Relativity. Exclusively a speed problem.

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Abstract

Special Relativity derived by Einstein is a mathematical approach with the unphysical results of time dilation, length contraction and the invariance of the light speed. This paper presents an approach where the Lorenz transformations are build exclusively on equations with speed variables instead of the mix of space and time variables and, where the interaction with the measuring instrument is taken into consideration. The results are transformation rules between inertial frames that are free of time dilation and length contraction. The equations derived for the momentum, energy and the Doppler effect are the same as those obtained with special relativity. The present work shows the importance of including the characteristics of the measuring equipment in the chain of physical interactions to avoid unphysical results.

1 Introduction.

Space and time are variables of our physical world that are intrinsically linked together. Laws that are mathematically described as independent of time, like the Coulomb and gravitation laws, are the result of repetitive actions of the *time variations* of linear momenta [8].

To arrive to the transformation equations Einstein made abstraction of the physical interactions that make that light speed is the same in all inertial frames. The result of the abstraction are transformation rules that show time dilation and length contraction.

The physical interactions omitted by Einstein are given in the authors "Emission & Regeneration" UFT [8] and are:

- photons are emitted with light speed c relative to their source
- photons emitted with c in one frame that moves with the speed v relative to a second frame, arrive to the second frame with speed $c \pm v$.

- photons with speed $c \pm v$ are reflected with c relative to the reflecting surface
- photons refracted into a medium with $n = 1$ move with speed c independent of the speed they had in the first medium with $n \neq 1$.

The concept is shown in Fig. 1

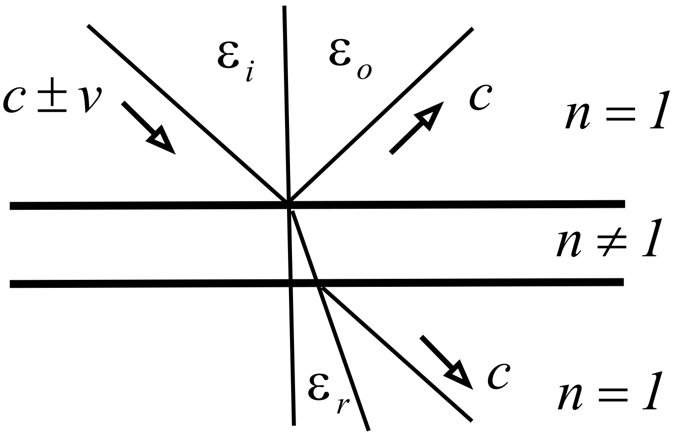

Figure 1: Light speed at reflections and refractions

The Lorenz transformation applied on speed variables, as shown in the proposed approach, is formulated with absolute time and space for all frames and takes into account the physical interactions at measuring instruments that produce the constancy of the measured light speed in all inertial frames.

2 Lorenz transformation based on speed variables.

The general Lorentz Transformation (LT) in orthogonal coordinates is described by the following equation and conditions for the coefficients [2]:

$$\sum_{i=1}^{4}(\theta^i)^2 = \sum_{i=1}^{4}(\bar{\theta}^i)^2 \qquad \sum_{i=1}^{4}\bar{a}^i_k\bar{a}^i_l = \delta_{kl} \qquad \sum_{i=1}^{4}\bar{a}^k_i\bar{a}^l_i = \delta^{kl} \tag{1}$$

with

$$\bar{\Theta}^i = \bar{a}^i_k\Theta^k \ + \ \bar{b}^i \tag{2}$$

The transformation represents a relative displacement $\bar{b}^i$ and a rotation of the frames and conserves the distances $\Delta\Theta$ between two points in the frames.

Before we introduce the LT based on speed variables we have a look at Einstein's formulation of the Lorentz equation with space-time variables as shown in Fig. 2.

$$x^2 + y^2 + z^2 + (ic_o\, t)^2 = \bar{x}^2 + \bar{y}^2 + \bar{z}^2 + (ic_o\, \bar{t})^2 \tag{3}$$

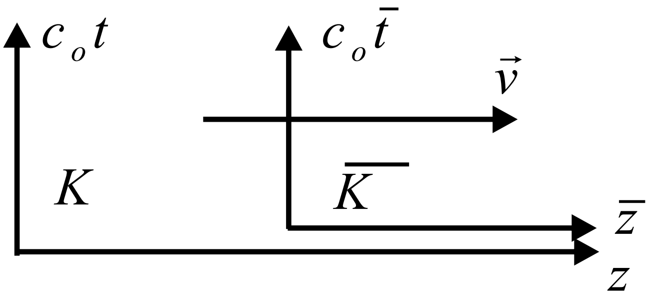

Figure 2: Transformation frames for **space-time** variables

For distances between two points eq. (3) writes now

$$(\Delta x)^2 + (\Delta y)^2 + (\Delta z)^2 + (ic_o\, \Delta t)^2 = (\Delta \bar{x})^2 + (\Delta \bar{y})^2 + (\Delta \bar{z})^2 + (ic_o\, \Delta \bar{t})^2 \tag{4}$$

The fact of equal light speed in all inertial frames is basically a speed problem and not a space-time problem. Therefor, in the proposed approach, the Lorentz equation is formulated with speed variables and absolut time and space. Dividing eq. (4) through the **absolute time** $(\Delta t)^2$ and introducing the forth speed v_c we have

$$v_x^2 + v_y^2 + v_z^2 + (iv_c)^2 = \bar{v}_x^2 + \bar{v}_y^2 + \bar{v}_z^2 + (i\bar{v}_c)^2 \tag{5}$$

The concept is shown in Fig. 3.

