New equations for bodies motions

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Abstract

New equations for bodies motions are derived from non-instantaneous forces, some equations of special relativity (but derived from Newtonian Physics), the galilean transformations and a preferred frame (the cosmic microwave backgound).

1. Introduction

In the new newtonian physics we use:

a) some special relativity equations, see Table 1.
b) Non-instantaneous forces, see Sect. 5 and 6
c) the galilean transformations and a preferred frame (the cosmic microwave backgound), see Sect. 4.

Below, we have a comparative for the basic equations of special relativity and new newtonian physics.

Experiment	Special Relat.	New Newton. Phys.
Mass variation	$m = m_0 \gamma$	$m = m_0 \gamma$ (1)
Kinetic energy	$k = m_0 c^2 (\gamma - 1)$	$k = m_0 c^2 (\gamma - 1)$ (2)
Relation mass-energy	$E = mc^2$	$E = mc^2$ (3)
Time dilation	$\Delta t = \Delta t_0 \gamma$	See section 6.2
Michelson-Morley	$\delta = 0$	See section 7

Table 1 - Equations of special relativity and new newtonian physics

Using the concepts of newtonian physics, Lewis (35 indications to Nobel prize in chemistry) [1] derived the equations of mass variation, kinetic energy and mass-energy.

The equations (1), (2) and (3) are respectively (15), (16) and (18) in [1]. Where m_0, v, c are respectively rest mass, velocity of the particle, velocity of light, $\beta = v/c$ and $\gamma = 1/\sqrt{1-\beta^2}$.

From [1] we have: "Recent publication of Einstein and Comstok on the relation of mass to energy has embolded me to publish certain views which I have entertained on the subject and a fews years ago appeared pure speculative, but which have been so far corrobated by recent advances in experimental and theoretical physics….. In the following pages I shall attempt to show that we may construct a simples system of mechanics which is consistent with all know experimental facts and which rests upon the assumption of the thruth of the threes great conservation laws, namely the law of conservation of energy, the law of conservation of mass and the law of conservation of momentum".

2. Inertial and non-inertial frames

New equations for bodies motions in inertial and non-inertial frames are deducted, see Sect. 5 and 6.

The need of new equations is shown by Novello [2], original in portuguese and our translation is:

" Four of the principal criticizes to the relativity are in the territory of the astrophysics and of the cosmology, to know: singularity, dark matter, dark energy and quantization….The scientists began then to seek for a new theory of the gravitation that would be the version relativistic of the newtonian formulation then describing the gravitational field as scalar, that is, for only one function (similar in this aspect, to the newtonian version)...."

3. Force

From equations (1), (2) and (3) we derive the equation of force:

$$\mathbf{F} = \frac{d(m\mathbf{v})}{dt} = m\frac{d\mathbf{v}}{dt} + \frac{\mathbf{v}(\mathbf{F}.\mathbf{v})}{c^2} \qquad (4)$$

$$F_x = m\frac{dv_x}{dt} + \frac{v_x^2 F_x}{c^2} \qquad (5)$$

$$F_y = m\frac{dv_y}{dt} + \frac{v_y^2 F_y}{c^2}$$

Substituting (1):

$$F_x = m_o \gamma \gamma_x^2 \frac{dv_x}{dt} \qquad (6)$$

$$F_y = m_o \gamma \gamma_y^2 \frac{dv_y}{dt}$$

Where $\gamma = 1\big/\sqrt{1-\beta^2}$, $\gamma_x = 1\big/\sqrt{1-\beta_x^2}$ and $\gamma_y = 1\big/\sqrt{1-\beta_y^2}$.

4. Basic equations

From (6), the galilean transformations, non-instantaneous force, the preferred frame S (cosmic microwave backgound) and the frame S' we have the equations of bodies motions.

From the newtonian physics we have:

a) The velocity of the light is a constant c with respect to the preferred frame, independently the direction of propagation, and of the velocity of the emitter.

b) An observer in motion with respect to the preferred frame will measure a different velocity of light according to Galilean velocity addition.
c) The preferred frame is the cosmic microwave background (CMB), and the velocity of the earth with respect to the CMB is approximately 390 km/s (0.0013c).
d) According to Zeldovich: at every point of the Universe there is an observer in relation to which microwave radiation appears to be isotropic.

From the new newtonian physics we have:
e) Coulomb force is generated by an electric wave. Gravitational force is generated by a gravitational wave. The electric and gravitational waves has velocity constant c with respect to the preferred frame, independently the direction of propagation, and of the velocity of the emitter.

