Four mysteries solved: double-slit, spooky action, tunneling, and accelerating Universe

by

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Abstract: There are more phenomena in quantum mechanics and in cosmology that we cannot imagine how they work. The four most known phenomena are the result of the double-slit experiment, the spooky action at a distance (the working method of the non-local correlation in quantum entanglement), how the tunneling works, and why the Universe accelerates. These phenomena cannot be explained in the system of the space-time model. We need a new model with a new axiom. Space-matter theory changes the axiom of space and time. Space waves. We can express spatial distances, time units and energy with space waves. Space is what the matter senses as space. Time is one characteristic of space waves. Using this new approach, we can solve our old mysteries.

Key words: double-slit, spooky action, tunneling, space-wave, time-wave, space-matter theory, Lajtner-burger, Lajtner-submarine, accelerating Universe

There are more phenomena in quantum mechanics we know, but we cannot explain how they work. The missing explanations show that there are "white spots" on the maps of today's physics theories and models. Three questions have been unanswered for more than a hundred years.

- How to explain the double-split experiment?
- How to explain the spooky action at a distance (the nonlocal correlation in quantum entanglement)?
- How to explain tunneling?
- How to explain the accelerating Universe?

The special and general theory of relativity and the space-time model are based on axioms that don't allow us to explain these strange phenomena. Of course, there are famous and known explanations of all the above-mentioned questions, but these answers don't connect the three questions. If we change our axioms, we can easily answer the questions, and we can see that these questions have one common root. To discover this common root, we have to change one of our most important axiom: the axioms of time.

1. THE SPACE-TIME CONTINUUM BY EINSTEIN

In modern physics, every frame of reference is equivalent according to Einstein's space-time model of the special and general theory of relativity[1, 2, 3, 4 5, 6, 7]. The special relativity introduced many definitions, like time dilation, length contraction, and mass–energy equivalence expressed as $E=mc^2$, where c is the speed of light in a vacuum, E is the energy and m is the mass. c is a universal speed limit, and (therefore) exists the relativity of simultaneity.

Einstein's general relativity theory gave a more complex system of gravity than Newton's Law of Gravity[8]. The general theory of relativity is a geometric theory of gravity, where gravity is the curvature of space-time generated by mass (energy). The curvature of space-time is an action-reaction phenomenon of energy and space.

Both the velocity of matter and the velocity of non-matter (space) have their speed limit. They cannot be faster than c and the models of relativity themselves don't use a higher speed than c.

Space-time has three spatial dimensions and one time dimension, so space-time is a four-dimensional model according to Einstein. In later theories built on space-time, for example in superstring theories, there are different space-times according to their dimensions. See for example the popular 9+1 model, where space-time can have 9 spatial dimensions and 1 time dimension[9]. The modern models of physics needs space and time that are independent dimensions. But what is space and what is time? Theoretically they aren't matter but "something else"; in our reality both originate in matter. Why? Because of the way they are measured.

2. SPACE-TIME MODEL VS. SPACE-MATTER MODEL

2.1. Time and space

What is time? Today's physicists claim that time is what we measure as time.
What does the phrase "what we measure" mean? Just energy and mass are measurable. The physics concept of measuring time is derived from two "bodies" acting upon each other, where the "bodies" can only be matter – for example, the Earth's rotation in relation to the Sun, the motion of a spring inside a wall clock, or atomic vibration powering an atomic clock. The essence is always the same. One matter moves in relation to another matter.

One second is defined as a changing character of the cesium 133 atom[10] that we can measure. One second has its start and has its end that we measure. The main element of time is the change. If there is no change, there is no time. We measure changes of matter measuring time.

Can we measure space? Measuring space, we measure matter. The meter is the length of the path travelled by light in a vacuum during a given time interval[11]. We can measure neither time nor space at all. We measure only matter. Do we measure all matter? No. Heisenberg's Uncertainty Principle gives us a limit we on what can measure[12]. From now on I refer to matter as 'measurable matter'. I suppose in the first part of this paper, there is nothing else— just space and matter. Where there is space, there is no matter, where there is matter, there is no space. Space is the phenomenon that the modern physics calls space. Matter is everything else. You will see, this statement is too simple. I'll fix it later.

2.2. Action-reaction of space and matter

We know from quantum mechanics that particles of matter are in constant vibration. It is a physical impossibility for matter to come into contact with space without its vibrations having an effect. Based on the Casimir Effect[13] and other physical phenomena like gravity waves measured by LIGO[14, 15], we can state that space exists in waves and vibrations.

2.3. Viewpoint of space

Einstein's special theory of relativity describes how the mass of an object increases with its velocity relative to the observer. The increasing velocity of mass decreases the spatial distance. When an object is at rest, and both the object and the observer are in the same inertial frame of reference, the object has a 'rest mass' (m_0). The rest mass is the smallest value of mass in the given inertial frame of reference which is connected with the longest spatial distance s_0. The observer is always matter and the object is always matter.

What if the observer is space itself? Can we describe a model of a moving mass from the viewpoint of waving space? Yes, we can[16].

If an observer "made out of space" was able to measure the wavelengths of space wave λ, it would find the shortest wavelengths (λ_0), if the mass is at rest—that is, the mass does not move in space, $v_0 = 0$. From the viewpoint of space, the 'rest mass' is possible, since the vibration of the space wave is much faster than the vibration of mass. See later.

If the mass moves in space $v_1 > v_0$, the wavelength of space wave is longer ($\lambda_1 > \lambda_0$). Knowing λ_0 and λ_1, we know when the mass moves in space. The space waves also show if the mass accelerates. If $\lambda_{i+1} \neq \lambda_i$ and $i = 0, 1, 2...$, then the acceleration of mass $a \neq 0$. i represents time. If $\lambda_{i+2} = \lambda_{i+1}$, then $a = 0$, that is the object continues to move at a constant velocity from the viewpoint of space. Newton's First Law of Motion can be given as $\lambda_{i+1} = \lambda_i$.

Since space is always given, we can use it as a general observer. Space always has a common framework with every mass. Saying this, space is an absolute entity behind the relativity.

It sound like an old aether model, doesn't it? No, it doesn't.

2.4. No aether, but space waves

Aether theories propose the existence of a substantial medium, the so-called aether. Aether is a space-filling substance, and a transmission medium for the propagation of gravity forces (and even the electromagnetic force) according to physicists at the end of the 19th and the beginning of the 20th century. The works of Lorentz[17, 18] represent the theory.
In the aether model, time is a "local time" that connects systems at rest and in motion in the aether.

In my model, there is no aether. The space waves and the changes in wavelengths of space waves represent the re/actions that the re/actions of matter cause. And there is no "local time". The definition of time makes a big difference between the space-time model and the aether model. In my model, there is neither "local time", nor space-time.
In the next chapter I'll show how we can use a new aspect holding the results of the space-time model.

The new model is the space-matter model.

3. SPACE-MATTER MODEL: SPATIAL DISTANCES AS SPACE WAVES

3.1. Wavelength and spatial distance

If the mass of the object is at rest relative to the (non-space) observer, then the given spatial distances of the object and of the (non-space) observer can be given as the sums of the wavelengths of space waves: $s_{observer} = \sum_1^n \lambda_{observer}$ and $s_{object} = \sum_1^n \lambda_{object}$,

where

$$s_{observer} = s_{object} = \sum_1^n \lambda_{observer} = \sum_1^n \lambda_{object} . \qquad (1)$$

If the object moves relative to the observer $v_{object} > 0$, then the observer will realize

$$s_{observer} > s_{object} . \qquad (2)$$

Equation (2) shows the values we calculate using the theory of special relativity. But behind the curtain is Eq. (3).

$$\sum_1^n \lambda_{observer} < \sum_1^n \lambda_{object} . \qquad (3)$$

That is,

$$\sum_1^n \lambda_{observer} = \sum_1^p \lambda_{object} , \qquad (4)$$

where n>p. The same *s* spatial distance can be made out of $n \times \lambda_{observer}$ and out of $p \times \lambda_{object}$. The observer's wavelength of space wave doesn't change, but the object's wavelength of space wave does, $\lambda_{observer} < \lambda_{object}$. In other words, the spatial distance $s_{observer}$ is built out of more waves of space than the s_{object}. The object will travel the *s* spatial distance using its own space waves—that is, the spatial distance for the object is really shorter—now *p* pieces long instead of *n*.

