Superluminal velocity explained

Dr. Tamas Lajtner

Abstract Superluminal velocities do exist in tunneling. In theories don't. Why? Because physicists think the speed of light in spacetime is the absolute speed limit. The superluminal velocity cannot be explained within the spacetime model. How to explain the superluminal velocity during tunneling? Supposing more spaces and more times. The superluminal, tunneling particle travels in barrier. The barrier is an object from our viewpoint. But the particle uses this barrier as space. Studying the tunneling, there are many spaces. Every space has its own time unit and unit space distance. The law of speed limit remains true in every space. The speed of light is the speed limit in every space, but from our viewpoint the same particle travels at different velocities in different spaces.
It can be summarized in one sentence: A step in the country of giants is longer than in the country of dwarves.
The paper is an excerpt out of the book entitled "19 false axioms of physics".

Keywords: superluminal, tunneling

19. TUNNELING: SPACE MADE OF MATTER

19.1. Tunneling

Quantum tunneling refers to the quantum mechanical phenomenon where a particle (with or without mass) tunnels through a barrier that it normally could not surmount.

In experiments many particles are sent to the barrier, and only a part of them gets through the barrier. They are the tunneling particles.

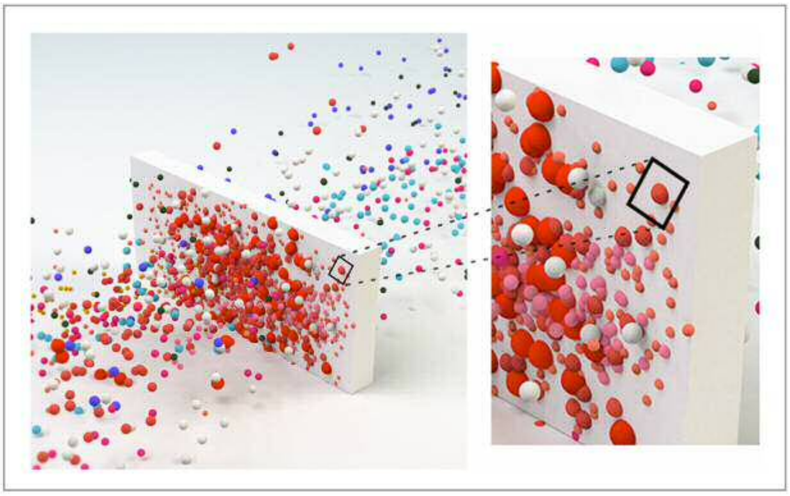

FIG. 19-1 Tunneling.
(Credit: Artistic representation CC0 Christophe Lebedinsky, toutestquantique.fr, Edited)

Fig. 19–1 shows clearly that in tunneling only the group velocity is important, physicists do not observe single particles i.e. phase waves. But if we examine the tunneling effect as the behavior of *a given* particle, we can analyze *this* single particle i.e. *its* velocity. Analysing the tunneling of one single particle we can draw conclusions on matter-space and the metamorphoses of this particle. In the forthcoming parts of this study I analyze the behavior of a "single" tunneling particle e.g. which is framed with black. Particles travel at superluminal velocities during the tunneling, therefore these particles will be called fast waves in the forthcoming parts of this study. (The above mentioned fast light is not a fast wave, because it remains measurable. Fast wave is immeasurable.)

Nimtz[48], Enders and Spieker first measured superluminal tunneling velocity with microwaves in 1992. According to their statements, 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. Tunneling, however, does take time, which can be measured.

According to Nimzt, the particle cannot spend any time inside the barrier[49], because the wave function has no missing part (and no missing time). The tunneling method of the particle is unknown and immeasurable. If the wave does not spend time inside the barrier, what is the tunneling time? Nimtz supposes that the measured barrier traversal time is the time spent at the front boundary of the barrier.

There comes the second riddle in tunneling. Experiments show[50] that tunneling particles are faster than light, and these facts are *not* compatible with the Theory of Relativity. According to Theory of Relativity the growing velocity of particles with a mass (for example an electron) causes growing mass, and if $v \to c$, then mass $m \to \infty$. Since the mass m (of the electron) is never ∞, and the tunneling is fact, we have to suppose that $v=c$ never occurs. There is a discrete jump at velocities, and $v<c$ becomes $v>c$ without $v=c$. The velocity $v>c$ is immeasurable as yet.

19.2. Tunneling particles—fast waves

In tunneling, the light meets a barrier that acts as a matter-space. The light “decides” whether it can enter this space. I suppose it depends on the unit action, wavelength and frequency of the matter-space. If it can enter this barrier as matter-space, it has to adapt itself to the new space. It will probably change its spin as well. Different space and different time force a metamorphosis of the $object_1$. $Object_1$ will appear in a form that is not written in our books. I think in tunneling objects are fast waves and even the electron (fermion!) is massless here. As mentioned above, the massless condition can be created, because the electron leaves the Space and enters into matter-space. The axiom of matter is only matter is over. (No. 8)

Let us see the electron during tunneling. We assume the tunneling shows that $v_{tunneling\text{-}object}>c$. It is a fact measured. The electron has mass.

The tunneling electrons seem to violate the special theory of relativity[51]. They do not violate it if we suppose electrons have different forms in different spaces, and the barrier acts as matter-space. In matter-space the tunneling electron becomes fast wave[52]. The metamorphoses from particle into fast wave and back do not mean that the electron changes identity. The essence of the electron always remains the same, only the form of the electron changes. Particle, fast wave, particle. Let us see the two metamorphoses of an electron during tunneling[53].

Tunneling presented from the viewpoint of the form of the electron (or other tunneling particle):

- Before the barrier: electron—particle or wave.
  - Metamorphosis 1.
- In the barrier: unknown object (fast wave).
  - Metamorphosis 2.
- After the barrier: electron—particle or wave.

It means that the unknown, faster-than-light-object is the same electron we know, but it *does* have a new form we do not know. The given form of an electron always depends on the space in which it travels.

So there is a 'fast wave–wave–particle triality' instead of the 'wave–particle duality'. Note fast wave is a form of particle made of matter.