5. Inertial frames and non-instantaneous force

Suppose two inertial frames (S ,S'), one particle without acceleration (charge Q, mass M) and one particle with acceleration (charge q , mass m).

S is the preferred frame (CMB) and S' is with velocity V constant in relation to S and parallel to the axis x. The velocity of q is **v** in relation to S .

Charge Q is at rest in S' (it is an approach for $M >> m$ and $Q \geq q$ or $Q >> q$ and $M \geq m$) and we have the Figure 1.

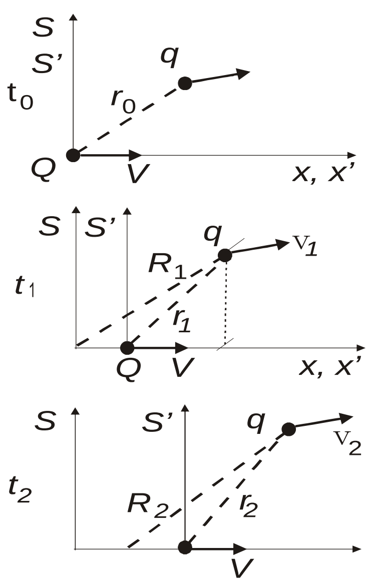

Figure 1 – Inertial frames S , S' and the particles q,Q.

At time t_0 the charge Q emits an electric wave front which happens in the charge q at time t_1. At time t_1 the charge Q emits an electric wave front which happens in the charge q at time t_2 and so forth. The electric wave has velocity c in relation to S .

For $V > 0$, constant and from the Galilean transformations we have:

$$
\begin{aligned}
x &= Vt + x' \\
y &= y' \qquad\qquad (7) \\
t &= t'
\end{aligned}
$$

(see about time dilation in Section 6.2, Equ. (25).

$$R_x = V\Delta t + x' \tag{8}$$

where Δt is the interval time in the which the force travels the distance R and $R = c\Delta t$.

$$R_y = y = y' \tag{9}$$

$$R_x = V\frac{R}{c} + x' = BR + x'$$

$$R = \frac{Bx' \pm \sqrt{x'^2 + y'^2 (1 - B^2)}}{1 - B^2} \tag{10}$$

where $B = V / c$.

The non-instantaneous Coulomb force in q is:

$$F_x = KqQ\frac{R_x}{R^3} \tag{11}$$

$$F_y = KqQ\frac{R_y}{R^3}$$

Equaling (6) and (11) we have the differential equations:

$$m_0 \gamma\gamma_x^2 \frac{dv_x}{dt} = KqQ\frac{R_x}{R^3} \tag{12}$$

$$m_0 \gamma\gamma_y^2 \frac{dv_y}{dt} = KqQ\frac{R_y}{R^3}$$

Multiplying and dividing the first term of (12) for dx' and from $dv_x = dv_{x'}$ we have:

$$m_0 \gamma\gamma_x^2 \int v_{x'} dv_{x'} = \pm KqQ \int \frac{R_x}{R^3} dx' \tag{13}$$

$$m_0 \gamma\gamma_y^2 \int v_{y'} dv_{y'} = \pm KqQ \int \frac{R_y}{R^3} dy'$$

where (+) is repulsive force and (-) is attractive force.

The differential equation is of second order and we need two integration.

In the first integration we have:

$$v_{x'} = f(x') \tag{14}$$

$v_{y'} = f(y')$

In the second integration we have:

$$x' = f(t) \qquad (15)$$

$$y' = y = f(t)$$

5.1 - Gravitation

The non-instantaneous gravitational force in q is:

$$m_0 \gamma \gamma_x^2 \frac{dv_x}{dt} = G m_0 \gamma M_0 \gamma_M \frac{R_x}{R^3} \qquad (16)$$

$$\gamma_x^2 \frac{dv_x}{dt} = G M_0 \gamma_M \frac{R_x}{R^3} \qquad (17)$$

where $\gamma_M = 1 / \sqrt{1 - V^2/c^2}$.

We note that for $V = 0$ we have an instantaneous force ($R = r$). From (9) and (10) we have:

$$R_x = x = x'$$
$$R = \sqrt{x'^2 + y'^2} \qquad (18)$$
$$\gamma_x^2 \frac{dv_x}{dt} = G M_0 \frac{R_x}{R^3}$$

6. Non-inertial frame and non-instantaneous forces

a) We have the preferred frame (S) and one non-inertial frame (S'). Particle Q is at rest in S' and q is with acceleration in relation to S'.

b) Let us suppose the particular case of repulsive forces between equal particles (mass $m = M$ and charge $q = Q$). We can make a mathematical artifice where we have: two inertial frames (S, S') and two particles (q, Q) with acceleration between them, equal in modulus and inverse y direction.