The $\lambda_{observer} < \lambda_{object}$ is a real phenomenon, not the viewpoint of the observer. Behind the relativistic length contraction is a real difference of wavelengths of observer and object.

3.2. Calculation of the change of wavelength of space wave

The calculation is based on the Lorentz-transformation of the special theory of relativity. The known formula of the length contraction is this:

$$s' = s(1 - \frac{v^2}{c^2}), \qquad (5)$$

where v is the velocity of the object with mass. So the change of wavelength of every space wave is

$$\lambda' = \frac{\lambda}{1 - \frac{v^2}{c^2}}, \qquad (6)$$

Of course, the model can be more precise using Newton's Law of Gravity that makes different lengths of wavelengths of space waves. The differences of wavelengths of space waves depend on the distance between space wave and mass. In this study, I use the two-dimensional cosine model, because it is more simple.

If the wavelengths of space waves are given in a three-dimensional model, where they depend on the distance between mass and space wave, this leads us to a new form of the general theory of relativity, where the metric tensor doesn't describe the curvature of space, but the wavelengths of space waves. This new model is the space-matter model.

4. SPACE-MATTER MODEL: TIME AS SPACE WAVES

The space-matter model is a surprising model, where space has three spatial dimensions and time has no dimension. In the space-matter model, time comes into existence when mass and space meet. Also, whenever mass and space meet, the result is time. Time is the action-reaction phenomenon (or mutual effect) of matter and space, and appears as space waves.

What does this imply? If we have matter and space, we have time. Time is not the fourth dimension. It is a phenomenon. It is a spatial wave, a series of signals with properties. It has characteristics like speed, frequency and action that can be calculated[19].

On the other hand, space has time, too, since the actions of matter can be used as time impulses in the case of space. The question of space's time is very complex; I shan't go into details here.

4.1. Time as spatial wave

Can time have waves? In some models, time may have waves, cp. references[20, 21, 22]. If time does exist, and it is not just our human production, it must have effects on matter and the matter must have effects on time. Knowing the theory of relativity, this statement is not new. But there is something missing. The theory of relativity doesn't describe the reactions of space caused by actions of the vibration of particles (matter).

If there is matter in space, there is a (set of) waving spatial signals that cannot be "switched off". Space waves always exist when matter exists. Every wave has its "effect" on matter. The "effect" has its start and end. So, we can produce one second using (a set of) space waves. We can describe time as waves of space caused by matter, where the space wave has its effect on matter. Saying this, space and matter produce time; time is not an independent phenomenon.

According to modern physics, only mass changes the space waves through causing gravity. Accepting this, *our* time is the action-reaction of mass and space that exists as space waves.

This is not the only space wave—that is, not the only time, just *our* time.

4.2. Time wave and time unit

The matter-space vibrations, from the point of view of matter, can vacillate between strong and weak. It oscillates. The change is periodic, and one period is one unit of time. This unit of time has two parts:

a) the hit, when space acts upon matter most strongly; and
b) the period between hits, when the force of space acts less strongly upon matter.

FIG.1 shows the *naive* model of the hits of space on matter.

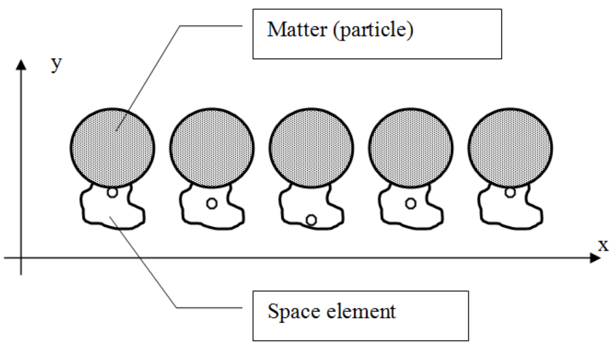

FIG. 1. Time impulses given in generally as hits of space on matter. Our time impulses comes from space and mass. Two-dimensional model, x and y are spatial distances, not proportional. The white shape illustrates an element (a range) of space. The grey circle illustrates a particle of matter. Note the space element is a phenomenon with structure. The elementary particle of matter also has structure.

The FIG.1. illustrates the different states of vibration of one space element (space particle) pictured as a small, white ball. The vibration can be given as a cosine function, where a) equals the positive amplitude of the cosine function. The first and the last space element show this state. Every other value of the function is b). Our time is created by space and mass. In my cosine-model a pulse of time exists, if $\cos(x) = 1$. The time impulse is followed by a lack of time pulse, when $\cos(x) < 1$.

4.3. Space waves vs. time waves

Every non-space object produces space wave. Light, too. According to modern physics light has no time. This is not possible according to the space-matter model, but here and now I accept this axiom. To be more precise, I use it this way: *our* time wave is a wave of space produced by mass and "sensed" by mass and energy. This is *the* time. A time wave is the result of a space action followed by matter's reaction and vice versa. Our time wave is a set of space waves, where the set contains one or more waves of space, where the amplitude is given as $\cos(x) = 1$. Every non-space object generates space waves, so there can be many unknown space waves with many different amplitudes. In our lives (and in our models), we use the time of mass, but a "non-mass" object can use different time waves.

4.4. Lajtner-burgers of mass

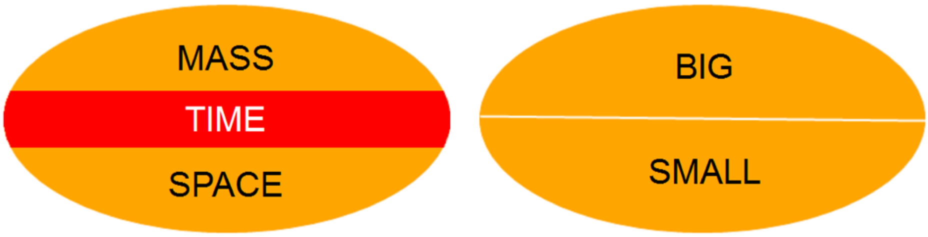

FIG. 2. Space-matter model displayed as Lajtner-burgers.

FIG.2. shows there is no way to put together space and mass without time coming into being. Time is the result of the action-reaction of space and mass. The wavelength of the space wave gives us the spatial distance; the frequency of space waves give us time—if mass is in space. Mass and space create *our* time.

The second illustration of Fig.2. (Lajtner-burger *Diet.*) shows the same in a more complex approach. Here space appears as *space and time* for mass (SMALL), and mass appears as *matter and time* for space (BIG). If we speak about *our* time, solely mass can be matter. If we want to understand phenomena like tunneling or nonlocal correlation in quantum entanglement, we have to use the definition of time in wider meaning, where space and matter meet.

4.5. Time's new definition

Using BIG and SMALL, we can give a new definition of time. Time combines our three spatial dimensions and the three spatial dimensions of space. Are they not the same? Three spatial dimensions are three spatial dimensions, aren't they? In mathematics, yes. In physics, no. The *actions* of their buildings elements are at different scales. And the actions cannot change their given dimensions.

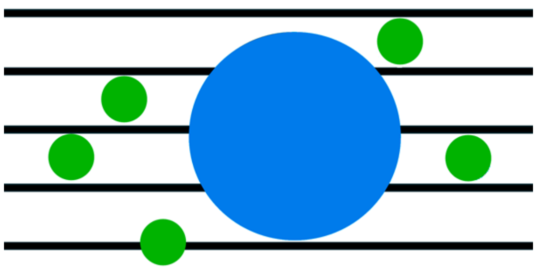

FIG. 3. There are two different three-dimensional spatial dimensions depending on the actions of the objects (model, not proportional).

FIG. 3. shows there is an essential difference in the scale (of actions) of space and mass (SMALL and BIG). Both exist in three-dimensional space, but mass is fundamentally incapable of entering the three-dimensional world of space. Similarly, space is unable to exploit the opportunities of the matter's three-dimensional world. The picture above illustrates how space cannot span two bars, while matter cannot fit between them.

From the above statements, a new definition of time emerges. Time is the meeting of "bodies" that exist in two three-dimensional spaces that have different scales. Or in other terms: time comes into being if two different three-dimensional spaces meet; or to be more precise, if two objects with different scales of actions meet.
Our time merges three different things: the three-dimensional spatial world of space, our three-dimensional spatial world of mass, and their actions and reactions. In our normal life we cannot sense the three spatial dimensions of space, therefore we can figure with one time dimension. This *dimension* is *our* action/reaction.