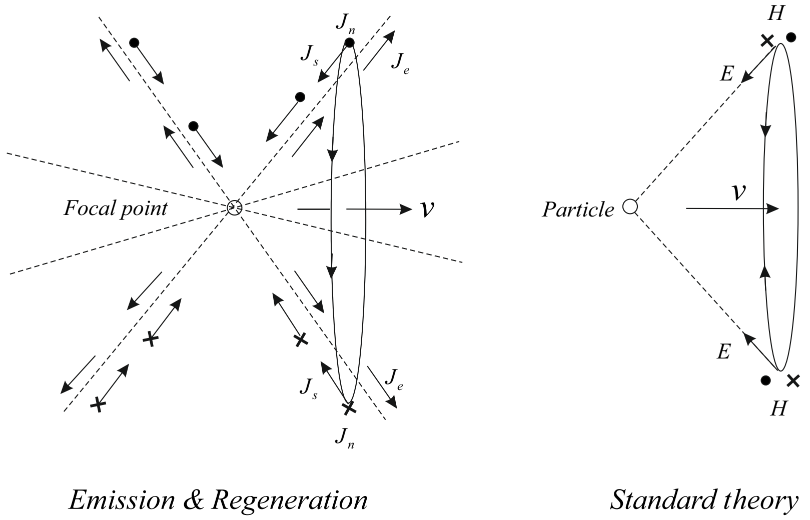

Figure 3: Particle as focal point in space

The forth speed v_c introduced is the speed of Fundamental Particles (FPs) that move radially through a focus in space, according to a new representation of basic subatomic particles like the electron or positron, as defined in the approach "Emission & Regeneration" Unified Field Theory [8] from the author. Fig. 3.

The FPs store the energy of the subatomic particles as rotations defining longitudinal and transversal angular momenta. The speed v_c is independent of the speeds v_x, v_y and v_z, forming together a four dimensional speed frame.

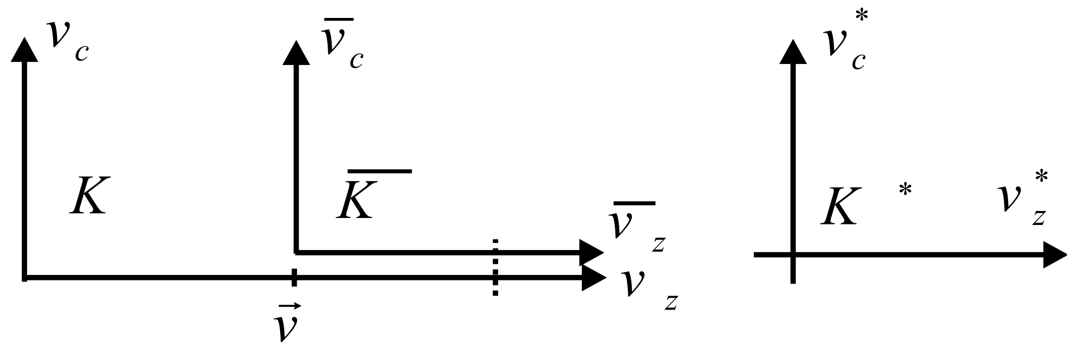

Figure 4: Transformation frames for **speed** variables

For the Lorentz transformation with speed variables Fig. 4 we get the following transformation rules between the source frame K and the virtual frame $\bar{K}$:

a) $\bar{v}_x = v_x$ $\qquad$ $v_x = \bar{v}_x$

b) $\bar{v}_y = v_y$ $\qquad$ $v_y = \bar{v}_y$

c) $\bar{v}_z = (v_z - v)\ \gamma_v$ $\qquad$ $v_z = (\bar{v}_z + v)\ \gamma_v$

d) $\bar{v}_c = (v_c - \frac{v}{v_c}\ v_z)\ \gamma_v$ $\qquad$ $v_c = (\bar{v}_c + \frac{v}{\bar{v}_c}\ \bar{v}_z)\ \gamma_v$

with $\quad \gamma_v = [1 - v^2/v_c^2]^{-1/2}$

2.1 Transformations for momentum and energy of a particle.

For $v_z = 0$ and $v_c = c$, where c is the light speed, we get

a) $\bar{v}_x = v_x$ $\qquad$ b) $\bar{v}_y = v_y$

c) $\bar{v}_z = -v\ \gamma_v$ $\qquad$ d) $\bar{v}_c = c\ \gamma_v$

We see that for $v_z = 0$ the transformed speeds $\bar{v}_z$ and $\bar{v}_c$ are not linear functions of the relative speed v because

$$\gamma_v = \left(1 - \frac{v^2}{v_c^2}\right)^{-1/2} = 1 + \frac{1}{2}\,\frac{v^2}{v_c^2} + \frac{1\cdot 3}{2\cdot 4}\,\left(\frac{v^2}{v_c^2}\right)^2 + \frac{1\cdot 3\cdot 5}{2\cdot 4\cdot 6}\,\left(\frac{v^2}{v_c^2}\right)^3 + \cdots \tag{6}$$

The case $v_z = 0$ is the case of a particle placed at the origin of the frame K where the momentum and the energy of the particle are given by

$$p = m\,\bar{v}_z = -m\,v\gamma_v \qquad\qquad E = mc\,\bar{v}_c = mc\,c\gamma_v = \sqrt{E_o^2 + E_p^2} \tag{7}$$

$$E_o = mc^2 \qquad \textit{and} \qquad E_p = mc\bar{v}_z = mc\,v\gamma_v \tag{8}$$

As the speed v_z is parallel to the relative speed v between the frames, the momentum and the energy of a particle moving with v_z in the frame K are afected by the non linear factor γ_{v_z}, where

$$\gamma_{v_z} = \left[1 - v_z^2/v_c^2\right]^{-1/2} \tag{9}$$

To get the momentum and the energy in the frame $\bar{K}$ for the general case with $v_z \neq 0$, we must take the transformed speeds $\bar{v}_i$ and multiplyed them with γ_{v_z}.