So, the case a) and b) are similar and mathematically equal, that is, the values calculated of R, v, F, t, etc are the same when calculated in relation to S.

The velocity of S' in relation to S is constant and $V > 0$. We consider only the Coulomb force. See Fig. 1.

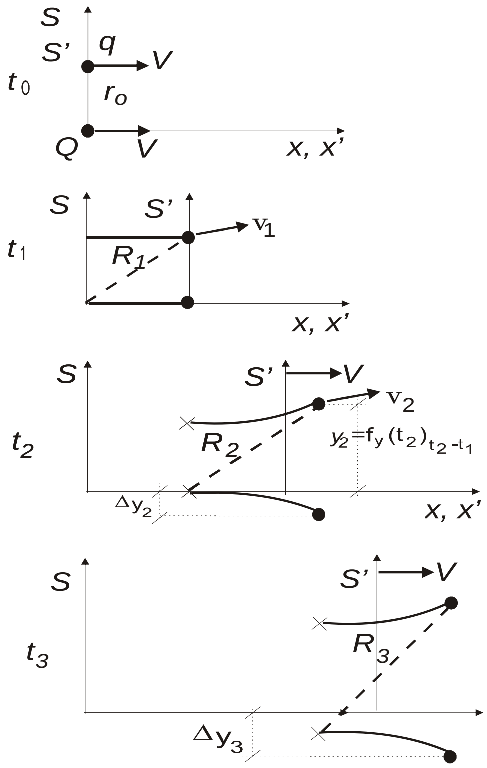

Figure 2 – Non inertial frame - Mathematical artifice using two inertial frames (S, S') and particles q, Q with acceleration between them equal in modulus and inverse y direction. For t_o to t_1 the particles has no acceleration and for $t > t_1$ its has acceleration in relation to S and S'.

6.1 From t_o to t_1 - First sequence

In this interval time the particles has no acceleration and the trajectories are parallel.
This is an approach, see Fig. 3.

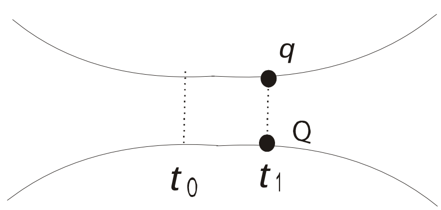

Figure 3 – Trajectories of particles q, Q. In the interval time t_o to t_1 the trajectories are approximately parallel.

The initial velocity of q and Q is V and parallel to x, x'.
From the Galilean transformations we have:

$$x = Vt$$
$$y = y' \qquad (19)$$
$$t = t'$$
(see about time dilation in Section 6.2, Equ. (25).

From Fig. 1 we have:

$$R = c\Delta t \tag{20}$$

where $\Delta t = t_1 - t_o$ is the interval time in the which the force travels the distance R.

$$R_x = V\Delta t \tag{21}$$
$$R_y = y = y'$$

$$R = \frac{y'}{\sqrt{1-B^2}} \tag{22}$$
$$R_1 = \frac{y_1'}{\sqrt{1-B^2}}$$

$$R_{x1} = BR_1 \tag{23}$$
$$R_{y1} = y_1$$

6.2 Time dilation

From (22) and dividing both terms by c we have:

$$\frac{R_1}{c} = \frac{y_1'}{c}\frac{1}{\sqrt{1-B^2}} \tag{24}$$

$$\frac{R_1}{c} = t_1 - t_o = \frac{t_a}{\sqrt{1-B^2}} \tag{25}$$

Equation (25) is the time dilation where $t_a = y_1'/c$ (for $V = 0$). The equation is only for the first sequence. For the others sequences the time dilation is different from (25). This subject should be continued the research. So, the time dilation in new newtonian physics is due the variation of forces (inside the atom) in relation to the velocity of the atom (v). For the example above we have $t_1 - t_o = t_a/\sqrt{1-\beta^2}$ and $\beta = v/c$.

