# ALL SPECIAL RELATIVITY EQUATIONS OBTAINED WITH GALILEAN TRANSFORMATION

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## Abstract

Demonstration how to do the light velocity c it to be the same independently of the velocity of observer and obtain the mass-energy equivalence $E = \mathrm{mc}^2$ using the Galilean transformations and the 4 dimensions zoom-universe model characteristics.

Demonstration how to interpret it the time dilation/length contraction typical of the special relativity using the Galilean transformations and the 4 dimensions zoom-universe model characteristics.

Demonstration how to obtain the typical waves equation with transmission velocity c and how to obtain it through the medium for transmission of light given by the zoom-universe model.


## Zoom universe model characteristics

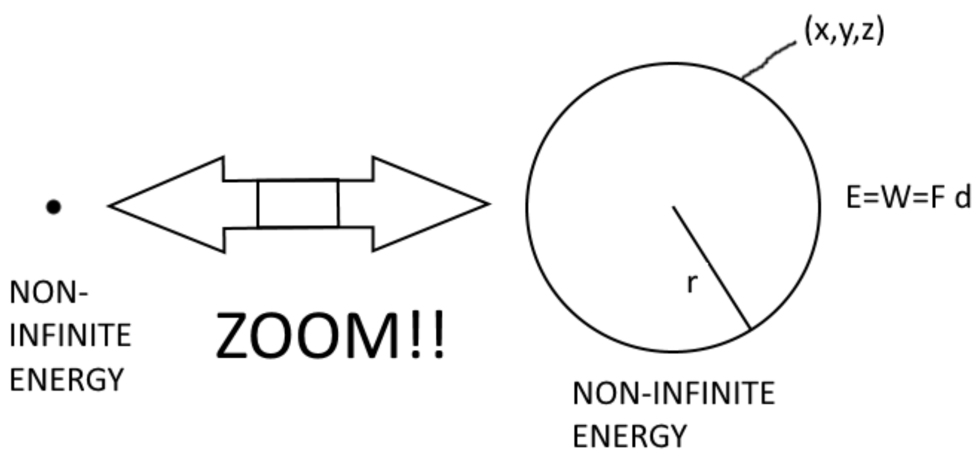
The Euclidean space is composed by 4 dimensions (x,y,z,Zz).

The normal 3 dimensions ( x,y,z) $\mapsto$ $(\alpha,\theta,\phi)$ are curved by a four dimension creating a hypersphere with radius r.

The coordinates of the surface of the hypersphere embedded can be ( x,y,z) intrinsic 3d view or $(\alpha,\theta,\phi)$ with r as radius extrinsic 4d view

If we represent the total non-infinite energy of that universe with a point in this Euclidean space we have 0 dimensions, if we make a zoom now we have 4 dimensions, 3 surface intrinsic coordinates (x,y,z) and 1 extrinsic coordinate r, with the same non-infinite energy

A object in a zoom scale, exist in all zoom scales, with which, we have a medium for transmission of light and electromagnetic waves similar at the transmission of longitudinal waves for solid through normal dimension (x,y,z)