FIG. 3. shows more than this. It shows, that different dimensions could come into existence in all cases, where the 'rest action' of the matter particle creates a different dimension from the 'rest action' of another mass particle or 'rest mass' of another mass. Saying this, space can be even a non-space object in a given relation. See 'rest action' in Chapter 8.

5. PITCH OF SPACE-MATTER MODEL

Matter causes waves in space. Solely through the use of space waves, we can express spatial distance, time and energy. Why? Because space waves have the shortest wavelength, the fastest speed, and the smallest energy expressed in our terms.

- Every spatial distance can be expressed using the wavelength of space waves.
  In our physics terms: This is the shortest unit of distance.
- Every unit of time can be expressed using the periodicity of space waves.
  In our physics terms: This is the shortest unit of time.
- Every amount of action (energy) can be expressed using the value of the action of space waves.
  In our physics terms: This is the smallest unit of energy.

Let's see the calculated values of space-matter in the next chapter using a simple two-dimensional cosine model as space wave.

6. CALCULATED VALUES IN THE SPACE-MATTER MODEL

6.1. How can we derive our time units from the space wave?

If we wish to express the time function of space waves in terms of physics' units of time, we may do so. If we take as our unit of time one second, the space waves show us how to divide that unit into the smallest possible parts of time. The time appears as the frequency of the space wave, or in other words, the action of the space wave. One second is as long as the space wave expresses $E_{\sec}$ energy. It is calculable according to the model of space-matter.

$$v_{TIME} / \lambda_{TIME} = f_{TIME} . \qquad (7)$$

In Eq. (7) λ_{TIME} is the Planck-length[23] and

$$v_{TIME} = \frac{\mathrm{c^2}_{\mathrm{meter}}}{\mathrm{t}_{\mathrm{Planck}}} , \qquad (8)$$

where t_{Planck} is the Planck time[24] and $c^2{}_{meter} = (2.997 \times 10^8)^2$ meters derived from $E = m \times c^2 = F \times c^2{}_{meter}$, where $c^2{}_{meter}$ is the distance around the mass, where mass and its modifications of wavelengths of space wave expressed as F are one entity within one time unit—that is, without time. In a closed system, the total momentum is constant according to Newton's Second Law of Motion. Using this law in a wider context, the mass and the given portion of space build a closed system.

Using the values mentioned above, the speed of time wave (space wave) is $v_{TIME} = 1.667 \times 10^{60}$ meters/sec. The *c* speed limit of the matter is not valid in the case of space and time waves. These waves spread in the texture of space. The measurement of gravitational waves by LIGO doesn't change this statement. See later.

$f_{TIME} = 1.031 \times 10^{95}$ $(\sec^{-1})$, using a simple cosine function to calculate the frequency of the time wave. The frequency of the time wave cuts one second into 1.031×10^{95} time-pieces. So, if we stress the *frequency of the space wave*, we are speaking about *time wave*.

h_{TIME} can be calculated supposing a theoretical photon, where $\lambda_{photon} = \lambda_{TIME}$, and using the Planck law[25] as a pattern that light has adopted from the wave of time.

$$f_{photon} \times h = f_{TIME} \times h_{TIME} \tag{9}$$

$$\frac{c}{\lambda_{photon}} \times h = \frac{v_{TIME}}{\lambda_{TIME}} \times h_{TIME} \tag{10}$$

$$h_{TIME} = h \times \frac{c}{v_{TIME}} \tag{11}$$

So, seconds can be expressed as energy. $E_{\sec} = 1.956 \times 10^9$ Joules, that is, 1 second represents $E_{\sec}$ energy, according to the cosine model.

Time waves (space waves) are not any kind of matter, but it's "action", its "energy" can be described with our physics units of matter. We have to be very careful with expressions like "action of time wave", "energy of time wave" etc., because action and energy etc. are the characteristics of matter. (To make the difference clearer, I suggest using *L*action (Low Action), *L*energy (Low Energy) etc. in the cases of time and space waves.)

6.2. How can we derive our spatial distance from the space wave?

If we wish to express our terms of physics' units of distance using the characteristic of space wave made by mass, we may do so. If we take as our unit of spatial distance one meter, the space waves show us how to build that unit from the smallest possible spatial parts. The shortest spatial distance is given by the wavelength of the space wave. 1 meter = $k_{TIME} \times \lambda_{TIME}$, where *k* is the wave number of the space wave (time wave). Using waves that have energy, we can give one meter as energy, too.

6.3. Meter, kg and second expressed in eVolt

Using the action of time waves (space waves), we can express mass, energy, time and spatial distance in the same dimensions, for example in eVolt.

First see the well-known value[26]:

$$1\ kg \text{ represents } 5.61 \times 10^{35}\ eV \quad (12)$$

Now let's see the new results using the cosine model:

$$1\ meter \text{ represents } 7.32 \cdot 10^{-33}\ eV, \quad (13$$

$$1\ second \text{ represents } 1.22 \cdot 10^{28}\ eV. \quad (14)$$

There is one more surprising conclusion: time, spatial distance and energy can be given in meters and in seconds, too. For example:

$$1\ second \text{ represents } 1.66 \times 10^{60}\ meters. \quad (15)$$

The values come from the cosine model. If the model is more accurate (for example it is a three-dimensional model accepting the changing values of gravitational force), the above-mentioned values will change, but the principle remains the same.

The above-written is surprising, but it has old roots. There must be a way to convert – for example – spatial distance into mass and mass into spatial distance, since the special theory of relativity shows the connection of mass and spatial distance using:

$$s' \cdot m' = s \cdot \sqrt{1 - \frac{v^2}{c^2}} \cdot m \cdot \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}} = s \cdot m = \text{constant}_{\text{s m}} \quad (16)$$

The transformation of kg into meters was meaningless, but we can now express both in eV.

6.4. New constant

If time waves are derived from space waves there arises a strange phenomenon—the time and the distance are the two sides of the same medal from the viewpoint of mass.

$$f_{space\ wave} = f_{time\ wave} \quad \text{and} \quad \lambda_{time\ wave} = \lambda_{space\ wave} \quad (17)$$

If a mass generates growing wavelengths of space, the frequency of the space wave decreases—that is, the time unit for the mass grows in the same portion. Mass always needs the same time expressed as $f_{time\ wave}$ to travel the one $\lambda_{space\ wave}$. Mass can never travel faster, never more slowly in space from its own viewpoint. According to a Hungarian proverb: "It is not possible to jump over its own shadow", that is, "The leopard cannot change his spots". This is displayed in the Eq. (18) by v_{sm} . Accelerating motion appears in a non-space inertia frame of reference according to the mass, but it doesn't appear in the framework of waving space according to the mass.

$$v_{sm} = c \tag{18}$$

Eq. (18) comes from the space-matter model combined with the special theory of relativity. c is true, because of Eq. (19).

An observer can realize the acceleration of mass in space, if the observer is able to measure the changing wavelengths of space waves around the mass. The mass itself isn't able, since its time depends on its space waves. Eq. (18) doesn't mean at all that the velocity of an object cannot be higher than c according to an observer. Eq. (18) characterizes how objects "can see their shadows" in the waving space.

Eq. (18) also shows that mass particles cannot be motionless in space—that is, particles (matter) must vibrate, and they always have time.

6.5. Different spaces vs. wormholes

In Eq. (18) we can see the same phenomenon in mass-space relation, what we know about the relation between mass and light. The speed of light is independent of the v velocity of the mass it is always c, according to the given mass. Mass and light follow the same rule, but their spaces are different. Mass travels in space, light travels on the space wave generated by mass. This highlights the reason of the gravitational red shift of light. Light's frequency level (*FL*) is constant in the case of the given photon:

$$FL = const = f_{light} / f_{time\ wave} \tag{19}$$

Mass and light have different spaces—that is, there *are* different spaces. Objects opt for what is space for them. Mass and light (and other hypothetical or real particles) use different spaces, where the wavelengths of space waves are different. The different wavelengths of space waves result in there being spaces, where $v_{limit} >> c$, where v_{limit} is a velocity measured by mass. These spaces can be seen as wormholes. What is a wormhole in the space-time model? A wormhole[27] or an Einstein–Rosen bridge[28] is a hypothetical "bridge" connecting two sheets of space-time.