6.3 From t_1 to t_2 - Second sequence

$$x = Vt + x'$$
$$y = y' \tag{26}$$
$$t = t'$$

From Fig. 1 we have:

$$R = c\Delta t \tag{27}$$

$$R_x = V\Delta t + x' \tag{28}$$
$$R_y = y = y'$$

where $\Delta t = t_2 - t_1$.

$$R = \frac{Bx' \pm \sqrt{x'^2 + y'^2 (1 - B^2)}}{1 - B^2} \tag{29}$$

From (29) and the differencial equation (13), in the first integration we have:

$$v_{x'} = f(x')_{t_2 - t_1} \tag{30}$$

$$v_{y'} = f(y')_{t_2 - t_1}$$

In the second integration we have:

$$x' = f_x(t)_{t_2 - t_1} \tag{31}$$

$$y' = f_y(t)_{t_2 - t_1}$$

And at time t_2 we have:

$$x'_2 = f_x(t_2)_{t_2 - t_1}$$

$$y'_2 = f_y(t_2)_{t_2 - t_1}$$

$$x_2 = Vt_2 + x'_2 \tag{32}$$

$$y_2 = y'_2$$

$$R_{x2} = BR_2 + x'_2$$

$$R_{y2} = y_2$$

6.4 From t_2 to t_3 - Third sequence

$$x = Vt + x'$$
$$y = y' \tag{33}$$

$t = t'$

From Fig. 1 we have:

$$R = c\Delta t \tag{34}$$

where $\Delta t = t_3 - t_2$.

$$R_x = V\Delta t + x' - x'_2 \tag{35}$$

$$R_y = y + f_y\left(t - \frac{R}{c}\right)_{t_2 - t_1} - y_1$$

For example: for $R_{2.1}$, see Figue 4, we have:

$$R_{y2.1} = y_{2.1} + \Delta y_{1.1} = y_{2.1} + y_{1.1} - y_1 \tag{36}$$

where $y_{1.1} = f_y\left(t_{2.1} - \frac{R_{2.1}}{c}\right)_{t_2 - t_1}$.

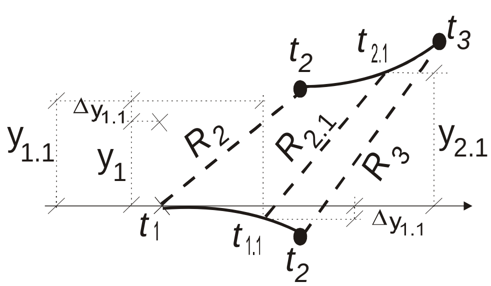

Figure 4 - The function $f_y\left(t_{2.1} - R_{2.1}/c\right)_{t_2 - t_1}$

$$R = \frac{Bx' - Bx'_2 \pm \sqrt{\left(-2Bx' + 2Bx'_2\right)^2 - (1 - B^2)\left(-x'^2 - 2x'x'_2 + x'^2_2 - y'^2 - 2y'\left(f_y(t - R/c)_{t_2 - t_1} - y_1\right) + \left(f_y(t - R/c)_{t_2 - t_1} - y_1\right)^2\right)}}{1 - B^2}$$

(37)

From (37) and the differencial equation (13), in the first integration we have:

$$v_{x'} = f(x')_{t_3 - t_2} \tag{38}$$

$$v_{y'} = f(y')_{t_3 - t_2}$$

In the second integration we have:

$$x' = f_x(t)_{t_3 - t_2} \tag{39}$$

$$y' = f_y(t)_{t_3 - t_2}$$

And at time t_3 we have:

$$x_3' = f_x(t_3)_{t_3 - t_2}$$

$$y_3' = f_y(t_3)_{t_3 - t_2}$$

$$x_3 = Vt_3 + x_3' \tag{40}$$

$$y_3 = y_3'$$

$$R_{x3} = BR_3 + x_3' - x_2'$$

$$R_{y3} = y_3 + y_2 - y_1$$

6.5 From t_3 to t_4 - Fourth sequence

$$R_x = V\Delta t + x' - x_3' \tag{41}$$
$$R_y = y + f_y(t - R/c)_{t_3 - t_2} - y_1$$

And at time t_4 we have:

$$x_4' = f_x(t_4)_{t_4 - t_3}$$

$$y_4' = f_y(t_4)_{t_4 - t_3}$$

$$x_4 = Vt_4 + x_4' \tag{42}$$

$$y_4 = y_4'$$

$$R_{x4} = BR_4 + x_4' - x_3'$$

$$R_{y4} = y_4 + y_3 - y_1$$

And we repeated the same calculations for the next sequences.

7. Michelson Morley experiment and the new newtonian physics

The Michelson Morley experiment [3] involves one semi-transparent mirror (half silvered) where the incident ray r_a is refracted, reflected and divided in two rays (r_b and r_d). See Fig. 5.

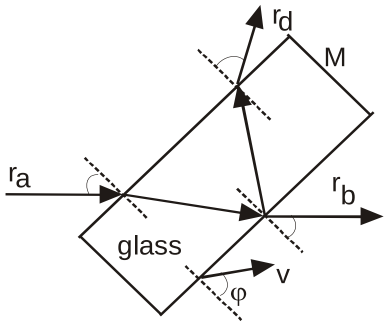

Figure 5 - The semitransparent mirror M with velocity V; the incident ray (r_a), the refracted-reflected-refracted ray (r_d) and the refracted-refracted ray (r_b).