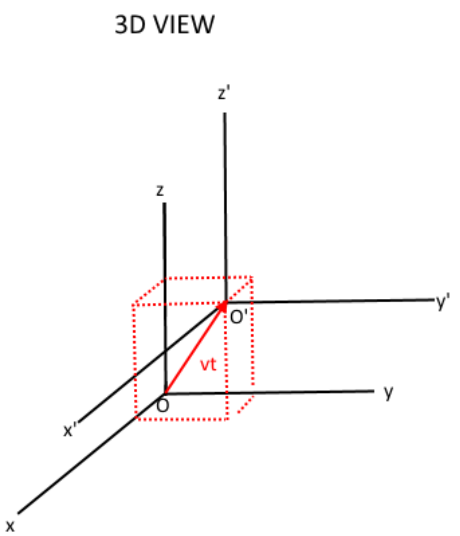


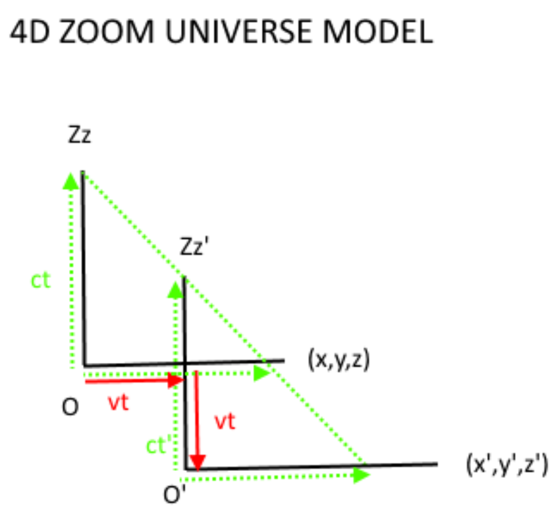
## Galilean transformations

$x' = x - v_x t \qquad y' = y - v_y t \qquad z' = z - v_z t \qquad , \qquad v = v_{\downarrow} = \sqrt{v_x^2 + v_y^2 + v_z^2}$

$z_z' = z_z + v_{\downarrow} t \qquad , \qquad z_z' = \sqrt{x^2 + y^2 + z^2}$ (if the $z_z'$ it's in the same zoom level than O)

$t' = t \qquad , \qquad z_z' = \sqrt{x'^2 + y'^2 + z'^2}$ (if the $z_z'$ it's in the same zoom level than O')




## Demonstration c is the same independently of the observer

The zoom universe model hypersphere is very large, we can take a "small" interval and make it is a plane interval

From the point of view of the mobile observer O' the length that light travels it's ct' ,it's the same length of $z_z'$ dimension

$x'^2 + y'^2 + z'^2 = (ct')^2$

Apply the Galileo transformations

$(x - v_x t)^2 + (y - v_y t)^2 + (z - v_z t)^2 = (ct)^2$

$x^2 - 2 x v_x t + (v_x t)^2 + y^2 - 2 y v_y t + (v_y t)^2 + z^2 - 2 z v_z t + (v_z t)^2 = (ct)^2$

As it's still at the same zoom level that the mobile observer O'

$(z_z')^2 + (v_{\downarrow} t)^2 - 2 x v_x t - 2 y v_y t - 2 z v_z t = (ct)^2 \qquad (1)$

It is $(x v_x + y v_y + z v_z)$ equal to $(z_z' v_{\downarrow})$ ?

$(x v_x + y v_y + z v_z) = \sqrt{v_x^2 + v_y^2 + v_z^2} \sqrt{x^2 + y^2 + z^2}$

$(x v_y - y v_x)^2 (x v_z - z v_x)^2 (y v_z - z v_y)^2 = 0$

$x v_y = y v_x \qquad \longrightarrow \qquad \frac{x}{y} = \frac{v_x}{v_y}$

$x v_z = z v_x \qquad \longrightarrow \qquad \frac{x}{y} = \frac{v_x}{v_y}$

$y\, v_z\ = z\, v_y \qquad \longrightarrow \qquad \frac{x}{y}\ = \frac{v_x}{v_y}$

Yes, in all cases is equal since as the light spreads like a sphere, whatever the direction of v it is equal to the light spread direction , with what, $(x\, v_x + y\, v_y + z\, v_z) = (z_z'\, v_\downarrow)$

Combining with equation (1) we have:

