Special Galilean relativity

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This paper is an extract of [7] listed in section Bibliography.

Abstract

Special Relativity derived by Einstein presents time and space distortions and paradoxes. This paper presents an approach where the Lorenz transformations are build on equations with speed variables instead of space and time variables as done by Einstein. The result are transformation rules between inertial frames that are free of time dilation and length contraction for all relativistiv speeds, according to Galilean relativity. All the transformation equations already existent for the electric and magnetic fields, deduced on the base of the invariance of the Maxwell wave equations are still valid. The present work shows the importance of including the characteristics of the measuring equipment in the chain of physical interactions to avoid unnatural conclusions like time dilation and length contraction.

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 [7].

To arrive to the transformation equations Einstein made abstraction of the physical origin that makes 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 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 cause that produces the constancy of 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]:

$$\sum_{i=1}^{4}(\theta^i)^2 = \sum_{i=1}^{4}(\bar{\theta}^i)^2 \qquad \sum_{i=1}^{4}\bar{a}_k^i\bar{a}_l^i = \delta_{kl} \qquad \sum_{i=1}^{4}\bar{a}_i^k\bar{a}_i^l = \delta^{kl} \tag{1}$$

with

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

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. 1.

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

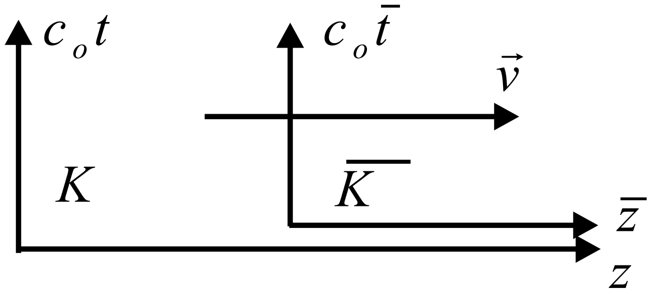

Figure 1: Transformation frames for **space-time** variables

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.

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

The 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 [7] from the author. 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.

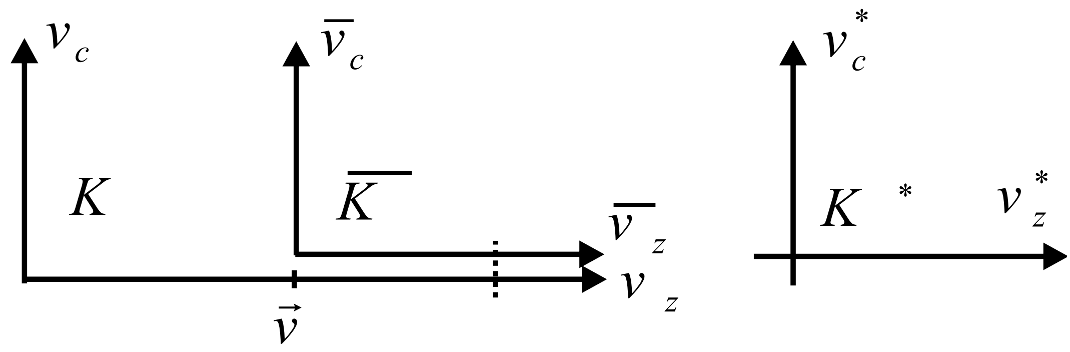

Figure 2: Transformation frames for **speed** variables

For the special Lorentz transformation with speed variables we get the following transformation rules between the frames K and $\bar{K}$:

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) $\bar{v}_z = \dfrac{v_z - v}{\sqrt{1 - v^2/v_c^2}} = (v_z - v)\,\gamma \qquad v_z = (\bar{v}_z + v)\,\gamma$

d) $\bar{v}_c = \dfrac{v_c - \dfrac{v}{v_c}\,v_z}{\sqrt{1 - v^2/v_c^2}} = (v_c - \dfrac{v}{v_c}\,v_z)\,\gamma \qquad v_c = (\bar{v}_c + \dfrac{v}{\bar{v}_c}\,\bar{v}_z)\,\gamma$

The factor

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

gives the non-linearity of the variables (linear momentum, energy, etc.) with the relative speed v of the frames, as will be shown for each case.

Note: The frame $\bar{K}$ is a *virtual* frame because the speeds calculated with the Lorentz transformation equations for this frame are not the real speeds of the particles, which are $\bar{v}_{r_z} = v_z \pm v$ according to the Galilean relativity. The frame $\bar{K}$ gives the virtual velocities that allow the calculation of the *potential values* of the momentum, acceleration, energy and energy density current which are not linear functions of the real speed $\bar{v}_{r_z}$. The potentiality of the values consists in that they are the values of the variables before they are detected by the measuring equipments that are placed in the frame K^* as shown in Fig 2. The virtual speeds are obtained by the product of the real speeds with the factor γ.