19.3. Changed spins?

During tunneling the spin of the electron probably changes as well. This change needs time. Therefore tunneling time is longer than pure travelling time in barrier. The changing spin and the new kind of space may be able to explain the metamorphosis of the particle and its tunneling time. The available data fail to establish anything certain.

The tunneling shows that also photons with no mass make metamorphoses, since their measured tunneling speed is superluminal and not c from our viewpoint. That is, generally speaking, the given form of $object_1$ with or without mass depends on the space in which it travels. $Object_1$ has several forms, and its forms depend on the spaces where it travels. Its actual form seems to have its own range of velocity. In tunneling it appears as fast wave and from our viewpoint it has superluminal velocities. Axiom of every elementary particle has only its known form is out of order. (No. 9)

19.4. How does tunneling work?

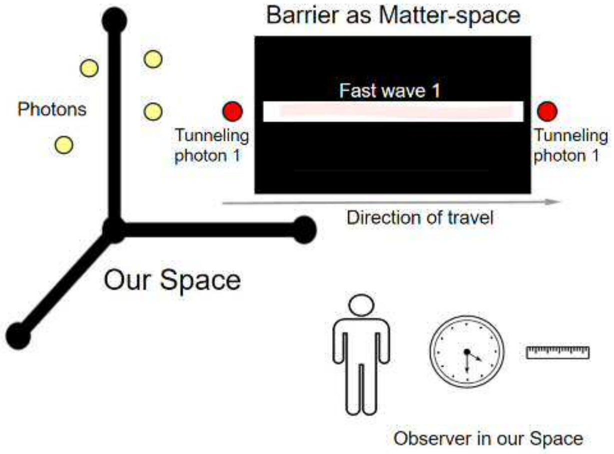

FIG. 19-2 Observer in Space measures the data of tunneling. Model, not proportional. In the experiment the observer knows the length of the barrier, the tunneling time, the frequency and the wavelength of photon before tunneling. See Table 19–1. (Model, not proportional.)

(Credit © T. Lajtner, Lajtner.com from CC BY 4.0 from Space CC BY 4.0 E Bolat, edited; Clock CC BY 4.0 BF Varsino, edited; Ruler CC BY 4.0 S Walter, edited; Black box CC BY 4.0 A Kirma, edited; Man Public Domain CC0 JR Kim, edited. The edited pictures are from Noun Project.)

Topic	Experiment 1	Experiment 2	Experiment 3	Note
ú	4.702	8.552	2.565	$\acute{u} = \frac{v_{fw}}{c}$
f_0	$8.7 \cdot 10^{9}$	$9.97 \cdot 10^{9}$	$8.7 \cdot 10^{9}$	frequency of light before tunneling (1/sec)
λ_0	$3.45 \cdot 10^{-2}$	$3.01 \cdot 10^{-2}$	$3.45 \cdot 10^{-2}$	wavelength of light before tunneling (m)
T	$8.1 \cdot 10^{-11}$	$1.17 \cdot 10^{-10}$	$1.30 \cdot 10^{-10}$	tunneling time (sec)
L	$1.142 \cdot 10^{-1}$	$3.00 \cdot 10^{-1}$	$1.00 \cdot 10^{-1}$	length of the barrier (m)

Table 19-1 The tunneling times and the lengths of barriers in three experiments.

The experiments are made by Nimtz[54, 55, 56]. Here matter particles travel at superluminal velocities: $v_{fw}>c$. This kind of superluminal velocity will be called superluminal_M.
The highest speed was measured in Experiment 2, here the fast wave is 8.552 times faster than a photon.

How does tunneling work? The question can be answered by using the new space and time definitions and knowing how light works. The barrier is a space made up of matter, matter-space where $h_{barrier}>h_{Space}$. Therefore the photon in the barrier functions as fast waves, and it travels inside the barrier at $c_{matter\text{-}space}=c$.

Matter (light) is functioning as fast wave in the barrier and the barrier acts as matter-space. Light holds its frequency product constant, i.e. it remains the same value that was in light's space. Otherwise in matter-space light works the same way as in its "normal" space. In matter-space, like in light's space its frequency level and its coordinate system are constant. Light enters matter-space. This is a very simple step shown by FIG. 17–2 This is one step move in accordance with light, but an adequate model that describes the details is of several steps. Light detects the wave of the barrier and adopts it as the new reference wavelength. Its frequency will be given by the product of frequencies from Eq. (17–3). It develops its f_{fw}. Light holds the frequency level $f_{fw}/f_{space\text{-}i}$ constant in this matter-space in accordance with
Eq. (17–2), i.e..

Travel in space (=spacetime) or travel in matter-space are different conditions even for light itself. See the product of frequencies in Eq. (17–3). The longer or shorter *t* and *s* do not make a difference as long as they are a simple change of wavelength of Space. But in this case the units are changed. Matter-space is a different space with different space action.

19.5. Travelling time in the barrier

We are able to measure only tunneling time, but tunneling time is longer than traveling time in the barrier. As mentioned above, according to Nimzt's statement, the particle does not spend any time inside the barrier. In fact it does, but its actual travelling time inside the barrier is much shorter than tunneling time.

$$t_{tunneling}=t_{Metamorphosis1}+t_{travelling}+t_{Metamorphosis2} \qquad (19\text{-}1)$$

Eq. (19–1) shows that a particle needs time to adapt itself to the new space. This is something like we will see soon in the case of the spooky action. Why do traveling particles need time for metamorphosis? Because they must rescale the structure of their action h. Let us see what it means.

19.6. Slow tunneling?

Ramos and his team[57] constructed an unusual tunneling environment. The tunneling ”particles” were rubidium (Rb) atoms instead of elementary particles. Rb atoms traveled through a 1.3 µm thick optical barrier made of laser beam. (The laser beam has no mass.)

Here Ramos measured a traversal time of 0.627 ms, i. e. $v_{tunneling}=2.07^{-3}$ m/s, i. e. ú<<1.

This result is in fundamental contradiction with the superluminal tunneling velocities measured by Nimtz and many others in the last years.

I think either Ramos came up with a new way of tunneling, or it is not tunneling, just traveling through a transparent optical medium (optical potencial) with a certain index of refraction, or it is a special mix of these.