There is no wormhole in the space-matter model, but different spaces. The different spaces seem to make the spatial distances shorter, because the wavelengths of space waves are longer here. From the viewpoint of a mass observer, the following seems to be true: $v_{limit} >> c$.

6.6. What can be space; or, Lajtner-submarine

Studying some unique physical phenomena, we realize that the Lajtner-burgers don't describe these ones. This complexity displays the Lajtner-submarine. See FIG. 4.

Let's introduce the following notations:

- Space. This is *the* space we know as space, made out of space.
- Time. This is our time generated by mass in Space.
- $Space_{act}$. This is the space where the object travels.
- $Time_{act}$. This is the time that is given by the space where the object travels.
- $Space_m$. This is a space made out of mass that another matter uses as space.
- $Time_m$. This is the time that is given by $Space_m$.
- Space $wave_L$. This is a space wave generated by light.
- Space $wave_{MV1}$. This is a space wave created by Matter $Wave_1$.
- Space $wave_{MV2}$. This is a space wave created by Matter $Wave_2$.

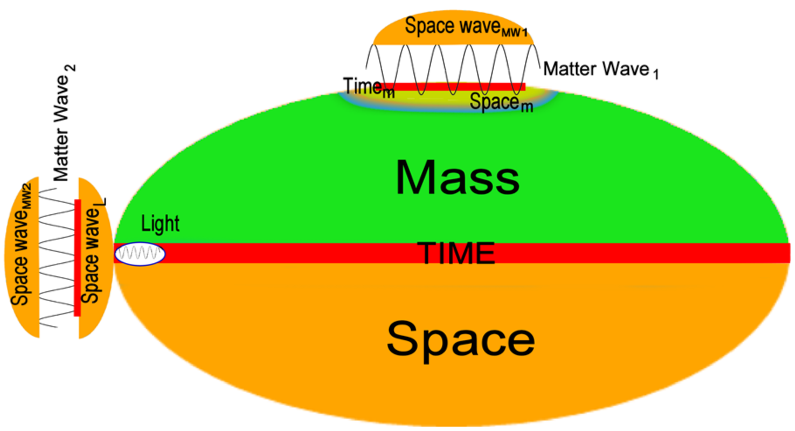

FIG. 4. Space-matter model displayed as Lajtner-submarine (not proportional). The illustration sketches the complexity of space and time. It doesn't want to display every possible opportunity. It emphasizes that the question "What is space?" cannot be answered without knowing whose space we speak about.

In FIG. 4. you cannot see the element of the Lajtner-burger Diet. These connections are not highlighted here; of course, they remain true in the case of Mass and Space. FIG. 4. shows, there are different spaces. Light and mass are able to generate space, and to appear as space for another matter. Space is a wider category than just "Space", space is always must be understood in relations.

Let's see the top of the figure. It shows, space can be created from matter, it is $Space_m$. Its time is $Time_m$. A given waving matter particle called Matter $Wave_1$ can travel in Space and in $Space_m$. For Matter $Wave_1$ $Space_{act}$ = $Space_m$, but the following can be possible, too: $Space_{act}$ = Space. In FIG. 4. Matter $Wave_1$ uses $Space_m$. If the Matter $Wave_1$ jumps from $Space_{act}$ = Space to $Space_{act}$ = $Space_m$ or back, then the Matter $Wave_1$ has to change itself, too. See the Chapter 11 on tunneling. Matter $Wave_1$ creates Space $wave_{MW1}$.

Let's see the left side of FIG.4. Light travels on the space waves of mass, that is, on our time wave. The light generates Space $wave_L$ used by Matter $Wave_2$. For example the spooky action at a distance (the non local correlation in quantum entanglement) travels on Space $wave_L$. The red line here without text symbolizes the time of this space. Matter $Wave_2$ creates Space $wave_{MW2}$.

Light itself also can be space, see the fast lights later. Saying this, not only Space, but mass, light and their space waves can be used and are used as space in many cases.

If

$$Space_{act} \neq Space \,, \tag{20}$$

that is,

$$\lambda_{Space_{act}} >> \lambda_{Space} \,, \tag{21}$$

then the velocity of the Matter Wave is grater then c.

$$v_{MW} >> c \,, \tag{22}$$

There are many spaces in FIG.4., but every space and time wave can be derived from the space waves created by masses.

$$\kappa_{act} = \frac{f_{space_{act}}}{f_{Space}} \tag{23}$$

where κ_{act} depend on the given $Space_{act}$.

6.7. Synchronization of space wave and matter vibration

You can see that the waving of space is faster than the vibration of matter. $f_{space-wave} > f_{matter-vibration}$. These motions must be synchronized. The synchronization of these motions needs algorithms of both sides. Matter and space must have algorithms. Saying this, there are structures of matter built from smaller bricks than themselves. In other words, the elementary particle of matter we know cannot be the last building bricks of the matter. These smaller bricks (or their twins) are in space, too—that is, both space and matter have structures.

More aspects of the algorithm of matter can be sketched using the space-matter theory (cp. Reference 14). I think that the algorithm of matter, ("the DNA of matter") can be almost as well decoded as the DNA of livings beings.

The elementary bricks can be postulated; space-matter theory is the way to describe them. In this study I don't go down this route, because the length of this paper is limited.

Saying this, I don't think we know all elementary (matter) particles, since we don't know when and how the algorithms of matter (and space) come into being. Researching the possible algorithms, we would be able to give a minimum condition for the smallest matter/non-matter particles that may exist and cannot be put into the Standard Model. See the discovery of a new, unknown particle[29] by Debrecen University (Hungary) in 2016. This particle seems to represent a new fundamental interaction[30]. that cannot be put into the Standard Model. Space-matter theory is dedicated to describing new fundamental interactions

7. DOUBLE-SLIT EXPERIMENT IN SPACE-MATTER

7.1. The mystery of the double-slit experiment

Young performed the first two-slit experiment[31] ever. In 1801 he found that light paints an interference pattern on the observing screen.

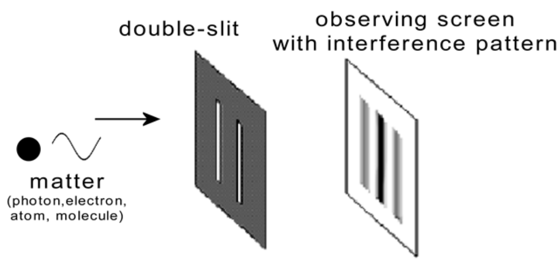

FIG. 5. Double-slit experiment, model, not proportional.

Light reaches the screen at discrete points (that is as a particle), but an interference pattern appears on the observing screen using single photons, that is light waves. See FIG. 5. Each photon seems to interfere with itself. Jönsonn gave a new meaning to the double-slit experiment; in 1961 he performed the double-slit experiment with electrons[32]. Electrons have masses, that is (little) matter with and without mass produces the interference. In 1974 Merli, Missiroli, and Pozzi[33 34] in their experiment used single electrons, showing that each electron interferes with itself. There are also molecules that are able to interfere themselves[35].

How can we explain that light (electron, atom, molecule) interferes with itself? There are more popular and well-known interpretations I cite here three views.

- Everybody knows the Copenhagen Interpretation by Bohr and Heisenberg[36]. According to this, physical systems generally do not have definite properties prior to being measured. "Matter" doesn't have definite position as long as no observation is being made. Matter spreads as wave. This wave goes through both slits at the same time, so it interferes with itself. The interference is made by the matters wave. We don't know the position of the matter, we just know the probability of it. The act of measurement affects the system, causing the set of probabilities to reduce to only one of the possible values immediately after the measurement. This feature is known as wavefunction collapse. In the space-matter model the probabilities of matter waves don't play any role in this case, so this interpretation does not conform with space-matter.
- Wiener, Dirac[37] and Feynman[38] and Wheeler[39] rewrote and improved the Copenhagen Interpretation giving a path-integral formulation that contains the time reversal transformation. The time reversal transformation is meaningless in space-matter model.
- A known explanation is the pilot-wave interpretation known as de Broglie–Bohm theory[40, 41]. The matter passes through just one given slit (not both slits). Matter sends a pilot-wave that passes through both slits at the same time. The interference pattern is caused by the interference of the pilot wave. This model is not far from the space-matter, since here is something else other than matter that the interference causes.