$$\bar{p} = m\,\bar{v}_z\gamma_{v_z} = m\,(v_z - v)\gamma_v\gamma_{v_z} \qquad\qquad \bar{E} = mc\,\bar{v}_c\gamma_{v_z} = mc\,(v_c - \frac{v}{v_c}v_z)\gamma_v\gamma_{v_z} \tag{10}$$

We define an equivalent γ_u for the transformation between the frames K and $\bar{K}$

$$\gamma_u = \gamma_{v_z}\gamma_v = \left[1 - u^2/v_c^2\right]^{-1/2} \qquad \textit{with} \qquad u = \sqrt{v^2 + v_z^2 - \frac{v^2 v_z^2}{v_c^2}} \tag{11}$$

so that we can write

$$\bar{p} = m\,(v_z - v)\gamma_u \qquad \textit{and} \qquad \bar{E} = mc\,(v_c - \frac{v}{v_c}v_z)\gamma_u \tag{12}$$

Note: The frame $\bar{K}$ is a *virtual* frame because the speeds calculated with the Lorentz transformation equations for this frame are virtual speeds and not the real Galilean speeds of the particles, which are $\bar{v}_{r_z} = v_z \pm v$. The frame $\bar{K}$ gives the virtual velocities that allow the calculation of the values of the momentum and energy, which are not linear functions of the real Galilean speed $\bar{v}_{r_z}$.

For the distances between the frames K and $\bar{K}$ the Galilean relativity is valid.

$$\Delta \bar{z} = z_o \pm v \, \Delta t \qquad with \qquad \Delta \bar{t} = \Delta t \quad for\ all\ speeds \quad v \tag{13}$$

If we start counting time when the origin of all frames coincide so that it is

$$z = \bar{z} = z^* = 0 \qquad for \qquad t = 0 \tag{14}$$

we get for the different types of measurements

Measurement	**K**	$\bar{\mathbf{K}}$	$\overset{*}{\mathbf{K}}$
ideal	$z = z_o$	$\bar{z} = z_o \pm v\ t$	$z^* = z_o \pm v\ t$
non destructive	$z = z_o$	$\bar{z} = z_o \pm v\ t$	$z^* \approx z_o \pm v\ t$
destructive	$z = z_o$	$\bar{z} = z_o \pm v\ t$	$z^* = z_o \pm v\ t_{meas}$

where t_{meas} is the time the destructive measurement took place at the instrument placed in K^*.

As time and space are absolute variables it is

$$\Delta t = \Delta \bar{t} = \Delta t^* \qquad \Delta z = \Delta \bar{z} = \Delta z^* \tag{15}$$

Note: The Lorentz transformation equations a),b) and c) are independent equations with the variables v_x, v_y and v_z; there is no cross-talking between them. Not so equation d) where $\bar{v}_c$ is a function of v_c and v_z. The speed v_z is modifying $\bar{v}_c$.

2.2 Transformations for electromagnetic waves at measuring instruments .

According to the approach "Emission & Regeneration" Unified Field Theory [8] from the author, measuring instruments are composed of an interface and the signal comparing part. Interfaces are optical lenses, mirrors or electric antennas.

The concept is shown in Fig.5

Electromagnetic waves that are emitted with the speed c_o from its source, arrive to a relative moving frame of the measuring instrument with speeds different than light speed, are first absorbed by the atoms of the interface and than emitted with light speed c_o to the signal comparing part .

To take account of the behaviour of light in measuring instruments an additional transformation is necessary.

In Fig 5 the instruments are placed in the frame K^* which is linked rigidly to the *virtual* frame $\bar{K}$. Electromagnetic waves from the source frame K move with the real

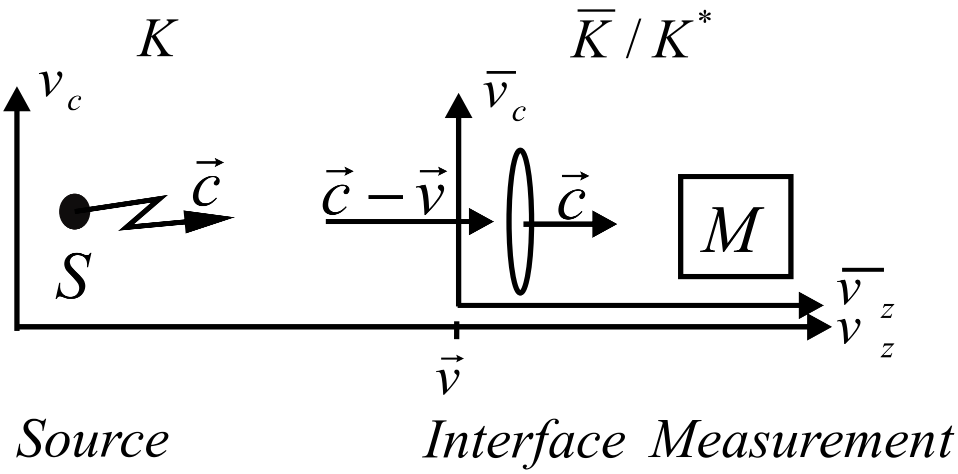

Figure 5: Transformation at measuring equipment's interface

speed $\bar{v}_{r_z} = c_o \pm v$ in the *virtual* frame $\bar{K}$. The real velocity $\bar{v}_{r_z}$ can take values that are bigger than the light speed c_o.