Between the frames K and $\bar{K}$ the Galilean relativity is valid.

$$\Delta \bar{z} = z_o \pm v\ \Delta t \qquad with \qquad \Delta \bar{t} = \Delta t \quad for\ all\ speeds \quad v \tag{7}$$

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

$$z = \bar{z} = z^* = 0 \qquad for \qquad t = 0 \tag{8}$$

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 is an absolute variable it is

$$\Delta t = \Delta \bar{t} = \Delta t^* \tag{9}$$

2.1 Transformations for electromagnetic waves at measuring instruments .

According to the approach "Emission & Regeneration" Unified Field Theory [7] from the author, electromagnetic waves that arrive from moving frames with speeds different than light speed to measuring instruments like optical lenses or electric antennas, are absorbed by their atoms and subsequently emitted with light speed c_o in their own frames. To take account of the behaviour of light in measuring instruments an additional transformation is necessary.

In Fig 2 the instruments are placed in the frame K^* which is linked rigidly to the *virtual* frame $\bar{K}$. Electromagnetic waves from the frame K move with the real 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)	$v_z = c_o$	$\bar{v}_{r_z} = c_o \pm v$	
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 *potential values* of the momentum, energy and frequency, which are not linear functions of the real speed $\bar{v}_{r_z}$. The potentiality of the values consists in that they are the values of the variables before they are detected by the measuring equipment, which for electromagnetic waves changes the speed abruptly to the speed of light c_o in the frame K^*. The virtual speeds in frame $\bar{K}$ are obtained through the product of the real (Galilean) speeds in frame $\bar{K}$ with the factor γ.

For electromagnetic waves we get for the different types of measurements

Measurement	**K**	$\bar{\mathbf{K}}$	$\overset{*}{\mathbf{K}}$	**Refraction**
ideal	$v_z = c_o$	$\bar{v}_z = c_o \pm v$	$v^*_z = c_o$	$n = 1$
non destructive	$v_z = z_o$	$\bar{v}_z = c_o \pm v$	$v^*_z < c_o$	$n > 1$
destructive	$v_z = c_o$	$\bar{v}_z = c_o \pm v$	$v^*_z = 0$	$n \Rightarrow \infty$

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

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

Following, equations are derived for particles with rest mass $m \neq 0$ that are observed from 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, acceleration, energy and energy density current between rigid linked frames.

3.1 Linear momentum.

To calculate the linear momentum in the virtual frame $\bar{K}$ of a particle placed at the origin of frame K with $v_x = v_y = v_z = 0$ we use the equation $c)$ of sec 2, with $v_c = c_o$ because K is not a virtual frame. The speed $v_c = c_o$ describes the speed of the Fundamental Particles (FP) [7] emitted continuously by electrons and positrons and which continuously regenerate them, also when they are in rest in the frame K ($v_x = v_y = v_z = 0$).

$$\bar{v}_z = \frac{v_z - v}{\sqrt{1 - v^2/v_c^2}} = (v_z - v)\gamma \qquad \textit{and get} \qquad \bar{v}_z = \frac{-v}{\sqrt{1 - v^2/c_o^2}} \tag{10}$$

The negative sign of $\bar{v}_z$ is because for the frame $\bar{K}$ the particle in the frame K moves in $-\bar{z}$ direction.

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

$$\bar{p}_z = m\,\bar{v}_z = m\,\frac{-v}{\sqrt{1 - v^2/c_o^2}} = p_z^* \tag{11}$$

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

With eq. (6) we can write the linear momentum as

$$m\,v\,\gamma = m\,v + m\,v\,\left\{\frac{1}{2}\,\frac{v^2}{v_c^2} + \frac{1\cdot 3}{2\cdot 4}\,\left(\frac{v^2}{v_c^2}\right)^2 + \frac{1\cdot 3\cdot 5}{2\cdot 4\cdot 6}\,\left(\frac{v^2}{v_c^2}\right)^3 + \cdots\right\} \tag{12}$$

where the first term of the right side is the linear part of the momentum due to the relative speed v between the frames, and the second term in {} brackets the contribution due to the non-linearity in v.