7.2. The mystery of the double-slit experience is solved

In the space-matter model, the interpretation of this phenomenon is the simplest ever: space waves. The waves of space generated by matter interfere with themselves. The matter can be pushed by them. The interference doesn't come into being in matter's wave but in the space waves. Saying this, the double-split experiment shows that mass and photon generates space waves—that is, photon has its own time.

8. SPEED AND ACTION OF MATTER IN SPACE-MATTER

8.1. Light speed and maximum action

In the space-matter model, the *c* speed of a light particle (photon) is the limit for carrying *h* action. If $\lambda_{fw} = \lambda_{photon}$, then the wave of a (non-mass) particle carries the biggest action when the particle travels with the speed of light. See Eq. (24).

$$E_{fw} = f_{fw} \times h \times \frac{c}{v_{fw}}, \tag{24}$$

If $v_{fw} = c$, then we arrive back at the original Planck-formula. In the space-matter model, the capstone is the fundamental physical constant[42] $h \times c$, instead of *c*.

8.2. Fast light and its action

The speed of light exists as a speed limit in the space-matter model, too. This applies to subatomic particles described in the Standard Model[43] and bigger objects built from them. In the space-matter model, the action of an object is connected with its velocity[44].

$$h_{fw} = h \times \frac{c}{v_{fw}}, \tag{25}$$

Fast waves ($v_{fw} > c$) occur, if $h_{fw} < h$.

Fast light travels on light beam. It uses as space another light. A different space occurs a different working of the travelling light. According to the 'fast light and slow light' experiments[45] at the University of Rochester (USA), light is fast light, when its speed v_{fl} is greater than c, $(v_{fl} / c) > 1$. In my opinion, fast light is a kind of fast wave, so Eq. (25) defines the action of fast light. $h_{fl} < h$. Eq. (6) shows the energy of fast light. Saying this,

$$f_{fl} \times h_{fl} < f_{fl} \times h, \tag{26}$$

where f_{fl} is the frequency of fast light. But we know from the experiment that the energy of fast light is

$$E_{fl} = f_{fl} \times h. \tag{27}$$

Eq. (27) shows the measured value of E_{fl}. How is it possible? Eq. (8) covers a relationship, a context, which is shown in Eq. (9).

$$E_{fw} = (f_{fw} \times (h \times \frac{c}{v_{fw}})) \times (\kappa \times \frac{v_{fw}}{c}), \tag{28}$$

where $\kappa > 0$, it is a factor that depends on the type of fast wave. In the case of fast light

$$\kappa = 1. \tag{29}$$

that is,

$$E_{fl} = (f_{fl} \times (h \times \frac{c}{v_{fl}})) \times (1 \times \frac{v_{fl}}{c}) = f_{fl} \times h, \tag{30}$$

Eq. (27) remains true, because the energy of fast light Eq. (24) gets additional energy displayed in Eq. (30). The additional energy of fast light is a *special kinetic energy* caused by v_{fl}, where $(v_{fl}/c) > 1$ in the case of fast light[A].

This kind of kinetic energy isn't a snap phenomenon in the space-matter model. It exists, because every non-space phenomenon changes the space waves. Changing space waves means changes of energy of non-space objects.

Fast light is one type of fast wave. We speak about fast light, if $h \geq h_{rest} \geq h_{light0}$, where h_{light0} is the minimum "inborn rest action" that light needs to have to be able to exist as light (photon), and h_{rest} is the actual value of its rest action.

8.3. Light speed and maximum 'rest action'

Now we can correct the definition written in Chapter 8.1. In the space-matter model, the *c* speed is the highest speed for carrying the biggest h_{rest},, where h_{rest}, is the *rest action* of light. See Eq. (31).

$$h = h_{rest} + h_v, \tag{31}$$

where h_{rest} is the action of the light and/or fast light, h_v is the action that depends on the v_{fl} velocity of fast light. If $v_{fl} = c$, then we suppose that $h_v = 0$ and $h = h_{rest}$.

In the case of non-photon fast waves:

$$h \times \frac{c}{v_{fw}} = h_{fw\,rest}, \tag{32}$$

$$h_{fw} = h_{fw\,rest} + h_{fw\,v}, \tag{33}$$

[A] This kind of mathematical method may be strange in physics, but it is a well-established method in economics.

where $h_{fw\,rest}$ is the (inborn) rest action of fast wave and $h_{fw\,rest} < h_{light0}$. The velocity of fast wave causes $h_{fw\,v}$.

9. THE SPOOKY ACTION IN SPACE-MATTER

9.1. The mystery of the nonlocal correlation in quantum entanglement

The spooky action at a distance is the nick name of the non-local correlation in quantum entanglement given by Einstein, Podolsky and Rosen[46].

Quantum entanglement is a physical phenomenon that occurs when two particles interact in such ways that the quantum state of each particle cannot be described independently. The most known example is the change of spins of photons.

Two independent measurements prove that $v_{nlcqe} > 10{,}000 \times c$, where v_{nlcqe} is the speed of non-local correlation in quantum entanglement[47, 48]. How do we explain this in the space-time model? The only solution could be an Einstein–Rosen bridge, a wormhole. But there are more open questions here: Do wormholes exist always and everywhere? How are photons able to open wormholes?

9.2. The mystery of the spooky action is solved

We know two measurements of the velocity of non-local correlation in quantum entanglement. They show many different velocities. The E_{nlqe} energy value of the nonlocal correlation must be ($h/2\pi$). Why does the non-local correlation have many different velocities? The fast wave (as non-local correlation) seems to use the special kinetic energy described in Eq. (33). If $E_{nlqe} = f_{nlqe} \times h_{nlqe1}$, then the special kinetic energy must exist in every case, where $h_{nlqe\,1} > h_{nlqe} \geq h_{nlqe\,0}$, and $h_{nlqe\,0}$ is the smallest rest action that an existing non-local correlation must have and h_{nlqe} is the actual value of rest action. (We know many values of velocities measured by both experiments, so we would be able to calculate a rough interval of existing rest actions h_{nlqe}.)

In this study we don't know the value of h_{nlqe}; let's suppose: $h_{nlqe\,1} = h_{nlqe}$. The non-local correlation in quantum entanglement has the mission to change the spin of photon, which needs $h/2\pi$ value energy. We know the velocity: $v_{nlcqe} > 10{,}000 \times c$, so h_{nlqe} is given by Eq. (25). We can calculate the frequency using Eq. (24): $f_{nlcqe} > 1{,}591 \ \ (1/\text{sec})$.

Note that this fast wave made out of matter represents a new, unknown fundamental force that travels on the space waves generated by light. See FIG.4.

10. NEW FUNDAMENTAL FORCE

The non-photon fast waves don't represent any known fundamental forces. They aren't known fundamental interactions (no electromagnetic, no strong nuclear, no weak nuclear, no gravitational force.) They represent a new kind of fundamental force we cannot find in our physics books. They come up in the space-matter model. The space-matter model is useful in many cases, for example, it describes the nonlocal correlation in quantum entanglement very simply. There are two ways to describe it: with fast waves (that is, with particles) or with space waves (that is, without particles). Here I show the fast wave model, because it works in both cases, with the "old" and with the "new" definition of time.

Now let's see it as fast waves, where the action of non-local correlation in quantum entanglement is smaller than the action of light. $h_{nlqc} < h_{light0}$. Understanding the logic of the above mentioned, you will also understand how tunneling can be described as fast wave.

11. TUNNELING IN SPACE-MATTER

11.1. The mystery of tunneling

Quantum tunneling refers to the quantum mechanical phenomenon where a particle (with or without mass) tunnels through a barrier that it classically could not surmount.
First Nimtz, Enders and Spieker[49] measured the faster than light (superluminal) tunneling velocity with microwaves in 1992. The puzzle is that the jump of the particle over the barrier has no time (it spends zero time inside the barrier) and the particle is undetectable in this condition. Where is the particle? The tunneling does take time, so this time can be measured. See FIG. 6.