The links between the frames for an electromagnetic wave that moves with c_o in the frame K are:

	K	$\bar{\mathbf{K}}$	$\overset{*}{\mathbf{K}}$
e)	λ_z	$\bar{\lambda} = \lambda_z$	
f)	$v_z = c_o$	$\bar{v}_{r_z} = c_o \pm v$	$v_z^* = c_o$
g)	$f_z = c_o/\lambda_z$	$\bar{f}_{r_z} = \bar{v}_{r_z}/\lambda_z$	
h)		$\bar{f}_z = \bar{f}_{r_z}\ \gamma$	$f_z^* = \bar{f}_z$
i)	$E = h\ f_z$	$\bar{E} = h\ \bar{f}_z$	$E_z^* = h\ f_z^*$

e) shows the link between the frames K and $\bar{K}$. The wavelengths $\lambda_z = \bar{\lambda}_z$ because there is **no length contraction**.
f) shows the real Galilean speed $\bar{v}_{r_z}$ in frame $\bar{K}$.
g) shows the real frequency $\bar{f}_{r_z}$ in the frame $\bar{K}$.
h) shows the virtual frequency $\bar{f}_z$ in the frame $\bar{K}$ and the link to the frequency f^* of the frame K^*.
i) shows the equation for the energy of a photon for each frame.

Note: Also for electromagnetic waves the frame $\bar{K}$ gives the virtual velocity that allows the calculation of the values of the momentum, energy and frequency, which are not linear functions of the real speed $\bar{v}_{r_z}$.

For electromagnetic waves we have the following real speeds for the different types of measurements:

Measurement **K** $\bar{\mathbf{K}}$ $\overset{*}{\mathbf{K}}$ **Refraction**

ideal	$v_z = c_o$	$\bar{v}_{r_z} = c_o \pm v$	$v_z^* = c_o$	$n = 1$
non destructive	$v_z = c_o$	$\bar{v}_{r_z} = c_o \pm v$	$v_z^* < c_o$	$n > 1$
destructive	$v_z = c_o$	$\bar{v}_{r_z} = c_o \pm v$	$v_z^* = 0$	$n \Rightarrow \infty$

with n the optical refraction index $n = c_o/v_z^*$.

3 Equations for particles with rest mass $m \neq 0$.

Following, equations for physical magnitudes are derived for particles with rest mass $m \neq 0$ that are measured in an inertial frame that moves with constant speed v. For this case the transformation equations a), b), c) and d) from K to $\bar{K}$ are used. The transfomation from $\bar{K}$ to K^* is the **unit** transformation, because of conservations of momentum and energy between rigid linked frames.

3.1 Linear momentum.

To calculate the linear momentum in the virtual frame $\bar{K}$ of a particle moving in the source frame K with v_z and $v_x = v_y = 0$ we use the equation $c)$ of sec 2, with $v_c = c_o$. The speed $v_c = c_o$ describes the speed of the Fundamental Particles (FP) [8] emitted continuously by electrons and positrons and which continuously regenerate them, also when they are in rest in the frame K $(v_x = v_y = v_z = 0)$. From (10) we define

$$\bar{v}_z^{'} = (v_z - v)\gamma_u = (v_z - v)\gamma_{v_z}\gamma_v \tag{16}$$

The linear momentum $\bar{p}_z$ we get multiplying $\bar{v}_z^{'}$ with the rest mass m of the particle.

$$\bar{p}_z = m\,\bar{v}_z^{'} = m\,(v_z - v)\gamma_{v_z}\gamma_v = p_z^* \tag{17}$$

Because of momentum conservation the momentum we measure in K^* is equal to the momentum calculated for $\bar{K}$, expressed mathematically $p_z^* = \bar{p}_z$.

Eq. (17) is the same equation as derived with special relativity.

Note: The rest mass is simply a proportionality factor which is not a function of the speed and is invariant for all frames.

3.2 Acceleration.

To calculate the acceleration in the virtual frame $\bar{K}$ we start with

$$\bar{a}_z = \frac{d\bar{v}_z^{'}}{dt} \qquad \textit{with} \qquad \bar{v}_z^{'} = \bar{v}_z\,\gamma_{v_z} = (v_z - v)\gamma_v\gamma_{v_z} \tag{18}$$

what gives for $v_z(t)$ and $\gamma_{v_z}(t)$

$$\bar{a}_z = \frac{d\bar{v}_z'}{dt} = \frac{d\bar{v}_z}{dt}\gamma_{v_z} + \bar{v}_z\frac{d\gamma_{v_z}}{dt} = \frac{dv_z}{dt}\,\gamma_{v_z}\gamma_v + (v_z - v)\gamma_v\,\frac{d}{dt}\gamma_{v_z} \tag{19}$$

From momentum conservation $p_z^* = \bar{p}_z$ we have that

$$\bar{a}_z = a_z^* \tag{20}$$

3.3 Energy.

To calculate the energy in the virtual frame $\bar{K}$ for a particle that moves with v_z in the frame K we use the equation $d)$ of sec 2, with $v_c = c_o$. The equation $d)$ is used because it gives the speeds of the FPs where the energy of the subatomic particles is stored.

$$\bar{v}_c = \frac{v_c - \dfrac{v}{v_c}\,v_z}{\sqrt{1 - v^2/v_c^2}} = (v_c - \frac{v}{v_c}\,v_z)\gamma = \bar{v}_{r_c}\,\gamma \tag{21}$$

To get the energy in the frame $\bar{K}$ we multiply $\bar{v}_c$ with $mc\gamma_{v_z}$. See also eq. (10). We get

$$\bar{E} = mc\,\bar{v}_c\gamma_{v_z} = mc\,(v_c - \frac{v}{v_c}v_z)\gamma_v\gamma_{v_z} \tag{22}$$

Eq. (22) is the same equation as derived with special relativity.

With $v_z = 0$ we get

$$\bar{E} = \frac{m\,c_o^2}{\sqrt{1 - v^2/c_o^2}} = \sqrt{E_o^2\;+\;\bar{E}_p^2} \tag{23}$$

with

$$\bar{E}_p = m\,|\bar{v}_z|\,c_o = |\bar{p}_z|\,c_o \qquad \bar{v}_z = v_z\,\gamma_{v_z} \qquad E_o = m\,c_o^2 \tag{24}$$

To calculate the energy $\bar{E}_p = m\,\bar{v}_z\,c_o$ we must calculate $\bar{v}_z$ as explained in sec. 3.1 with $v_z = 0$.