Note: The rest mass is simply a proportionality factor which is not a function of the speed and is invariant for all frames. The quotient $v/\sqrt{1 - v^2/v_o^2}$ describes the dynamic of the particle.

3.2 Acceleration.

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

$$\bar{a}_z = \frac{d\bar{v}_z}{dt} \qquad \textit{with} \qquad \bar{v}_z = \frac{v_z - v}{\sqrt{1 - v^2/c_o^2}} \tag{13}$$

what gives

$$\bar{a}_z = \frac{d\bar{v}_z}{dt} = \frac{dv_z/dt}{\sqrt{1-v^2/c_o^2}} = \frac{a_z}{\sqrt{1-v^2/c_o^2}} \tag{14}$$

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

$$a_z^* = \frac{a_z}{\sqrt{1-v^2/c_o^2}} \tag{15}$$

3.3 Energy.

To calculate the energy in the virtual frame $\bar{K}$ for a particle that is placed in the origin of frame K we use the equation $d)$ of sec 2, with $v_z = 0$ and $v_c = c_o$ because K is not a virtual frame.

$$\bar{v}_c = \frac{v_c - \dfrac{v}{v_c}\, v_z}{\sqrt{1-v^2/v_c^2}} = (v_c - \frac{v}{v_c}\, v_z)\gamma \qquad and\ \ get \qquad \bar{v}_c = \frac{c_o}{\sqrt{1-v^2/c_o^2}} \tag{16}$$

We multiply now $\bar{v}_c$ with the momentum $p_c = m\, c_o$ and get

$$\bar{E} = p_c\, \bar{v}_c = m\, c_o\, \bar{v}_c = \frac{m\, c_o^2}{\sqrt{1-v^2/c_o^2}} = \sqrt{E_o^2\ +\ \bar{E}_p^2} \tag{17}$$

with

$$\bar{E}_p = m\, |\bar{v}_z|\, c_o = |\bar{p}_z|\, c_o \qquad and \qquad E_o = m\, c_o^2 \tag{18}$$

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 $v_z = 0$. We get

$$\bar{v}_z = \frac{v_z - v}{\sqrt{1-v^2/c_o^2}} = \frac{-v}{\sqrt{1-v^2/c_o^2}} \qquad resulting \qquad \bar{p}_z = \frac{-v\, m}{\sqrt{1-v^2/c_o^2}} \tag{19}$$

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 $\bar{K}$.

With eq. (6) we can write the energy as

$$m\, c_o^2\, \gamma = m\, c_o^2 + \frac{1}{2}\, m\, v^2 + m\, c_o^2 \left\{ \frac{1\cdot 3}{2\cdot 4} \left(\frac{v^2}{c_o^2}\right)^2 + \frac{1\cdot 3\cdot 5}{2\cdot 4\cdot 6} \left(\frac{v^2}{c_o^2}\right)^3 + \cdots \right\} \tag{20}$$

where the first term of the right side gives the rest energy in frame K and the following terms the kinetic energy which is not linear with the speed v.

3.4 Energy density current.

The energy of one electron or positron in the frame $\bar{K}$ is

$$\bar{E} = m\, c_o^2\, \gamma \tag{21}$$

and the energy density is

$$\bar{\rho}_E = \frac{N}{dV}\, m\, c_o^2\, \gamma \tag{22}$$

with N the number of electrons or positrons in the volumen dV.

To get the energy density current we must multiply with the real speed in the frame $\bar{K}$ which is $v_r = v_z \pm v$ and get

$$\bar{J}_E = \bar{\rho}_E\, v_r = \frac{N}{dV}\, m\, c_o^2\, (v_z \pm v)\gamma = \frac{J_{E_z} \pm \rho_E\, v}{\sqrt{1 - v^2/c_o^2}} \tag{23}$$

with

$$J_{E_z} = \frac{N}{dV}\, m\, c_o^2\, v_z \qquad and \qquad \rho_E = \frac{N}{dV}\, m\, c_o^2 \tag{24}$$

where J_{E_z} is the energy density current and ρ_E the energy density, both in the frame K.

Note: The number N of particles, the volume dV and the particle density are equal in all frames (no length contraction).

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) [7] 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 carrying each ray the FPs with the opposed transversal angular momenta of the other. At each ray FPs exist only along the length L of the photon which forms a focus that moves with light speed.