$(z_z')^2 + (v_\downarrow t)^2 - 2\, t\, (z_z'\, v_\downarrow)\ = (\text{ct})^2$

$(z_z' - v_\downarrow t)^2\ = (\text{ct})^2$

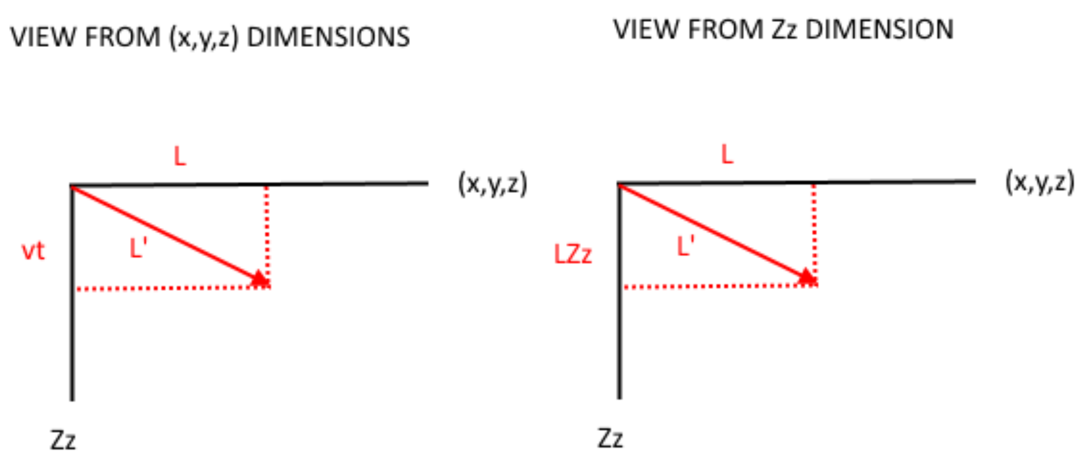
Apply the Galileo transformations

$(z_z)^2\ = (\text{ct})^2$

$x^2 + y^2 + z^2 = (\text{ct})^2$

It is true that the distance traveled and velocity of light is the same independently of the velocity of observer

# Length contraction




- **View from 3d (x,y,z) dimensions:**

First we have a own length called L’ and we use the velocity of light to have a invariance length $L' = \text{ct}$

From the 3D view we have:

$L^2 = (L')^2 - (\text{vt})^2$

$\frac{L}{L'} = \sqrt{1 - \frac{v^2}{c^2}} \qquad , \qquad \gamma = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}}$

$L = \frac{L'}{\gamma}$

It is the same as the special relativity.

- **View from Zz dimension:**

$\text{Lz}_z^2 = (L')^2 - (L)^2$

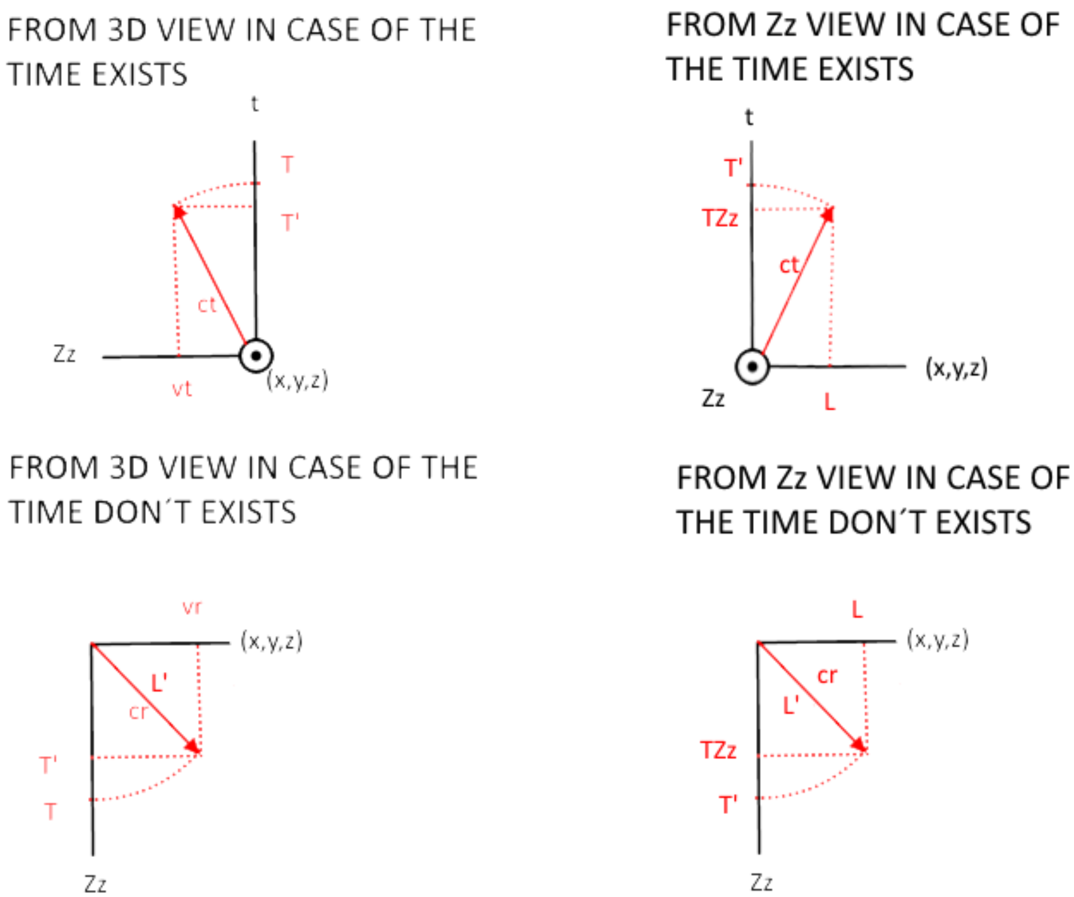
$\text{Lz}_z^2 = (L')^2 - \left(\frac{L'}{\gamma}\right)^2$

$\frac{\text{Lz}_z}{L'} = \sqrt{1 - \left(1 - \frac{v^2}{c^2}\right)} = \frac{v}{c}$

$Lz_z = \frac{v}{c} L' = \frac{v}{c} L \gamma$

This result don’t exist in special relativity, but it is very important in zoom special relativity.