The energy E_o is part of the energy in the frame $\bar{K}$ and invariant, because if we make $v = 0$ we get E_o as the rest energy of the particle in the frame K.

Because of energy conservation between frames without speed difference the energy E^* in the frame K^* is equal to the energy $\bar{E}$ in the frame $\bar{K}$.

4 Equations for particles with rest mass $m = 0$.

In this section the equations for electromagnetic waves observed from an inertial frame that moves with the relative speed v are derived. A comparison between the proposed approach and the Standard Model is made.

4.1 Relativistic Doppler effect.

The speed $v_c = c_o$ describes the speed of the Fundamental Particles (FP) [8] emitted continuously by electrons and positrons and which continuously regenerate them, also when they are in rest in frame K ($v_x = v_y = v_z = 0$). In the case of the photon no emission and regeneration exist.

The photon can be seen as a particle formed by only two parallel rays of FPs. The first ray carries FPs with opposed transversal angular momenta of equal orientation and the second ray carries FPs with transversal angular momenta opposed to the first ray. At each ray FPs exist only along the length L of the photon.

The concept is shown in Fig. 6

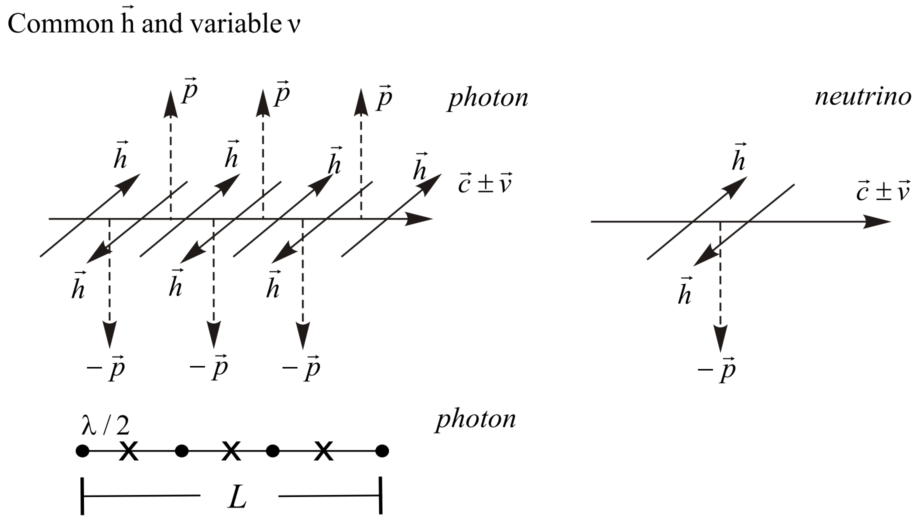

Figure 6: Photon and neutrino

To calculate the energy of a photon in the virtual frame $\bar{K}$ that moves with $v_z = c_o$ in the frame K we use the same equation d) of sec 2 used for particles with $m \neq 0$, with $v_z = c_o$ and $v_c = c_o$. We use equation d) because the energy is stored in FPs. We get

$$\bar{v}_c = \frac{v_c - \dfrac{v}{v_c}\, v_z}{\sqrt{1 - v^2/v_c^2}} = (c_o - v)\gamma_v \tag{25}$$

Note: As the energy of a photon is a function of the frequency, the energy in the frame $\bar{K}$ is not afected by the non linear factor γ_z.

The momentum of a photon in the frame K is $p_c = E_{ph}/c_o = h\ f/c_o$ which we multiply with $\bar{v}_c$ to get the energy of the photon in the frame $\bar{K}$. The transformation of the energy between the frames $\bar{K}$ and K^* is $E^* = \bar{E}$ and we get:

For the measuring instrument moving away from the source

$$\bar{E} = p_c\ \bar{v}_c = \frac{E_{ph}}{c_o}\ (c_o - v)\ \gamma_v = E_{ph}\ \frac{\sqrt{c_o - v}}{\sqrt{c_o + v}} = E^* = h\ f^* \tag{26}$$

With $E_{ph} = h\ f$ we get the well known equation for the relativistic Doppler effect

$$f^* = f\ \frac{\sqrt{c_o - v}}{\sqrt{c_o + v}} \qquad or \qquad \frac{f}{f^*} = \frac{\sqrt{1 + v/c_o}}{\sqrt{1 - v/c_o}} \tag{27}$$

and with $c_o = \lambda\ f$ and $c_o = \lambda^*\ f^*$ we get the other well known equation for the relativistic Doppler effect

$$\frac{\lambda}{\lambda^*} = \frac{\sqrt{1 - v/c_o}}{\sqrt{1 + v/c_o}} \tag{28}$$

Eq. (27) is the same equation as derived with special relativity.

Note: No transversal relativistic Doppler effect exists.

Note: The real frequency $\bar{f}_{r_z}$ in the frame $\bar{K}$ is given by the Galilean speed $\bar{v}_{r_z} = c_o \pm v$ divided by the wavelength $\bar{\lambda} = \lambda$. The energy of a photon in the frame $\bar{K}$ is given by the equation $\bar{E}_{ph} = h\ \bar{f}_z$ where $\bar{f}_z = \bar{f}_{r_z}\ \gamma$, with $\bar{f}_{r_z} = (c_o \pm v)/\lambda_z$ the real frequency of particles in the frame $\bar{K}$.

Note: All information about events in frame K are passed to the frames $\bar{K}$ and K^* exclusively through the electromagnetic fields E and B that come from frame K. Therefore all transformations between the frames must be described as transformations of these fields, what is achieved through the invariance of the Maxwell wave equations.

4.2 Transformation steps for photons from emitter to receiver.

Electromagnetic signals (photons) have to pass an interface at the receiver until a measurement can be made. The interface is an optical lense, a mirror or an antenna. The signals undergo two transformations when travelling from the emitter to the receiver. The first transformation occurs before the interface and the second behind the interface.

