatial properties of electromagnetic waves and particles in vacuum space. Properties that can be manipulated in certain experiments.

References:
11. Young, Thomas (1804). "*The Bakerian lecture. Experiments and calculation relative to physical optics*". Philosophical Transactions of the Royal Society of London. 94: 1–16. DOI: 10.1098/rstl.1804.0001.

Conclusion

The wave-particle duality is an imaginary construction that originates from outdated ideas about physical reality we used in classic physics (phenomenological physics).

Unfortunately this limited point of view is frustrating the discussion about the true nature of energy. Figure 5 shows the relation between a quantum of energy and its corresponding vector(s). But figure 3 shows that it is impossible to create a local surplus of energy if there is no created deficit of energy at exactly the same moment.

Planck's constant (h) is about the energy of the electromagnetic wave in relation to its frequency ($E = h f$). In other words, I cannot use figure 5 if I don't show another image where the energy decreases from 100% to 0% in $\approx 6 \times 10^{-23}$ sec. There doesn't exist a local surplus of energy in our universe without a corresponding deficit of energy. In line with the universal conservation laws (energy and momentum).