## Time delation




### ■ From 3d view in case of the time exists

The time, in case of exist, it’s a dimension and that’s why it must be perpendicular to the rest of dimensions in a Cartesian coordinate system.

the measurement of the time it’s only possible if we have a velocity o frequency in a known dimensions, if that velocity is through a unknown dimension (Zz) the projection in our known dimensions it will be our measure of time.

So for a fix observer O the time it will be T but for a mobile observer O’ the time it will be the projection in a know dimension T’ (own time)

$T'^2 = (T)^2 - (\mathrm{vt})^2$

$\frac{T}{T} = \sqrt{1 - \frac{v^2}{c^2}}$ , $\gamma = \frac{1}{\sqrt{1-\frac{v^2}{c^2}}}$

$T' = \frac{T}{\gamma}$

It is the same as the special relativity.

### ■ From 3d view in case of the time don’t exists

In case of the time don’t exist, our time perception can be the movement given by the Zz dimension caused for a not perceptible velocity for us (the movement of the Earth or the milky way for example), (centrifuge force causes a movement in zoom dimension Zz caused for a 3d velocity) or maybe for the universe expansion.

In this case Zz it will be the time dimension for us (note that I have replaced the time t for radian hypersphere r in the picture)

The equations are the same as in the previous case and the same as the special relativity.

- **From Zz view in case of the time exists**

The time for a Zz view (TZz) it will be the projection of the own time T' so:

$\mathrm{Tz}_z^2 = (T')^2 - (L)^2$

$\mathrm{Tz}_z^2 = (T')^2 - \left(\frac{L'}{\gamma}\right)^2 \quad , \qquad T' = L' = \mathrm{ct}$

$\frac{\mathrm{Tz}_z}{T'} = \sqrt{1 - \left(1 - \frac{v^2}{c^2}\right)} = \frac{v}{c}$

$\mathrm{Tz}_z = \frac{v}{c} T' = \frac{v}{c} \frac{T}{\gamma}$

This result don't exist in special relativity, but it is very important in zoom special relativity.

- **From Zz view in case of the time don't exists**

In this case Zz it will be the time dimension for us (note that I have replaced the time t for radian hypersphere r in the picture).

The equations are the same as in the previous case.

## Mass-energy equivalence

Any movement in (x,y,z) directions it would be equal to a circle movement in our zoom universe hypersphere, we have a centrifuge force and a centrifuge acceleration

$a = \frac{v_O^2}{R}$

but this acceleration will be an acceleration for the O observer view, we need the acceleration for the $\mathrm{O}z_z$ observer view

$\mathrm{Lz}_z = \frac{v}{c} L \gamma$

$v\, t_{z_z} = \frac{v}{c} L \gamma$

$L = \frac{c\, t_{z_z}}{\gamma}, \qquad \frac{\mathrm{dL}}{\mathrm{dt}} = v_O = \frac{c}{\gamma}$

$a = \frac{c^2}{\gamma^2 R}$

We know for the elasticity Hooke´s law that:

$\mathrm{F} = -\mathrm{K}\ \mathrm{Lz}_z$

$m \frac{c^2}{\gamma^2 R} = -\mathrm{K}\ v\, t_{z_z} \quad , \qquad \mathrm{K} = -m \frac{c^2}{\gamma^2 R\, v\, t_{z_z}}$

The intrinsic elastic constant it is:

$K_i = -m \frac{c^2}{\gamma^2 v\, t_{z_z}}$

but this constant it is for the $\mathrm{O}z_z$ observer view, the same constant for the O observer view