The concept is shown in Fig.7

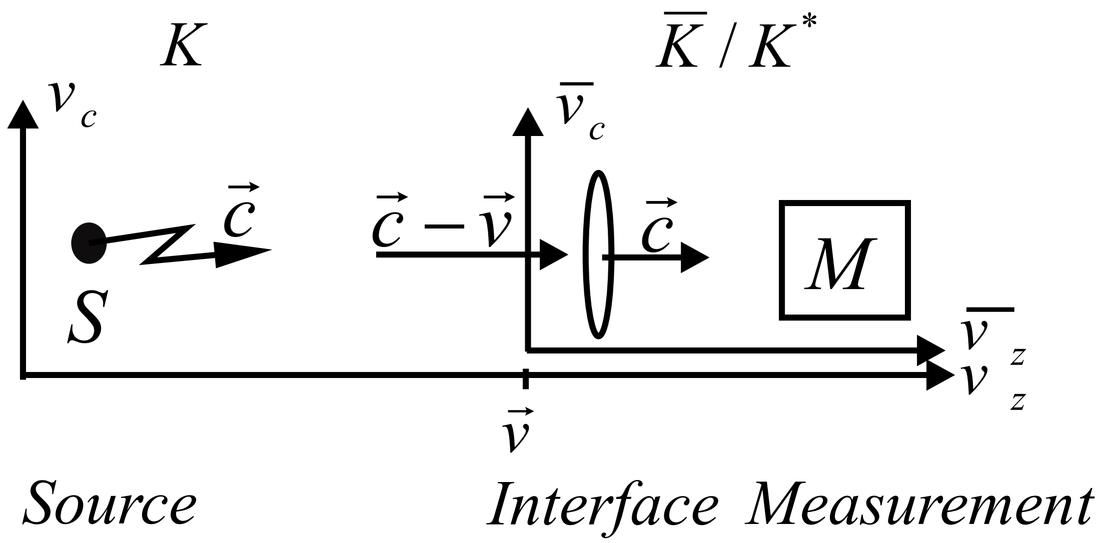

Figure 7: Transformation at measuring equipment's interface

If we assume that the emitters signal in the K frame is

$$c = \lambda\, f \tag{29}$$

the signal befor the interface of the receiver in the $\bar{K}$ frame is;
for the measuring instrument moving away from the source

$$\bar{f} = f\,\frac{\sqrt{c-v}}{\sqrt{c+v}} \qquad and \qquad \bar{\lambda} = \lambda \qquad and \qquad \bar{v}_z = c - v \tag{30}$$

At the output of the interface we get the signal in the K^* frame that is finally processed by the receiver.

$$f^* = f\,\frac{\sqrt{c-v}}{\sqrt{c+v}} \qquad and \qquad \lambda^* = \lambda\,\frac{\sqrt{c+v}}{\sqrt{c-v}} \qquad and \qquad v_z^* = c \tag{31}$$

At the first transformation the wavelength $\lambda = \bar{\lambda}$ doesn't transform (absolute space) and at the second transformation the frequency $\bar{f} = f^*$ (absolute time).

The speed before the interface $c \pm v$ is the galilean speed which changes to $v_z^* = c$, the speed of light, before the processing in the receiver. This explains why always c is measured in all relative moving frames.

5 Energy of Fundamental Particles.

A photon is a sequences of pairs of FPs with opposed angular momenta at the distance $\lambda/2$ as shown in Fig. 6. The potential linear moment p of a pair of FPs with opposed angular momenta is perpendicular to the plane that contains the opposed angular momenta. The potential linear moment of a pair of FPs with opposed angular momenta can take every direction in space relative to the moving direction of the pair.

The emission time of photons from **isolated** atoms is approximately $\tau = 10^{-8}\ s$ what gives a length for the train of waves of $L = c\ \tau = 3\ m$. The total energy of the emitted photon is $E_t = h\ \nu_t$ and the wavelength is $\lambda_t = c/\nu_t$. We have defined (see Fig. 6), that the photon is composed of a train of FPs with alternated opposed angular momenta where the distance between two consecutive FPs is equal $\lambda_t/2$. The number of FPs that build the photon is therefore $N_{\mathbf{FP}} = L/(\lambda_t/2)$ and we get for the energy of one FP

The concept is shown in Fig. 8

$$E_{\mathbf{FP}} = \frac{E_t}{N_{\mathbf{FP}}} = \frac{E_t\ \lambda_t}{2\ L} = \frac{h}{2\ \tau} = 3.313 \cdot 10^{-26}\ J = 2.068 \cdot 10^{-7}\ eV \tag{32}$$

and for the angular frequency of the angular momentum h

$$\nu_{\mathbf{FP}} = \frac{E_{\mathbf{FP}}}{h} = \frac{1}{2\ \tau} = 5 \cdot 10^7\ s^{-1} \tag{33}$$

Finally we get

$$\nu_t = N_{\mathbf{FP}}\ \nu_{\mathbf{FP}} = \ 5 \cdot 10^7\ N_{\mathbf{FP}}\ s^{-1} \qquad with \qquad N_{\mathbf{FP}} = \frac{c\ \tau}{\lambda_t/2} \tag{34}$$

Note: The frequency ν_t represents a linear frequency where the relation with the velocity v and the wavelength λ_t is given by $v = \lambda_t\ \nu_t$. The frequency $\nu_{\mathbf{FP}}$ represents the angular frequency of the angular momentum h.