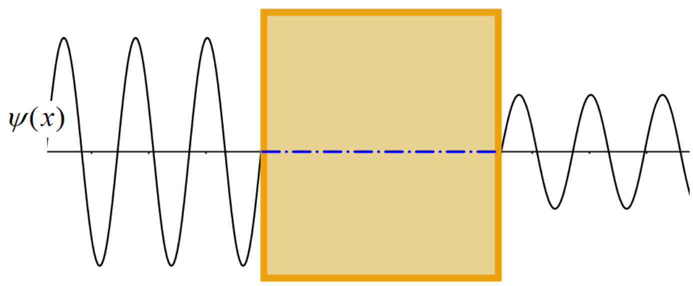

FIG. 6. The wave function of tunneling particle outside the barrier $\psi(x)$. The particle cannot spend time inside the barrier, because the wave function has no missing part (and no missing time). The tunneling method of the particle marked with a blue, interrupted line is unknown and immeasurable. If the wave doesn't spend time inside the barrier, what is the tunneling time? Nimtz supposes that the measured barrier traversal time is spent at the front boundary of the barrier.

The second riddle in tunneling: experiments show[50] that the tunneling particles are faster than light, and these facts are not compatible with the theory of relativity[51]. The growing velocity of the particle with a rest mass (for example electron) causes growing mass, and if v→c, then m→∞. Since the mass (of electron) won't be ∞, and the tunneling is fact, we have to suppose that v=c never occurs. There is a discrete jump in the velocities, and after v<c occurs v>c. How is it possible?

Nimzt[52] measured that the tunneling time τ approximately equals the oscillation time T,

$$\tau \approx T = \frac{1}{f_{tun\ part}}, \tag{34}$$

where $f_{tun\ part}$ is the frequency of tunneling particle. (The tunneling time equals approximately the reciprocal frequency of the wave of particle.) Eq. (35) shows how the barrier traversal time is connected with energy

$$\tau \approx \frac{h}{E_{tun\ part}}, \tag{35}$$

where $E_{tun\ part}$ is the energy of the tunneling particle. That is, the bigger the energy of the particle, the higher its velocity, the shorter its tunneling time. (34) and (35) give us the solution in space-matter.

11.2. The mystery of tunneling is solved

If L is the length of the barrier, then the velocity of the tunneling particle can be given as

$$v_{tun\ part} = f_{tun\ part} \times \lambda_{tun\ part} = \frac{L}{\tau} \tag{36}$$

$$\frac{1}{T} \times \lambda_{tun\ part} = \frac{1}{\tau} \times L \tag{37}$$

$$\lambda_{tun\ part} \approx L \tag{38}$$

Eg. (38) shows that the wavelength of the tunneling particle $\lambda_{tun\ part}$ is as long as the length of the barrier. It means, the tunneling particle has one wave inside the barrier.

In FIG. 7. I completed FIG. 4. with Eg. (38).

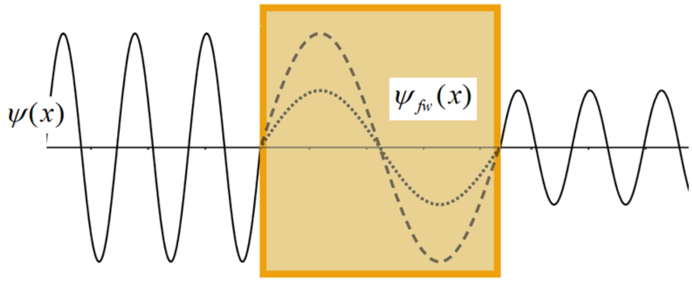

FIG. 7. The function inside the barrier is a fast wave $\psi_{fw}(x)$. We know the frequency of the fast wave, but don't know its amplitude.

The tunneling can be explained with the Lajtner-submarine in FIG.4. The space of fast wave $\psi_{fw}(x)$ is different from the Space, since its space is inside the barrier. From our viewpoint the barrier is matter. $\psi_{fw}(x)$ uses the matter as space, $\text{Space}_{act} = \text{Space}_m$. Space_m has very long "space wavelengths" $\lambda_{mass} >> \lambda_{Space}$. This is correct, since matter's wavelengths must be much longer than the wavelengths of Space. λ_{mass} is a very special data; in this case, this is the wavelength of Space_m, that is, the barrier made out of matter acts as space this way. On the other hand, the $\psi_{fw}(x)$ is a "normal" wave, which means, there are no half (or part) waves inside the barrier. Using Eq. (5) we can calculate the $h_{\Psi_{fw}}$. $\psi_{fw}(x)$ is a fast wave that acts like fast light does, so the above mentioned equations of fast light can be applied here. Since $\psi_{fw}(x)$ is a fast wave which is a new fundamental force, it isn't measurable (or not the same way we measure $\psi(x)$). The fast wave has a small "rest" $h_{\text{fast wave}}$ value. The "rest mass" of the barrier is much bigger than the "rest energy" of the fast wave, therefore time is able to come into being. Remember FIG.3. The barrier is able to appear as space and time for the tunneling particle. The tunneling particle shows that if two objects with different scales of rest energy meet, time comes into being. Time is always between space and matter, so in this case the barrier is space. See FIG.4.

Note there is no difference between $\psi(x)$ and $\psi_{fw}(x)$ from the viewpoints of the given particle, since its frequency level and (whole) energy remained unchanged.

$$f_{\Psi} / f_{space} = f_{\Psi_{fw}} / f_{space_m} . \tag{39}$$

$\psi(x)$ and $\psi_{fw}(x)$ are one and the same wave using different spaces, cp. Eq. (18). $\psi(x)$ uses $\text{Space}_{act} = \text{Space}$, and $\psi_{fw}(x)$ uses $\text{Space}_{act} = \text{Space}_m$.

12. CHANGING WAVELENGTHS OF SPACE WAVES AS A NEW FUNDAMENTAL INTERACTION

In the space-matter model the fast waves and $\psi_{fw}(x)$ are matter particles. Matter particles are in harmony with the philosophy of the Standard Model of Physics, where every physical progress is derived from matter particles.

In Einstein's modified space-time, gravity is expressed as the modification of space-time.

In space-matter there is a new possibility to connect these two different views. The above-mentioned fast waves and $\psi_{fw}(x)$ can be also given as the modification of wavelengths of space waves.

This is more then just a different viewpoint. Using the modified wavelength of space waves we can discover new contents and new connections. Let's see the quantum entanglement this way! Here we can describe a permanent (non-stop) connection between the two photons. In this case the whole system consists of two photons *and* space waves, where the modified wavelength of the space wave conveys the energy that the change of spin needs.

There is no model that can describe the quantum entanglement without space waves, since the fast wave needs its space to travel on. This space of fast wave exists between the two photons as modified space waves generated by these photons. Saying this, a quantum system can be satisfactorily described only with both phenomena: with matter particle and its space waves.

There is another example: we can build the best model that describes the working method of thought force, if we use the changing wavelengths of space waves[53]. Without the space-matter theory we cannot describe many options of thought force at all.

13. GRAVITY IN SPACE-MATTER

The space-matter model allows us to discern new features of gravity. The main part of the gravity in space-matter model is the existence of gravitational waves. LIGO detected gravitational waves, they exist. According to space-matter theory gravity is the difference of the wavelengths of space waves. The velocity of gravity is irrelevant from this viewpoint. The following model works in both cases: if $v_{gravity} = c$ or $v_{gravity} >> c$.

13.1. Speed of gravity is disputable

The velocity of gravity does not change the working method of gravity in the space-matter model. This is not true in the space-time model. In the space-time model, no particles (whether actual or hypothetical) can move faster than light cp. Standard Model of Physics. According to this concept even (a wave of) gravity, which travels in the fabric of space, has c velocity.

$$v_{gravity} = c \tag{40}$$

In 1974 Hulse and Taylor[54, 55] proposed measuring the gravitational wave to find Eq. (40). They were awarded the Nobel Prize with this measuring[56], but the question remained open. In 2013 scientists in China were supposed to measure the same value[57]. The question is still open, since the measurements was made by light, so the scientists may have measured the speed of light. There are physicists who state gravity must be much faster than light. For example Flandern states: $\mathrm{v}_{\mathrm{gravity}} \geq 2 \times 10^{10}\mathrm{c}$. This value is based on laboratory, solar system, and astrophysical experiments[58].