Saying this, in this experiment the Rb atoms do not use the laser beam as matter-space.

• • •

23. NO GENERAL CAUSALITY WITHOUT SUPERLUMINAL VELOCITY

In tunneling fast wave travels at $v_{fw}>c$ from our viewpoint. v_{fw} is a superluminal velocity measured. It is no theory;, it is a fact. And it is a problem at physics, because according to Special Relativity faster than light velocity destroys the general causality. This view, i.e. nothing is faster than light, is the essence of the theory of relativity. See the draft of Minkowski geometry of Special Relativity in FIG. 23–1. This geometrical explanation will be shown why fast waves do not work—in this theory.

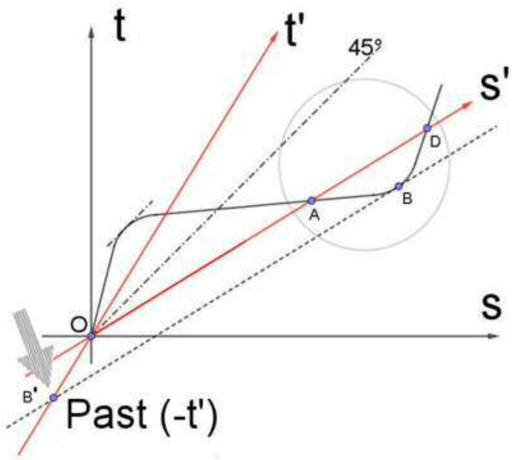

FIG. 23-1 No superluminal velocity either in special or in general relativity.
t and s and t' and s' are expressed in meters. According to Minkowski geometry of Special Relativity superluminal velocity in the st coordinate system is a time travel in the past in the s't' coordinate system. According to s't' events between AB and BD are in the past. Superluminal velocity in one system (e.g. st) is time travel in another system (e.g. s't'). B in st is B' in s't' and B' is in the past in s't'. B' contradicts general causality. Therefore in special (and general) theory of relativity, it is not possible to display an event at superluminal velocity.
(Credit CC BY–NC–SA 4.0 T. Lajtner, Lajtner.com)

According to the above mentioned, we cannot picture the fast wave in FIG 23–2.

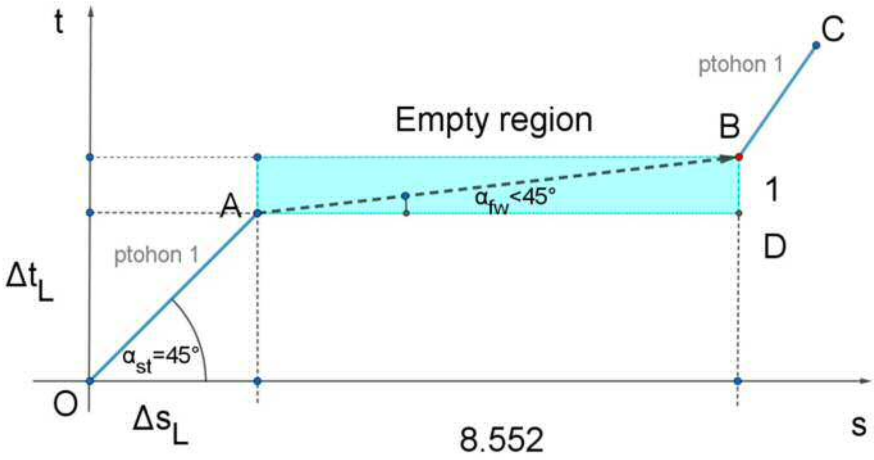

FIG. 23-2 Event OA and event BC are not connected.
Event OA is the path of photon1 before tunneling. Event BC is the path of photon1 after tunneling. The dashed arrow cannot be pictured in the Special Relativity, therefore event BC has no cause in the theories of relativity. The blue (grey in print) area is an empty area in the Special Relativity.

Superluminal velocities are fact, Theory of Relativity is a solid theory. Now fact and theory seem to contradict each other. Are they really in contradiction? Yes and no.

According to the Special Relativity fast wave AB does not exist in st. Saying this, event BC has no reason in st and nowhere else according to this theory. Therefore event BC remains a mystery, since it cannot originate from event OA. But in reality it does.

The main problem is that photon1 creates OA, AB and BC events. Without AB BC could not exist. But photon1 cannot be at point B within the given time period according to the theory of relativity. The theory is incomplete, because photon1 creates BC. Where is the part of Theory of Relativity that describes this? Nowhere.

Why? Because the Theory of Realtivity supposes one time and one space called spacetime. In spacetime there is no superluminal velocity. The theory is acceptable, but the sequel is missing: Where are the particles that travel at superluminal velocity?

23.1. More than one space

Superluminal velocities exists, therefore there are more spaces and more times not only the space and time of spacetime. In these spaces particles travel at superluminal velocity v>c—from our viewpoint. These are not mentioned either in Einstein's theories nor in modern physics at all. But these spaces exist, since tunneling exists.

In modern physics it is supposed that there is only one spacetime. Everything occurs only in this only spacetime. And this is false. In tunneling AB event happens in the barrier i.e. not in spacetime but in a different space, in a matter-space. Matter-space is not the spacetime. Different spaces mean different coordinate systems. In plain English, we need more spaces and times, therefore more coordinate systems to present the superluminal fast wave. The coordinate system of the matter-space is s't'. s't' is different from st.

In FIG. 23–3 there are two different spaces and two different times, pictured in two different coordinate systems.

The initial assumption was that points A and B should be connected by the matter-space marked with light red (light grey). We know about these points that the photon leaves st at the point A and returns to st at point B. The matter-space must connect A and B. We do not see into the matter-space, but we assume that the direction of travel of the fast wave is straight.