The momentum generated by a pair of FPs with opposed angular momenta is

$$p_{\mathbf{FP}} = \frac{2\ E_{\mathbf{FP}}}{c} = 2.20866 \cdot 10^{-34}\ kg\ m\ s^{-1} \tag{35}$$

Note: Isolated FPs have only angular momenta, they have no linear momenta and therefore cannot generate a force through the change of linear momenta . Linear momentum is generated only out of pairs of FPs with opposed angular momentum as

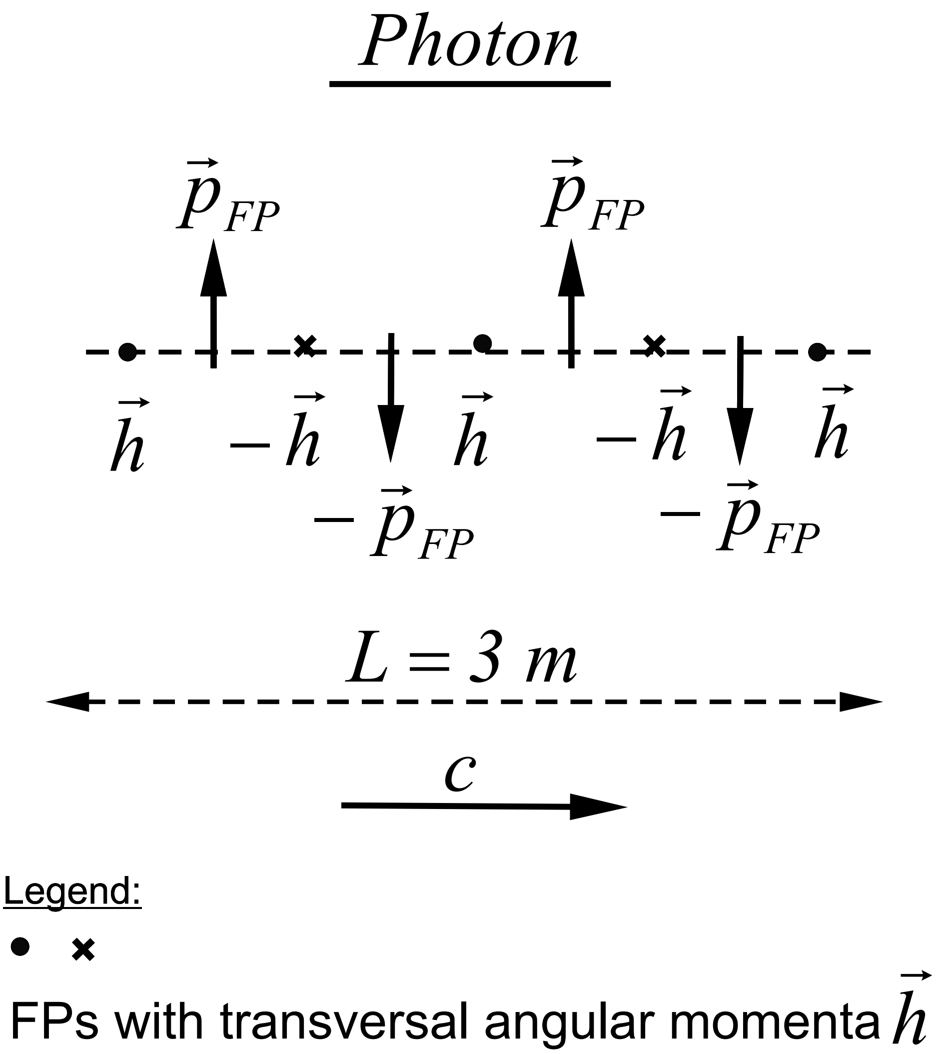

Figure 8: Photon as sequence of opposed angular momenta

shown in Fig. 6. It makes no sense to define a dynamic mass for FPs because they have no linear inertia, which is a product of the energy stored in FPs with opposed angular momenta. FPs that meet in space interact changing the orientation of their angular momenta but conserving each its energy $E_{FP} = 3.313 \cdot 10^{-26}\ J$.

The number N_{FP_o} of FPs of an resting BSP (electron or positron) is

$$N_{FP_o} = \frac{E_o}{E_{FP}} = 2.4746 \cdot 10^{12} \tag{36}$$

Note: Photons can be seen as a sequence of neutrinos with opposed potential linear momenta at the distance $\lambda/2$.

6 The invariant mass W.

The invariant mass W is defined by

$$W^2c^4 \equiv E^2 - p^2c^2 \tag{37}$$

W has the same value in any reference frame. We will show that for the frames K and K^* we get

$$(E^*)^2 - (p^*)^2c^2 = \left[E_o^2 - p^2c^2\right]\gamma_{v_z} \qquad with \qquad E_o = mc^2 \qquad p = mv_z \tag{38}$$

From sec. 3 “Equations for particles with $m \neq 0$” we get

$$(E^*)^2 = m^2c^2[c - \frac{v}{c}v_z]^2\gamma_u^2 \qquad and \qquad (p^*)^2c^2 = m^2c^2(v_z - v)^2\gamma_u^2 \tag{39}$$

$$(E^*)^2 - (p^*)^2c^2 = m^2c^2[c^2 + \frac{v^2}{c^2}v_z^2 - v_z^2 - v^2]\gamma_u^2 \tag{40}$$

We get

$$(E^*)^2 - (p^*)^2c^2 = [E_o^2(1 - \frac{v^2}{c^2}) - p^2c^2(1 - \frac{v^2}{c^2})]\gamma_u^2 \tag{41}$$

with

$$E_o = mc^2 \qquad p = mv_z \qquad \gamma_u = \gamma_v\gamma_{v_z} \tag{42}$$

Finally we get

$$(E^*)^2 - (p^*)^2c^2 = \left[E_o^2 - p^2c^2\right]\gamma_{v_z} \tag{43}$$

7 The proposed approach and the Standard Model.

The proposed approach [8] represents a photon as a package of a sequence of FPs with opposed angular momenta. Packages are emitted with the speed c_o relative to its source. A monochromatic source emitts packages with equal distances λ between FPs.