The first measurement of gravitational waves were made by LIGO. Space waves. Fact.

What about the velocity of gravity (space waves)? The physicists of LIGO work within the space-time model, so they accept Eq. (40) as fact. Based upon it, LIGO's scientists are supposed to have measured the gravitational waves of two black holes that collided. Their theory is known: the event took place 1.3 billion years ago. But there is a fact: the Fermi space telescope detected a burst of gamma rays 0.4 seconds later after the measurement of LIGO. In my opinion, LIGO did not measure the gravitational effect of two black holes that merged, but gravity's effect caused by the electromagnetic energy[59, 60]. Physicists at LIGO certainly refuse this interpretation[61].

From the perspective of the space-matter model, what LIGO's measurement precisely demonstrates is that everything, even light (electromagnetic energy), alters space (and time) waves. What is more, everything has time. This is exactly what the space-matter model propounds.

13.2. Gravity in space-matter

The gravity is when space pushes masses:

$$\sum \vec{F}_{space} \neq 0, \tag{41}$$

where $\vec{F}_{space}$ are vectors of the force (action) of space waves from the viewpoint of mass. Mass moves the direction of the resultant vector (except in special cases not detailed here).

Among bodies experiencing gravity, the frequency of space waves decreases. That is, the space "pressure" between the bodies decreases. Gravity arises, because the portions of space with higher force (action) shift the masses. If on one side of a mass the space wave has f_{s1} frequency, and on the opposite side of this mass the space wave has f_{s2} frequency and $f_{s1} < f_{s2}$, then the mass goes into the direction of f_{s1}. The greater f_{s2} frequency - the greater force (action) of space - moves the mass forward, see FIG.8.

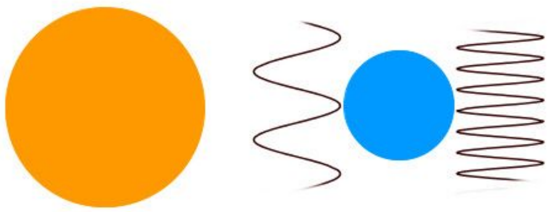

FIG. 8. Space wave model of gravity (model, not proportional). Big (yellow) and small (blue) masses and space waves. Gravity is when space waves push. Or, even more clearly, though less scientifically, "You'll get such a slap, you'll go flying!" If the blue planet gets four slaps from the right and one from the left, it will move left.

14. INFLATING UNIVERSE IN SPACE-MATTER

Gravity is the sum of different forces of space waves. The moving mass changes the wavelengths of space waves.

$$\frac{d}{dt}v = l\frac{d}{dt}\lambda , \quad (42)$$

where l is a proportionality factor.

The longer wavelengths of space waves cause a higher acceleration of mass. The accelerating mass makes the wavelength of the space wave longer, and the longer space waves accelerate the mass. This is why the gravity is an accelerating force.

The acceleration itself of the Universe is able to inflate the Universe, since the wavelengths of the space wave are constantly growing.

15. ACCELERATING UNIVERSE IN SPACE-MATTER

15.1. The mystery of accelerating Universe

Lemaitre[62] and Hubble[63] gave the first theoretical and observational evidences for the expansion of the Universe. The Hubble Law shows that the recessional speed of an object (galaxy) depends on the distance between Earth and the object (galaxy). The Hubble constant has been researched since 1927. The measurements are more and more precise; the show is on to refine its value.

Perlmutter, Riess and Schmidt[64, 65] found observational evidence for an accelerating Universe in 1998. The Universe expands at an increasing rate, that is, the velocity at which a distant galaxy is receding from the observer is continuously increasing with time.

Using the new definition of gravity described above, we can give a working explanation, where gravity itself causes as the accelerating Universe. Gravity makes the wavelength of space waves longer. In space-matter theory the space waves give the time waves. The unit spatial distance and the time unit are connected, they change together. See the above-mentioned.

15.2. The mystery of accelerating Universe is solved

How? The explanation is very simple using the space-matter model. (42) remains true in every case, every mass (matter) accelerates the same way and the same rate, since (18) also remains true.

$$a_{grav} = const \quad . \tag{43}$$

where a_{grav} is the gravitational acceleration we know. But the a_{grav} is connected with mass. From the viewpoint of space waves, there are different space waves and time waves. The galaxies of our Universe have different ages. The different ages of galaxies create an accelerating Universe. Why? The galaxies have been moving. The differences of age mean differences of time period of their moving. The velocity of a galaxy will continuously grow. The sooner started the moving, the faster is the today's moving. That causes a growing acceleration. If

$$v_{mass1} > v_{mass2} \ , \tag{44}$$

then

$$\lambda_{space\ wave\ by\ mass1} > \lambda_{space\ wave\ by\ mass2} \ , \tag{45}$$

$$\lambda_{time\ wave\ by\ mass1} > \lambda_{stime\ wave\ by\ mass2} \ , \tag{46}$$

According to space as an observer, the wavelengths of space waves around $mass_1$ are longer then around $mass_2$. The time unit of $mass_1$ is longer then the time unit of $mass_2$, that is, the time of $mass_1$ is slower. If we measure $mass_1$ with our time units and our spatial distances (as $mass_2$), we get the result: the acceleration of $mass_1$ accelerates from our point of view.

$$\frac{d}{dt}a_{mass1} > \frac{d}{dt}a_{mass2} \ , \tag{47}$$

Saying this, gravity accelerates the Universe.

This model has two advantages. First, the mass and the gravity can explain (a good part of) the accelerating Universe. Second, there are space waves in this model. Space waves have energy. This energy of space waves are not known. At the very moment the farthest galaxy from us whose observation has been published[66] is the GN-z11. Its distance from us is 13.39×10^9 light years. The age of our Universe is supposed to be 13.82×10^9 years[67]. I do think, just a couple of years and we will find galaxies that are farthest from us than 13.82×10^9 light years. In this case, we have to rethink the reason of cosmic microwave background, and its connection with the space waves.

References

[1] Einstein A. (1905) Zur Elektrodynamik bewegter Körper. Annalen der Physik 17, 891-921.

[2] Einstein A. (1907) Relativitätsprinzip und die aus demselben gezogenen Folgerungen- Jahrbuch der Radioaktivitaet, 4, 411-462.

[3] Einstein A. (1907) Die vom Relativätsprinzip geforderte Trägheit der Energie Annalen der Physik 23. 371-384.

[4] Einstein A. (1914) Formale Grundlage der allgemeinen Relativitätstheorie. Preussische Akademie der Wissenschaften, Sitzungsberichte, 1030-1085.

[5] Einstein A. (1915) Zur allgemeinen Relativitätstheorie. Preussische Akademie der Wissenschaften, Sitzungsberichte, 778-786, 799-801.

[6] Einstein A. (1915) Feldgleichungen der Gravitation. Preussische Akademie der Wissenschaften, Sitzungsberichte, 844-877.

[7] Einstein A. (1916) Grundlage der allgemeinen Relativitätstheorie. Annalen der Physik. 49, 769-822.

[8] Newton I. (1687) *Philosophiae Naturalis Principia Mathematica.*

[9] Nishimura J, Tsuchiya A, Kim S-W (2012) Expanding (3+1)-Dimensional Universe from a Lorentzian Matrix Model for Superstring Theory in (9+1) Dimensions. PhysRevLett.108.011601

[10] SI Brochure, The International System of Units (SI) http://www.bipm.org/en/publications/si-brochure/second.html (2014).

[11] SI Brochure, The International System of Units (SI) http://www.bipm.org/en/publications/si-brochure/metre.html (2014).

[12] Heisenberg W. (1927) Über den anschaulichen Inhalt der quantentheoretischen Kinematik und Mechanik. Zeitschrift für Physik 43 (3) 172-198.

[13] Casimir H B G, Polder D (1948) The Influence of Retardation on the London-van der Waals Forces. Phys. Rev. 73, 360.

[14] Weisberg J M, Taylor J H, Fowler L-A, (1981) Gravitational waves from an orbiting pulsar Scientific American 245: 74-82.

[15] https://www.ligo.caltech.edu/system/media_files/binaries/302/original/detection-press-release.pdf (2016).