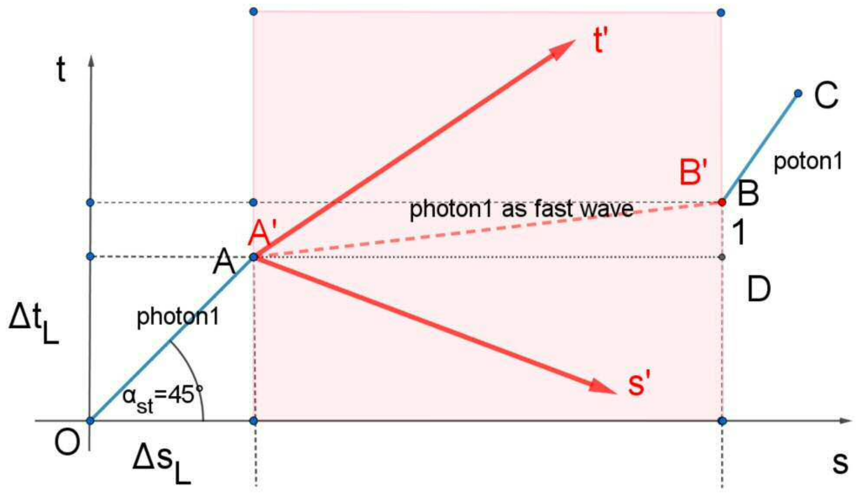

FIG. 23-3 Two different spaces, two different coordinate systems.
t, s and t', s' are expressed in meters. Two-dimensional model.
Using a system like this we can calculate the data of superluminal spaces and fast waves.
(Credit ©. Lajtner, Lajtner.com)

23.2. No general causality without superluminal velocity

Fast waves exist in s't'. Although the event A'B' is not in the frame of reference st, it is the reason of BC. Shall we handle matter-space as spacetime$_M$? Space and time can be connected as spacetime in our calculations, but we have to talk about several spacetimes, although physics has known only one spacetime until now. To avoid the misunderstandings there is a better solution. We can use our old terms like spaces, times and matter adding to them new terms like fast wave, matter-space, etc. Or we can even suppose:

Matter-space+time=spacetime$_M$.

Where spacetime$_M$ is a space made of matter and its time. Matter-space does not exist as space without travelling particles in it. It exists as matter-space as long as the particle travels in it. After and before it is merely matter. So it does not have time without travelling matter in it. Time will be created by travelling particles. Time – as always – is the action-reaction of matter and space (matter-space).

Superluminal$_M$ velocity (and even other superluminal velocity e.g. superluminal$_{EMB}$, see later)) cannot destroy general causality in Space-Matter Theory, since time travel is impossible here, because time is the "cooperation" of space and matter. General causality remains untouched in both in theory and in praxis. As it has actually been measured, superluminal$_{EMB}$ and superluminal$_M$ velocities exist. These velocities do not and cannot violate general causality[61].

What is more the general causality is broken without superluminal velocities and additional spaces and times. Superluminal velocities are the explanations of many unexplained phenomena, e.g. BC has no reason in st. Its reason is in s't'. The axiom that superluminal phenomena destroy general causality is false. (No. 12)

24. RELATIVITY SUPERLUMINAL$_M$

Our Space has the shortest basic units. Every matter-space has longer basic units. Therefore traveling particle in matter-space seems to travel at superluminal velocity from our viewpoint. Seeing FIG. 24–1, we will understand immediately why every matter-space is faster than our Space.

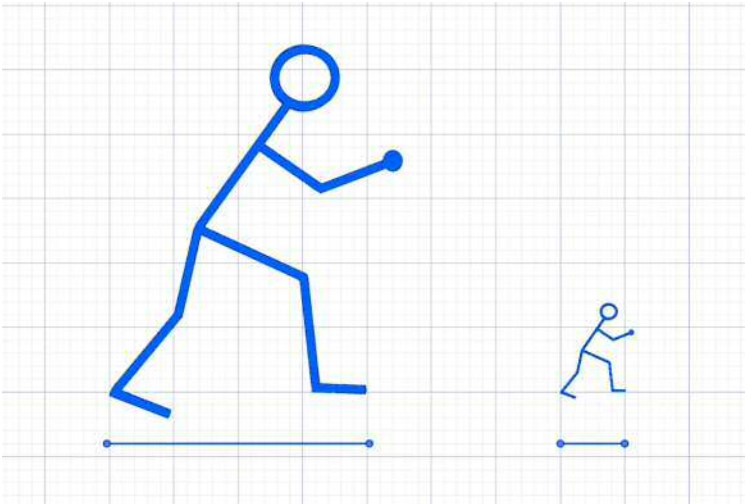

FIG. 24-1 The same step, a different country.
A step in the country of giants is longer than in the country of dwarves.
(Credit CC BY–NC–SA 4.0 T. Lajtner, Lajtner.com)

The giant in FIG. 24-1 is in the matter-space. E.g. the length of the barrier is one step according to him. The dwarf is in our Space. He thinks the length of the barrier is four steps long. The two men have the same size in the same space. (This model is not proportional.)

The units of matter-spaces are different from the unit of our Space. Its reason is that the wavelengths of waves of matter-space λ_{ms} are longer than the wavelengths of Space waves λ_{Sp}. $\lambda_{ms}>\lambda_{Sp}$.

So the same distance can be built out of less λ_{ms} than λ_{Sp}, $s=k_{ms}\ \lambda_{ms}$ and $s=k_{Sp}\ \lambda_{Sp}$ and $k_{ms}<k_{Sp}$. The distance in matter-spaces is shortened; there is a kind of length contraction in any matter-space compared to

our Space. Actually the length contraction is a length dilation studying the wavelength of space waves, $\lambda_{ms}>\lambda_{Sp}$.

Note different matter-spaces have different units of distance, see FIG. 24-2. For the same reason a given time period contains more Space time units than matter-space time units, i.e. there is a kind of time dilation in matter-spaces which is also real. The shortest time unit of any matter-space is longer than a time unit of Space. This is a real difference it is not a relativistic viewpoint.

In FIG. 24-2 there are two different matter-spaces.