The concept is shown in Fig. 3

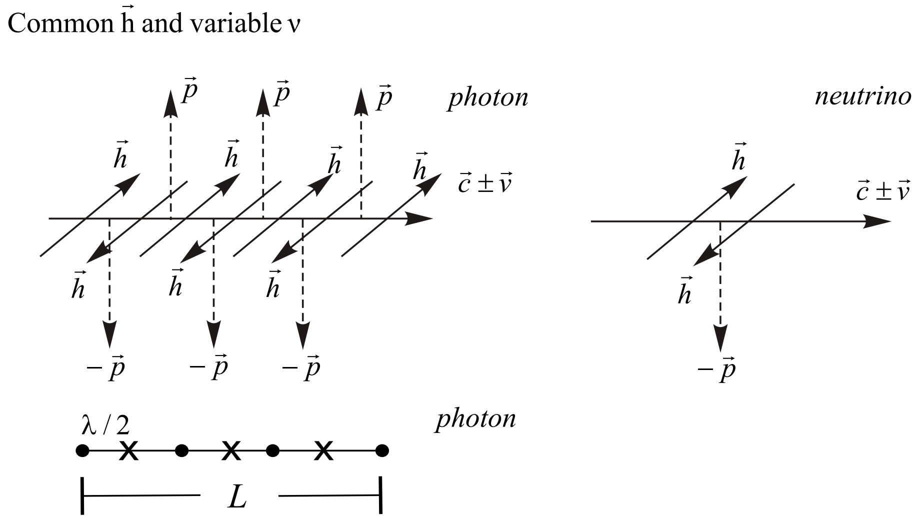

Figure 3: Photon and neutrino

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 $v_c = c_o$ because K is not a virtual frame. We get

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

The momentum of a photon in the frame K is $p_c = E_{ph}/c_o$ 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

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

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

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

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 Relativistic energy of FPs.

A photon is a sequences of pairs of FPs with opposed angular momenta at the distance $\lambda/2$ as shown in Fig. 3. 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 wave train 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 that the photon is composed of a train of FPs with alternated angular momenta where the distance between two consecutive FPs is equal $\lambda_t/2$. The number of FPs that build the photon is therefore $L/(\lambda_t/2)$ and we get for the energy of one FP

$$E_{\text{FP}} = \frac{E_t\ \lambda_t}{2\ L} = \frac{h}{2\ \tau} = 3.313 \cdot 10^{-26}\ J = 2.068 \cdot 10^{-7}\ eV \tag{29}$$

and for the angular frequency of the angular momentum h

$$\nu_{\text{FP}} = \frac{E_{\text{FP}}}{h} = \frac{1}{2\ \tau} = 5 \cdot 10^7\ s^{-1} \tag{30}$$

We can define an equivalent proportionality factor m_{FP}

$$E_{\text{FP}} = m_{\text{FP}}\ c^2 \qquad with \qquad m_{\text{FP}} = 2.29777 \cdot 10^{-24}\ \ kg \tag{31}$$

The relativistic energy of a FP is

$$\bar{E}_{\mathtt{FP}} = m_{\mathtt{FP}}\ c_o\ \bar{v}_c = \frac{m_{\mathtt{FP}}\ c_o^2}{\sqrt{1-v^2/c_o^2}} = \frac{2.068\cdot 10^{-7}}{\sqrt{1-v^2/c_o^2}}\ \ eV \tag{32}$$

A neutrino can be seen as $N_{\mathtt{FP}}$ pairs of FPs with opposed angular momenta that all contribute to one potential linear momentum.

$$E_{\mathtt{Neutrino}} = N_{\mathtt{FP}}\ E_{\mathtt{FP}} = N_{\mathtt{FP}}\ 2.068\cdot 10^{-7}\ eV \tag{33}$$

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

4.3 The proposed approach and the Standard Model.

The proposed approach [7] 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 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.

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.

5 Conclusions.

The special Lorentz transformation formulated by Einstein is based on space and time variables and the definition of different times for inertial frames, what leads to transformation rules between frames with time dilation and space contraction.

Based on the approach "Emission & Regeneration" Unified Field Theory [7], where electrons and positrons continuously emit and are regenerated by Fundamental Particles (FP), the following conclusions about *special relativity based on* ***speed variables*** were deduced:

- The fact of equal light speed in all inertial frames is basically a speed 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 atoms of measuring instruments like optical lenses or electric antennae are absorbed and subsequently emitted with light speed c_o relative to the measuring instruments, independent of the speed they have when arriving to the atoms of 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) of constant light speed in all frames and require therefore space and time distortions. The transformation rules of *special relativity based on speed variables* as done in the proposed approach, take into consideration the physical cause (measuring instruments) of the constant light speed in all frames 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 [7], 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.

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