[16] Lajtner T. (2015) Ez minden? http://mek.oszk.hu/13600/13685/

[17] Lorentz H A (1899) Simplified Theory of Electrical and Optical Phenomena in Moving

SystemsProceedings of the Royal Netherlands Academy of Arts and Sciences 1: 427-442. (1899)

[18] Lorentz H A (1904) , Electromagnetic Phenomena in a System Moving with any Velocity Smaller than that of Light Proceedings of the Royal Netherlands Academy of Arts and Sciences 6: 809-831.

[19] Lajtner T (2014) What is time? http://philica.com/display_article.php?article_id=444 (2014).

[20] Kozyrev N A (1967) Possibility of experimental study of properties of time http://www.univer.omsk.su/omsk/Sci/Kozyrev/paper1a.txt

[21] Kozyrev N A (1991) Selected Works (Leningrad State University).

[22] Chubykalo A, Espinoza A (2014) The Mathematical Justification of a Possible Wave Nature of the Time Flow of Kozyrev International Journal of Physics and Astronomy, Vol. 2. 9-20.

[23] Planck length http://physics.nist.gov/cgi-bin/cuu/Value?plkl|search_for=planck+lenth

[24] Planck time http://physics.nist.gov/cgi-bin/cuu/Value?plkt|search_for=Planck+time

[25] Planck M (1901) Über das Gesetz der Energieverteilung im Normalspectrum. Annalen der Physik 4: 553-563.

[26] http://physics.nist.gov/cgi-bin/cuu/Convert?exp=0&num=1&From=kg&To=ev&Action=Convert+value+and+show+factor

[27] Morris S M, Thorne K S, Yurtsever U, (1988) Wormholes, Time Machines, and the Weak Energy Condition Phys Rev Letters 61 (13). 1446-1449.

[28] Einstein A and Rosen N (1935) The particle problem in the general theory of relativity. Phys. Rev. 48, 73-77.

[29] Krasznahorkay A J, Csatlós M, Csige L, Gácsi Z, Gulyás J, Hunyadi M, Kuti I, Nyakó B M, Stuhl L, Timár J, Tornyi T G, Vajta Zs, Ketel T J, Krasznahorkay A. (2016) Observation of Anomalous Internal Pair Creation in 8Be: A Possible Indication of a Light, Neutral Boson Phys. Rev. Lett. 116, 042501 (2016)

[30] Feng J L, Fornal B, Galon I, Gardner S, Smolinsky J, at al. (2016) Protophobic Fifth Force Interpretation of the Observed Anomaly in 8Be Nuclear Transitions http://arxiv.org/abs/1604.07411

[31] Editor's Review (2008) https://www.aps.org/publications/apsnews/200805/physicshistory.cfm.

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[32] Jönsson C (1974) Electron Diffraction at Multiple Slits Am. J. Phys. 42, 4 .

[33] Merli P G,. Missiroli G F, Pozzi G (1976) On the statistical aspect of electron interference phenomena Am. J. Phys. 44: 306. (1976).

[34] Rosa R (2012). The Merli–Missiroli–Pozzi Two-Slit Electron-Interference Experiment Physics in Perspective 14: 178-195.

[35] Nairz O, Arndt M, Zeilinger A (2003) Quantum interference experiments with large molecules Am. J. Phys 71: 319–325. (2003).

[36] Heisenberg, W. (1927). Über den anschaulichen Inhalt der quantentheoretischen Kinematik und Mechanik, *Z. Phys.* 43: 172–198. Translation as 'The actual content of quantum theoretical kinematics and mechanics' here

[37] Dirac P A M (1933). "The Lagrangian in Quantum Mechanics". Physikalische Zeitschrift der Sowjetunion. 3: 64–72.

[38] Wheeler J A,. Feynman R P (1949) Classical Electrodynamics in Terms of Direct Interparticle Action, Rev. Mod. Phys. 21, 425-433

[39] Wheeler J A, Feynman R P (1945). Interaction with the absorber as the mechanism of radiation, Rev. Mod. Phys. 17, 157-181 http://authors.library.caltech.edu/11095/1/WHErmp45.pdf

[40] Broglie L de (1926) Ondes et mouvements. Paris: Gauthier-Villars,.

[41] Bohm D (1952). A Suggested Interpretation of the Quantum Theory in Terms of 'Hidden Variables' I. Physical Review. 85 (2): 166–179.

[42] CODATA, Value Planck constant over 2 pi times c in MeV fm, Physics.nist.gov (2013).

[43] Nagy S, http://nagysandor.eu/nuklearis/NEMO_sm.htm (2004).

[44] Lajtner T, http://philica.com/display_article.php?article_id=484 (2015).

[45] Gauthier D J. and Boyd R W (2007). http://www.photonics.com/Article.aspx?AID=27833.

[46] Einstein A, Podolsky B, Rosen N, (1935) Can quantum-mechanical description of physical reality be considered complete? Phys. Rev. 47, 777

[47] Salart D, Baas A, Branciard C, Gisin N and Zbinde H (2008) Testing spooky action at a distance. http://arxiv.org/pdf/0808.3316.pdf.

[48] Yin J, Cao Y, Yong H, Ren J, Liang H, Liao S, Zhou F, Liu C, Wu Y, Pan G, Zhang Q, Peng C and Pan J (2013) Bounding the speed of `spooky action at a distance'. http://arxiv.org/pdf/1303.0614.pdf .

[49] Nimtz G, Enders A and Spieker H (1994) Photonic tunneling times. J. Phys. I France 4 565-570 http://jp1.journaldephysique.org/articles/jp1/abs/1994/04/jp1v4p565/jp1v4p565.html

[50] Nimtz G. (2010) Tunneling Violates Special Relativity http://arxiv.org/pdf/1003.3944v1.pdf

[51] Gerlitz T G M, (2015) Superluminality and finite potential light-barrier crossing. Int. Jour. of Res. in Pure and App. Phys. 5(2): 19-24. http://urpjournals.com/tocjnls/45_15v5i2_1.pdf

[52] Nimtz G (2013) Tunneling: From Milliseconds to Attoseconds http://arxiv.org/pdf/0903.2582v1.pdf

[53] Lajtner T (2016). Thought force is a new fundamental interaction Physics Essays 29 (2): pp. 239-247.

[54] Hulse R A, Taylor J H (1974) A high-sensitivity pulsar survey The Astrophy J 191. L59-L61 .

[55] Hulse R A, Taylor J H (1975), The Astrophy J 195. L51-l53.

[56] http://www.nobelprize.org/nobel_prizes/physics/laureates/1993/press.html (1993).

[57] Tang K Y, Hua C C, Wen W, Chi SL, You QY, and Yu D, (2013) Observational evidences for the speed of the gravity based on the Earth tide Chinese Sci. Bull. 58. 4. 474-477.

[58] Flandern von T (1998) The speed of gravity - What the experiments say Phys. Letters A 250, 1-11.

[59] Loeb A (2016) http://phys.org/news/2016-02-ligo-twin-black-holes-born.html

[60] Gough E (2016) http://www.universetoday.com/127463/did-a-gamma-ray-burst-accompany-ligos-gravitational-wave-detection/

[61] Loeb A (2016) http://arxiv.org/abs/1602.04735

[62] Lemaitre G (1927) Un univers homogè ne de masse constante et de rayon croissant, rendant compt e de la vitesse radiale des nébuleuses extra-galactiques. Ann. Soc. Sci. de Bruxelles A47, 49-59.

[63] Hubble E (1929) A Relation between Distance and Radial Velocity among Extra-Galactic Nebulae. Proc. National Acad. Sci. 15, Issue 3 168-173.

[64] Perlmutter S, Aldering S, Goldhaber G, Knop G, Nugent R A, et al. (1998) Measurements of Omega and Lambda from 42 High-Redshift Supernovae http://arxiv.org/abs/astro-ph/9812133. (1998)

[65] Riess A G, Filippenko A V, Challis P, Clocchiattia A, Diercks A, et al. (1998) Observational Evidence from Supernovae for an Accelerating Universe and a Cosmological Constant http://arxiv.org/abs/astro-ph/9805201. (1998).

[66] Oesch, P. at al. (2016). "A Remarkably Luminous Galaxy at z = 11.1 Measured with Hubble Space Telescope Grism Spectroscopy". The Astrophy J 819 (2): 129.

[67] http://www.esa.int/For_Media/Press_Releases/Planck_reveals_an_almost_perfect_Universe (2013)