24.1. Units of superluminal$_M$ spaces

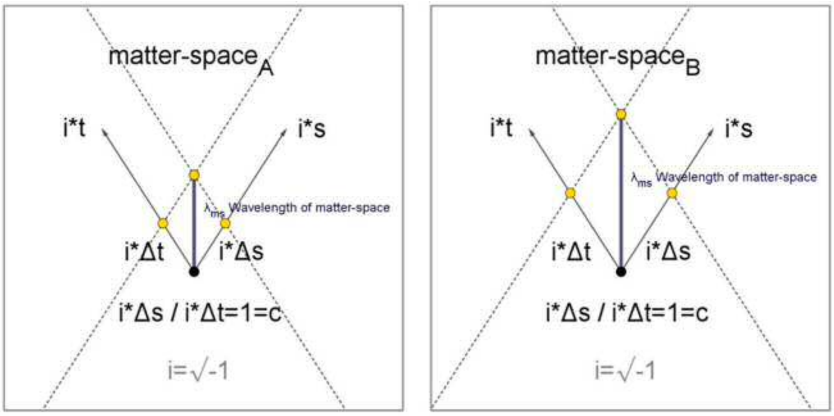

FIG. 24-2 Different wavelengths of “space” waves in two different matter-spaces.
Every *t* and *s* are in meters. This figure is similar to FIG. 17-2 and 15-1 at first sight, but differs significantly from them. We cannot enter these spaces, therefore the notation i=√-1 is used.
Here there are coordinate systems of two different matter-spaces. These coordinate systems show that particles create constant velocity in any matter-space, $i\Delta s_A/i\Delta t_A=i\Delta s_B/i\Delta t_B=1$ and c=1. The velocity of a particle is always c from the viewpoint of the given matter-space and from the viewpoint of the given particle travels in the matter-space. (Model, not proportional.)
(Credit © Lajtner, Lajtner.com)

Here is a short outline how to handle fast waves using special relativity. Now instead of the special Minkovski-geometry, we may use Euclidean coordinate system, where the essence of special relativity, the Lorentz-transformation[62] was created.

Let us recall Eq. (15-7). It claims that mass travels in its Space at velocity c measured by Space waves modified by mass. This is the only velocity of masses in Space. Photons travel in its space at c. We know there are electrons aside photons in tunneling. In tunneling each particle travels at the same velocity. Since electrons and photons travel in their own spaces at velocity c, they also have to travel during the tunneling in matter-spaces at c. Presumably they use the only speed they know: c. Every particle travels at c in any space from the viewpoint of the given space and the given particle.

In barriers of tunneling experiments fast waves travel at $c_{Exp\text{-}i}$=c. This velocity seems to be a fast wave from our viewpoint, but it is c from the viewpoint of the given matter-space. Saying this, there must be different basic units in matter-spaces.

FIG. 24–3 uses the data of Experiment 2 and shows an easy-to-understand solution. The three-dimensional model is only an example of st and s't' that helps understand the concept. s'= s·i, t'= t·i, where i=√-1.

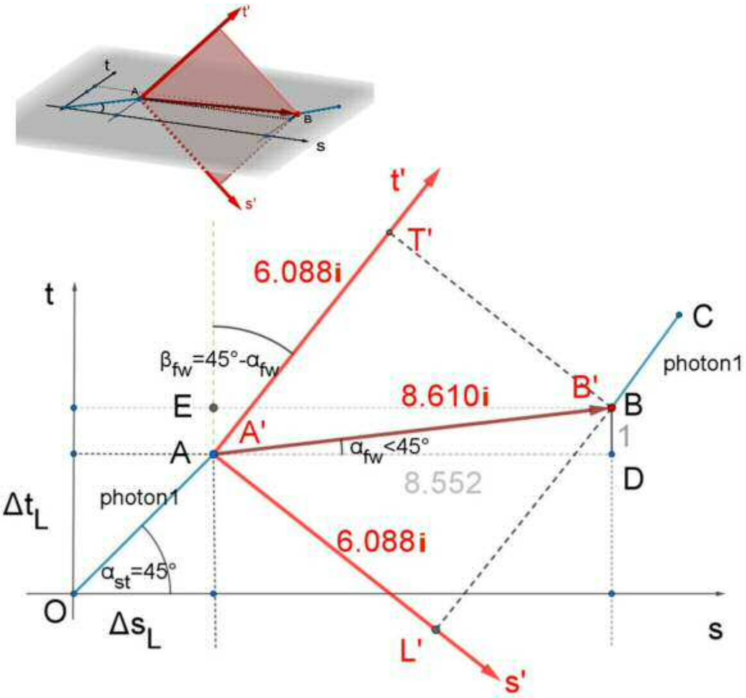

FIG. 24-3 v_{fw}>c velocity appears as c in matter-space st.
In the model st and s't' are two dimensional spaces with different units.
st is the coordinate system of Space, s't' is the coordinate system of matter-space.

Region AEBD is not interpreted from the viewpoint of photon1. As mentioned above, points A and B have no connection in st. A and B are connected in s't' using A' and B'. s't' is a fast space, where the unit distance and time unit are different from the units of st.

Time $unit_{st}$=1 m. Time $unit_{s't}$=6.088 m expressed in st units. The time unit in matter-space is longer. This result was expected. On the other hand, this particular number shows that the matter-space contains only one space wave. If it were not so, the time would have to be shorter in matter-space. The unit distance in matter-space is longer than the unit distance in Space, therefore the calculated length (6.088) is the length of the matter-space.

FIG. 24–3 contains more details not stressed here that can help you to understand the table below.

Note st and s't' are connected only in two points. A is connected with A', B with B'. There are no more connections between st and s't'.

We have a superluminal wave1 from the viewpoint of st, and a photon1 that travels at c in matter-space. We can "observe" the same photon1 from two different viewpoints. (Fast waves cannot be directly observed.) And we can calculate the units of matter-space, and we can calculate what st might look like from the matterspace.

Using Eq. (24-1, 2, 3, 4) the Table 24-1 can be filled out.

$$ú=v_1/v_2, \qquad (24\text{-}1)$$

where $v_1>v_2$, e.g. $ú=v_{fw}/c$.

$$ó=(-1(ú^2+1^2)/2)^{1/2} \qquad (24\text{-}2)$$

$$L'=L\cdot(ó/ú). \qquad (24\text{-}3)$$

$$T'=T\cdot(ó/1). \qquad (24\text{-}4)$$

In Table 24–1 it is supposed that the barrier consists of a single wave as matter-space $L'=\lambda_{ms}$, and the fast wave uses this one.