A package emitted with the speed c_o, the frequency f and the vawelength λ in the frame K will move in the virtual frame $\bar{K}$ with the real speed $\bar{v}_r = c_o \pm v$, will have the same vawelength $\bar{\lambda} = \lambda$ and a real frequency $\bar{f}_r = (c_o \pm v)/\lambda$. In the frame K^* the package is absorbed by the atoms of the interface of the measuring instruments and immediately reemitted with the speed c_o relative to K^*. The frequency f^* in the frame K^* is equal to the virtual frequency $\bar{f}$ in the frame $\bar{K}$ which is given by the product of the real frequency $\bar{f}_r$ and the factor γ_v.

$$f^* = \bar{f} = \bar{f}_r \, \gamma_v \qquad with \qquad \bar{f}_r = \frac{c - v}{\bar{\lambda}} \qquad and \qquad \bar{\lambda} = \lambda \tag{44}$$

The proposed approach unifies the frames $\bar{K}$ and K^* defining that the packages move from their source in frame K through space with the speed $c_o \pm v$ relative to the frame K^* of the instruments.

The Standard Model unifies the frames K and $\bar{K}$ to one frame defining that the packages (photons) move already from their source through space with the speed c_o relative to the frame K^* where the measuring instruments are located. This gives the impression that an absolute frame (aether) must exist for the photons to move always with ligth speed c_o independent of their sources.

For the Standard Model the length of a package in space (length of the wave train or coherence length) is $l = (c_o \pm v)\tau$ while for the present approach it is $l = c_o \, \tau$ (τ is the time needed for traversing the coherence length l), which is independent of the relative speed v .

Theories normally known as "Emission Theories" analysed by Willem de Sitter and Daniel Frost Camstock are theories that don't produce well defined spectroscopic lines for a star rotating around a neutron star (Astrometric binaries), contrary to what is observed. In the proposed approach packages with equal distances between their FPs (equal λ) but with different speeds $c_o \pm v$ from a star rotating around a neutron star (Astrometric binaries) produce well defined spectroscopic lines in accordance with experimental observations.

8 Reference coordinate system.

The "'Emission & Regeneration"' UFT is based on the idea that Subatomic Particles (SPs) emit continously Fundamental Particles (FPs) and are continously regenerated by FPs. Regenerating FPs are those FPs that previously were emitted by other Subatomic Particles (SPs). All physical laws that were derived from measurements are laws that were obtained observing the behaviour of SPs in an enviroment of other SPs that provided the regenerating FPs for the particle in observation. This enviroment constitutes the reference for the laws.

As the density of FPs emitted by a SP follows the inverse square distance law, the SPs that integrate the measuring equipment and the laboratory, and which are in the closer distance of the particle in observation, constitute the reference system for our physical laws. The mathematical describtions of the physical laws must contain the non-linear behaviour of the momentum and energy with the speed through the gamma factor.

9 Conclusions.

Einstein's SR is a perfect example of a classical theory that doesn't include physical interactions of the measuring instruments. The approach arrives to time dilation and length contraction, what is equivalent to say that time and length remain unchanged but that the *time unit* (second) contracts and the *length unit* (meter) dilates. This violates fundamental principles of theoretical and experimental physics because units must be universally valid for all frames.

Based on the approach "Emission & Regeneration" Unified Field Theory [8], where electrons and positrons continuously emit and are regenerated by Fundamental Particles (FP), the following conclusions about relativity between inertial frames were deduced:

- The fact of equal light speed in all inertial frames is a measuremet problem and not a space and time problem. Time and space are absolute variables and equal for all frames according to Galilean relativity.

- Electromagnetic waves are emitted with light speed c_o relative to the frame of the emitting source.

- Electromagnetic waves that arrive at the interfaces of measuring instruments like mirrors, optical lenses or electric antennae are absorbed by the electrons of their atoms and subsequently emitted with light speed c_o relative to the nuclei of the atoms, independent of the speed they have when arriving to the measuring instruments. That explains why always light speed c_o is measured in the frame of the instruments.

- The transformation rules of *special relativity based on space-time variables* as done by Einstein describe the macroscopic results between frames, making abstraction of the physical cause (measuring instruments) and require therefore space and time distortions. The transformation rules based on speed variables, as done in the proposed approach, take into consideration the physical cause (measuring instruments) and therefore don't require space and time distortions.

- All relevant relativistic equations can be deduced with the proposed approach. The transformation rules have no transversal components, nor for the speeds neider for the Doppler effect.

- The speed v_c of the fourth orthogonal coordinate gives the speed of the FPs emitted continuously by electrons and positrons and which continuously regenerate them.

- Particles with rest mass are more stable when moving because of the interactions of their Fundamental Particles (FPs) with the FPs of the masses of real reference frames as explained in [8], and not because of time dilation .

The transformation equations based on speed variables are free of time dilation and length contraction and all the transformation rules already existent for the electric and magnetic fields, deduced on the base of the invariance of the Maxwell wave equations are still valid for the proposed approach.

The electric and magnetic fields have to pass two transformations on the way from the emitter to the receiver. The first transformation is between the relative moving frames while the second is the transformation that takes into account that measuring instruments convert the speed of the arriving electromagnetic waves to the speed of light c_o in their frames.

The present work shows how the measuring equipment must be integrated in the chain of interactions to avoid unnatural conclusions like time dilation and length contraction.

Note: General Relativity introduced by Einstein is based on time dilation and length contraction and is the gravitation theory of the Standard Model. With the abolition of time and length distortions General Relativity is not more valid and is replaced by the gravitation theory based on the “reintegration of migrated electrons and positrons to their nuclei” as explained in [8].

Note: It is now the work of theoretical Professors from universities to correct the standard model making it free from the unphysical concepts of time dilation, length contraction and the principle of invariant light speed.

10 Bibliography.

Note: The present work is based on a completly new approach to explain the constancy of light speed in inertial frames and correspondingly no reference papers exist.

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