$\mathrm{Tz}_z = \frac{v}{c} \frac{T}{\gamma}$

$K_i = -m \frac{c^3}{\gamma v^2 t} = -m \frac{c^3}{\gamma v L}$

$\mathrm{Lz}_z = \frac{v}{c} L \gamma$

$K_i = -m \frac{c^2}{\mathrm{Lz}_z}$

Potential Energy (U) from the zoom universe hypersphere:

$$U = -\int_{-R}^{0} K\, \mathrm{Lz}_z\, dz_z = -\int_{-R}^{0} \frac{K_i}{R}\, \mathrm{Lz}_z\, dz_z = \int_{-R}^{0} m\, \frac{c^2}{R}\, dz_z = \mathrm{mc}^2$$

We can conclude that the mass-energy equivalence $E = \mathrm{mc}^2$ it is the potential energy that need the matter to exist in a scale zoom in the zoom universe model

# Light transmission medium

We use the typical longitudinal elastic wave transmission method.

We take a little piece of length $\Delta_{\mathrm{Zz}}$ and the elongation of this piece we named $\delta_{\Delta \mathrm{Zz}}$

$$F(\mathrm{Zz}) = -\mathrm{K}\, \delta_{\Delta \mathrm{Zz}} = -K_i\, \frac{\delta_{\Delta \mathrm{Zz}}}{\Delta_{\mathrm{Zz}}} = -K_i\, \frac{d\delta}{d_{\mathrm{Zz}}} \qquad (1)$$

We named $\psi(\mathrm{Zz})$ at displacement of a section of piece, $\rho$ at the mass density and dm to a little mass

$$\mathrm{dF} = \mathrm{dm}\ a \quad , \quad \mathrm{dm} = \rho\ \mathrm{dx\ dy\ dz}$$

$$\mathrm{F(Zz)} - \mathrm{F(Zz + dZz)} = \mathrm{dm}\ \frac{\partial^2 \psi}{(\partial t)^2}$$

Maclaurin series:

$$\mathrm{dZz}\ \frac{\partial F}{\partial \mathrm{Zz}} = \rho\ \mathrm{dx\ dy\ dz}\ \frac{\partial^2 \psi}{(\partial t)^2}$$

If

$$\mathrm{Lz}_z = \frac{v}{c}\, L\, \gamma$$

We can do

$$\mathrm{dx} = \frac{\mathrm{dZz}\, c}{v\, \gamma}$$

and

$$\frac{\partial F}{\partial \mathrm{Zz}} = \rho\ \frac{c}{v\, \gamma}\ \mathrm{dy\ dz}\ \frac{\partial^2 \psi}{(\partial t)^2} \quad (2)$$

The little elongation of this section of piece we can defined:

$$\mathrm{d}\delta = \psi(\mathrm{Zz + dZz}) - \psi(\mathrm{Zz}) = \frac{\partial \psi}{\partial \mathrm{Zz}}\ \mathrm{dZz} = \mathrm{d}\psi$$

Equation (1):

$$F(\mathrm{Zz}) = -K_i\ \frac{d\delta}{d_{\mathrm{Zz}}} = -K_i\ \frac{d\psi}{d_{\mathrm{Zz}}}$$

$$\frac{\partial F}{\partial \mathrm{Zz}} = -K_i\ \frac{\partial^2 \psi}{(\partial_{\mathrm{Zz}})^2}$$

Equation (2):

$$\frac{\partial^2 \psi}{(\partial t)^2} = -K_i\ \frac{v\, \gamma}{\rho\, c\ \mathrm{dy\ dz}}\ \frac{\partial^2 \psi}{(\partial_{\mathrm{Zz}})^2}$$

If ( in the O observer view):

$$K_i = -\mathrm{dm}\ \frac{c^3}{\gamma\, v^2\, t}$$

$$\frac{\partial^2 \psi}{(\partial t)^2} = \frac{\mathrm{dm}}{v\, t}\ \frac{c^2}{\rho\ \mathrm{dy\ dz}}\ \frac{\partial^2 \psi}{(\partial_{\mathrm{Zz}})^2} \quad , \quad \mathrm{dm} = \rho\ \mathrm{vt\ dy\ dz}$$

$$\frac{\partial^2 \psi}{(\partial t)^2} = c^2\ \frac{\partial^2 \psi}{(\partial_{\mathrm{Zz}})^2}$$

That is the wave equation with velocity of transmission by the medium (Zz) c, the light velocity

# References

- http://teoria-de-la-relatividad.blogspot.com.es/2009/

- https://es.wikipedia.org/wiki/Resorte