Topic	Experiment 1	Experiment 2	Experiment 2	Note
Measured in Space's units—from our viewpoint				
ú	4.702	8.552	2.565	ú=v_{fw}/c, c=1
$ó = i\sqrt{(ú^2+1^2)/2}$	3.399 i	6.088 i	1.947 i	conversion factor (without dimension) $i=\sqrt{-1}$
L	$1.142 \cdot 10^{-1}$	$3.00 \cdot 10^{-1}$	$1.00 \cdot 10^{-1}$	length of the barrier (m)
T	$8.1 \cdot 10^{-11}$	$1.17 \cdot 10^{-10}$	$1.30 \cdot 10^{-10}$	tunneling time (sec)
Matter-space from the viewpoints of fast wave and matter-space—in our units				
L'=L·(ó/ú)	$8.26 \cdot 10^{-2}$ i	$2.14 \cdot 10^{-1}$ i	$7.59 \cdot 10^{-2}$ i	the shortest spatial unit = the length of matter-space (m)
T'=T·(ó /1)	$2.75 \cdot 10^{-10}$ i	$7.12 \cdot 10^{-10}$ i	$2.53 \cdot 10^{-10}$ i	the shortest and only time unit in matter-space (sec)
v'_{fw}= L'/ T'=c	c	c	c	speed of fast wave in matter-space (m/sec)

Table 24-1 Tunneling time and the length of the barrier from different viewpoints.

Different matter-spaces have different time- and space units. Let us see the values of Experiment 2. The length of the matter-space is as long as λ_{ms} . It is $3.00 \cdot 10^{-1}$ meters from our viewpoint, inside the matter-space it is $2.14 \cdot 10^{-1}$ meters. The tunneling time is $1.17 \cdot 10^{-10}$ sec from our viewpoint, inside the matter-space it is $7.12 \cdot 10^{-10}$ sec.

The observer in matter-space is able to calculate L and T.

L=L'/(ó/ú). T=T'/(ó /1)

The time wave of matter-space must be faster that c. What can be faster than c? E.g. a group wave in matter-space can be faster, therefore a group wave can be the time wave of matter-space, cf. fast light experiment and group waves mentioned earlier. Or time wave can be a longitudinal wave.

In Table 24-1 is not part of the theory of special relativity, although the changes of length and time seem to depend on particles' velocities.

In reality, changes showed in Table 24-1 depend on the matter-space where particle is able to travel.

Let us step out of the spacetime of the special relativity. Unchained ourselves this way, we can build two different "bridges" between A and B. The first bridge is the tunneling.

The tunneling particle travels in matter-space at $c_{fw}=c_{matter\text{-}space}=c$. The barrier is a $space_i$ where units of time and spatial distance are different from time and spatial distance units of our Space and light's space. It means every $space_i$ has its own unit of time and spatial distance, if there is matter in $space_i$. The given values depend on $space_i$ and the given matter that travels in $space_i$. $c_{space\text{-}i}=c$ in every $space_i$, and matter always travels at c velocity in every $space_i$. If it cannot travel at c velocity in $spaces_i$, then the given $space_i$ is no space for this matter. This is not about a new method about how to change the speed of particles in our Space, and this is not about the Cherenkov radiation[63], it is about different spaces.

The second bridge is the coordinate system s_it_i that shows the velocity of information in st. Coming soon.

24.2. Velocities and the two parts of Planck constant

As written in Chapter 17.4. and also in Chapter 24.1. it seems to exist a fundamental law (according to my assumption): every object must travel in any space at velocity c. In plain English, there is only one velocity at which an object is able to travel relative to the given space. This velocity is c. In every space for every object made of matter or non-space.

Where is this constant? It cannot be in every space. It is the nature of matter. This constant velocity results from the nature of the Planck constant. The given space has its waves that have wavelength, frequency and action. These three features are not independent of each other. h_{space} can be thought of as a pressure that pumps energy (action) into the particles' "container" of $h_{kinetic}$. Bigger h_{space} pumps bigger portion of action into the particles' "container" of $h_{kinetic}$.

Our fundamental rule detailed in the earlier chapters is written in Eq. 24-5.

$$h_{matter\text{-}space}>h_{Space}. \qquad (24\text{-}5)$$

FIG. 24-4 artistically depicts Eq. 24-5.

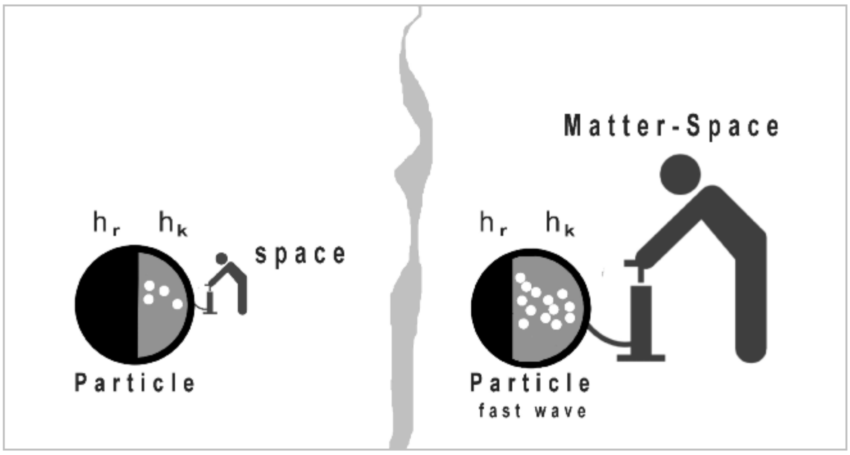

FIG. 24-4 Space and matter-space fill $h_{kinetic}$ into the same photon particle.
$h_{kinetic\text{-}s} < h_{kinetic\text{-}ms}$
Model, not proportional.
(Credit Particle inflated © T. Lajtner, Lajtner.com from Half full CC0 David Christensen from Noun Project, Edited, and from Air pump CC0 Luis Prado from Noun Project, Edited.)

The Planck constant is a constant of matter. Its value remains unchanged in every space. Since h_{rest}>0, therefore $h_{kinetic}$ cannot be infinite. So the superluminal$_M$ velocity has an upper limit.

As mentioned above, in tunneling there are two time periods: traveling time and time of two metamorphoses (wave↔fast wave). I think the real travelling speed is much higher than the speed of tunneling measured.

Until now we haven't measured values about the metamorphoses, so we cannot exactly calculate the pure travelling time. So the values given above are correct according to today's measurements.

24.3. Relativity superluminal$_M$

Table 24–1 presents the calculated units of matter-spaces from the viewpoint of matter-spaces. How to calculate the distance of Space from matter-space?

The operation is the following. See FIG. 24–5.

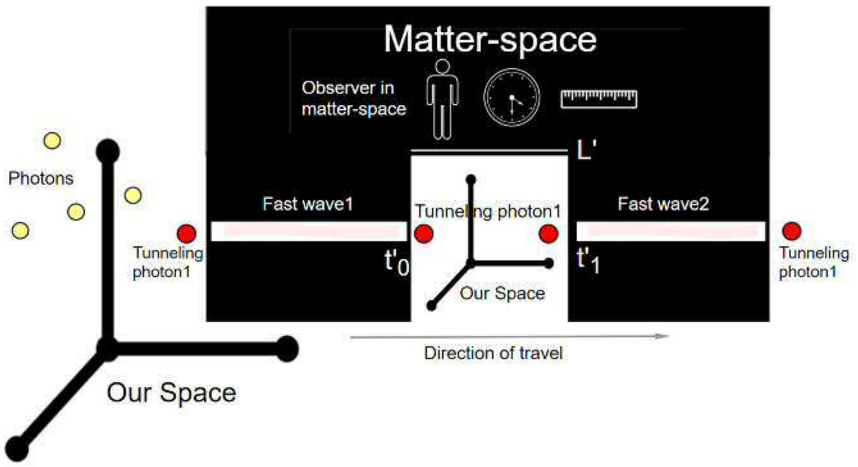

FIG. 24-5 Observer in matter-space.
In the following calculation will be supposed that the lack of the matter-space is as long as the length of the barrier in the tunneling experiment.
(Model, not proportional.)
(Credit © T. Lajtner, Lajtner.com)

The observer in matter-space cannot see and measure the photon outside the matter-space. He can measure time t_0 when the photon1 as fast wave1 leaves the matter-space, and time t_1 when the photon1 as fast wave2 re-enters the matter-space. Actually not by entering but when the photon1 had traveled L' distance in the matter-space.

Important! The observer in matter-space is not able to measure any part time that is shorter than the shortest time unit in his matter-space. So he will measure ú=9 instead of ú=8.552 measuring photon's time t_2. In my following calculation I calculated with ú=8.552, because I did not want to go into small details that can be confusing.

He can also measure the length of the lack in matter-space L', see FIG. 24–5. Therefore he is able to calculate the velocity of photon1 in light's space using L' and t_1-t_0. From the viewpoint of matter-space the velocity of photon1 in st will be calculated slowlier than c. Now the observer compares the $c_{fast\text{-}wave}$ and the v_{photon}. $ú=c_{fast\text{-}wave}/v_{photon}$.

He knows that the shortest wavelength of photon's space st must be shorter than L'. It is not the same, since ú≠1. It cannot be longer, because in this case it would not fit into L'. Knowing ú and the above mentioned the calculation works vice-versa. (Of course, he cannot calculate the shortest wavelength of our Space.)

Table 24–2 contains the details.

Topic	Experiment 1	Experiment 2	Experiment 3	Note
Photon1 from our viewpoint				
λ_0	$3.45\cdot10^{-2}$	$3.01\cdot10^{-2}$	$3.45\cdot10^{-2}$	wavelength of photon1 before tunneling (m)
f_0	$8.7\cdot10^{9}$	$9.97\cdot10^{9}$	$8.7\cdot10^{9}$	frequency of photon1 before tunneling (1/sec)
$v_{photon1}$	c	c	c	speed of light (m/s)
Fast wave1 in matter-space from the viewpoint of matter-space– in our units				
$\lambda'_{fw}=L'$	$8.26\cdot10^{-2}\,i$	$2.14\cdot10^{-1}\,i$	$7.59\cdot10^{-2}\,i$	wavelength of fast wave1 during tunneling (m)
$f'_{fw}=1/T'$	$3.63\cdot10^{9}/i$	$1.40\cdot10^{9}/i$	$3.95\cdot10^{9}/i$	frequency of fast wave1 during tunneling (1/sec)
v_{fw1}	c	c	c	speed of light (m/s)
Photon1 in our space from the viewpoint of matter-space				
$v'_{photon1}$	$6.38\cdot10^{7}$	$3.51\cdot10^{7}$	$1.17\cdot10^{8}$	speed of photon1 according to the observer in matter-space (m/s)
ú	4.702	8.552	2.565	$ú=c/v_{photon1}$

Table 24-2 The velocity of photon1 depends on the space of the observer.

The velocity of photon1 in our Space is less than c according to the observer in matter-space. In Experiment 2 it is $3.51\cdot10^{7}$ m/s. From our viewpoint its velocity is c. ($v_{photon}=3.51\cdot10^{7}$ m/s$<2.99\cdot10^{8}$ m/s=c.) The frequencies and the wavelengths of the same photon are also different in different spaces. The smaller number in the frequency of the fast wave does not mean that a part of photon's energy is lost.

The energy of fast wave E_{fw} is expressed in units of matter-space and it seems to be immeasurable, since f'_{fw} is an imaginary number, look at it in Table 24-2. Here the conservation of energy is to understand in a wider meaning, where the additional energy of matter-space caused by fast wave is also to calculate with.

$(E_0=h\cdot f_0)\equiv(E_{fw}= h\cdot f'_{fw}+E_{m\text{-}s})$,
The observer in the matter-space can calculate the velocity of fast wave1 from the viewpoint of st. $v_{fw\text{-}st}=ú\cdot c$.

24.4. Superluminal$_M$ information

Here comes the second bridge. It is the coordinate system s_it_i that shows the superluminal velocity of information in s_it_i. See FIG. 24–6.

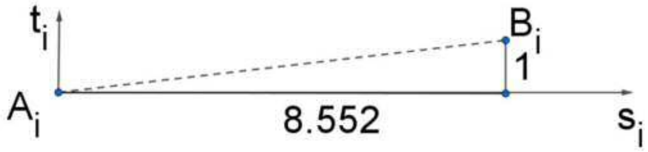

FIG. 24-6 Superluminal$_M$ information.
Every axis is in meters. Data of Experiment 2. Two-dimensional model.

Information can be sent from space1 into space1 without using traveling particle in space1. The photon1 disappears from space1 and reappears in space1. If the disappearance of a photon1 is the first information and the reappearance of a photon1 is the second information, then Information1 is no more valid and Information2 is valid. There is a change in information.

Note the information does not travel at all in space st. In st there are two points of the change of information. It has its start point: the photon1 disappears. And it has its end point: the photon1 reappears. If the distance and the time between the disappearance and reappearance of photon1 are measured, superluminal velocity will be given. In this sense, the superluminal$_M$ information is a real phenomenon. $v_{information}>c$. This can be pictured in the coordinate system s_it_i that shows the causal relationship between OA and BC, explaining the empty range of st.

Relativity superluminal$_M$ makes it possible to compare different spaces and the behaviors of particles in these spaces. It allows displaying superluminal$_M$ velocities. It is a new instrument to work with.

24.5. Rocket propulsion of photon?

Let us study the data of Table 24–2. The light (photon) has frequency f_0 before the tunneling. During the tunneling it has f_{fw}. $f_0 \neq f_{fw}$. After tunneling it has f_0 again cf. Ref 50.

We understand the change of f_0 into f_{fw}. In the matter-space the wavelength λ_{fw} is given. c is given, therefore the frequency of photon1 must be the following: $f_{fw}=c/\lambda_{fw}$.

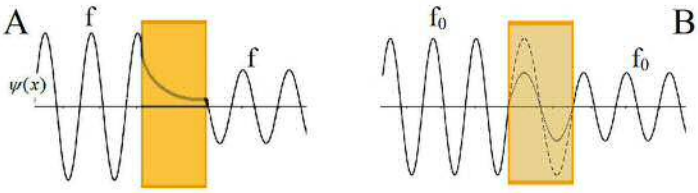

FIG. 24-7 We do not know what happens inside the barrier. ψ(x) is the wave function of tunneling particles outside the barrier. f is the wave packet frequency. f_0 is the frequency of one photon. I display FIG. 24-7 A and FIG. 24-7 B here, because at first glance you can see the significant difference between the two explanations. FIG. 24-7 A shows the most popular idea that tries to explain tunneling by using refractive idex cf. Chapter 17.1 and by the evanescent modes based on Schrödinger equation not detailed in this book.The tunneling particle and the evanescent modes are not observable; the explanation is based on calculation. The evanescent mode explanation violates the Special Relativity states Ref. 50, therefore either the Special Relativity or the evanescent mode explanation is false. FIG. 24-7 shows a different explanation: the Relativity Superluminal_M. Here the Special Relativity remains true; therefore Relativity Superluminal_M seems to be a useful model.

But how does the photon restore its original f_0 frequency entering its own space? The only way to do this, using its stored frequency level described in Chapter 17.3. If the frequency level can be stored, it means that photons and other particles e.g. electrons have structures. In other words: they work.

Let us remember Nimtz's remark mentioned in Chapter 19.1. The tunneling particle spends zero time inside the barrier. Using the model of Relativity Superluminal_M, we can explain why this statement is right and misleading at the same time. The shortest length unit in matter-space is λ_{ms}. The length of the barrier is $L'=\lambda_{ms}$. As long as the particle has not made the full L', it does not travel any distance, because there is no shorter distance than λ_{ms} in the given matter-space, since $L'=\lambda_{ms}$.

Why does photon seem to wait in the front of the barrier? Because it does wait. It must be charged with energy.

Photons seem to work like jellyfishes. A jellyfish fills its ”body” with water and then it presses the water out of itself. It is like the rocket propulsion. See FIG. 24−8.

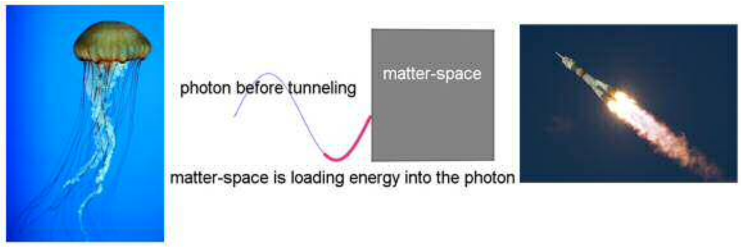

FIG. 24-8 Rocket propulsion of particles?
(Credit Rocket propulsion of particles CC BY 4.0 T. Lajtner, Lajtner.com from Jellyfish CC0 TDesigns, Pixabay, edited; Rocket CC0 skeeze, Pixabay)

I think, the photon must fill its $h_{kinetic}$-container before it can enter the matter-space. The photon can act as fast wave, if its container contains $h_{kinetic-ms}$ action. If the photon is charged with $h_{kinetic-ms}$ energy, it travels as fast wave inside the barrier i.e. in the matter-space. The matter-space has only one unit of distance, therefore the fast wave has only one wave period here. During the travelling, fast wave gives the energy (action) back to the given space. If it enters as photon into its own space, its own space fills $h_{kinetic-s}$ into the photon’s container.

$h_{kinetic-ms}>h_{kinetic-s}$. This is why photon can travel as fast wave.

The photon moves in its space, therefore it gives back the energy to its space. Electrons as fast waves seem to work the same way. Energy given and given back. It is an endless cycle. Spaces continuously reload the photon, and the photon gives the energy continuously back by moving in the given space.

To and fro. To and fro. To and fro.

The flow of energy form space to matter and back is a fundamental law. Therefore the model of growing mass described in Chapter 15.2. is a working model. The accelerating mass grows, because its additive growing mass originates from the space i.e. from the growing wavelengths of space wave. If the acceleration is negative, the process works backward[g].

[g] Knowing this, do we really need the Higgs boson?