So, for a complete calculations of the trajectory and the the displacement of the interference fringes we need to study the equations of refraction and reflection in vacuum and in glass.
The Michelson Morley experiment is composed of one semi-transparent mirror, 16 mirrors, a lens and a telescope.

7.1 Reflection in vacuum

In the Supplement of the MM paper [3], we show the equations of ray reflection in a moving mirror in relation to a preferred frame. The equations in relation to the CMB are the same.
From [3] we have:
" Let ab (Fig. 6) be a plane wave falling on the mirror m at an incidence of $45°$. If the mirror is at rest, the wave front after reflection will be ae. Now suppose the mirror to move in a direction which makes an angle φ with its normal, with velocity V. Let c be the velocity of light in the ether supposed stationary, and let ed be the increase in the distance the light has to travel to reach d. In this time….

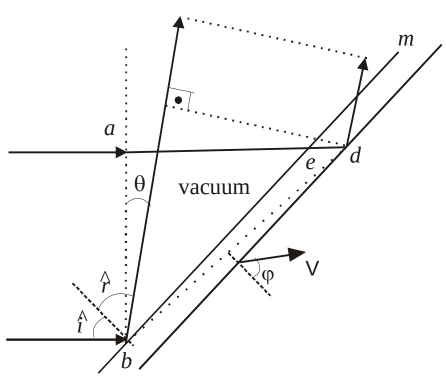

Fig. 6 – Reflection in vacuum. Incident plane wave and reflection plane wave.

$$\tan\left(45^\circ - \frac{\theta}{2}\right) = \frac{ae}{ad} = 1 - \frac{V\sqrt{2}\cos\varphi}{c} \quad .” \tag{43}$$

Below we have an equivalent and more general equation for any angle of the incident rays. From [4] Equs. (5) and (6) we have:

$$\tan\hat{r} = \frac{1 - B^2\cos^2\varphi}{1 + B^2\cos^2\varphi \pm 2B\cos\varphi\sec\hat{i}}\tan\hat{i} \tag{44}$$

Where $\hat{i}$ and $\hat{r}$ are respectively the angles of incidence and reflection in relation to the normal of the mirror. $B = V/c$, V is the velocity of the mirror in relation to CMB and φ is the angle of V with respect to the normal of the mirror.

The sign is negative when the mirror is moving away from the incident ray and positive when the mirror is moving towards it.

7.2 Reflection in glass

For $V = 0$:

$$u = \frac{c}{1.52} = 0.658c \tag{45}$$

Where u is the light velocity inside the glass in relation to CMB and glass with $V = 0$.

For $V > 0$:

$$\mathbf{u}_{CMB} = \mathbf{u} + \mathbf{V}\left(1 - \frac{u^2}{c^2}\right) \tag{46}$$

$$u_{CMB}^2 = \left[u_x + V_x\left(1 - \frac{u^2}{c^2}\right)\right]^2 + \left[u_y + V_y\left(1 - \frac{u^2}{c^2}\right)\right]^2 \tag{47}$$

Where u_{CMB} is the light velocity inside the glass in relation to CMB, V is the velocity of glass in relation to CMB and $V\left(1 - u^2/c^2\right)$ is the Fresnel drag.

$$\mathbf{u}_{glass} = \mathbf{u}_{CMB} - \mathbf{V} \tag{48}$$

Where u_{glass} is the light velocity inside the glass in relation to glass.

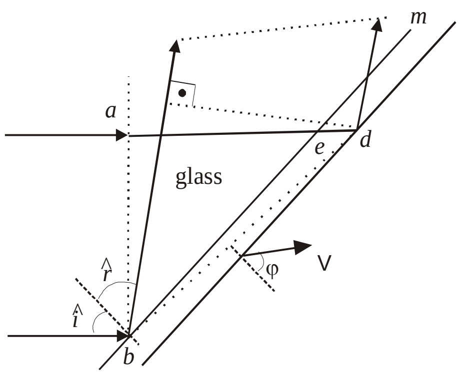

Figure 7 – Reflection in glass. Incident plane wave and reflected non-plane wave.

And from Fig. 7 we have after reflection a non-plane wave.
The equations of reflection in glass need to be developed.

7.3 Refraction in vacuum-glass for V = 0

From the Snell's law of refraction we have:

$$\sin\hat{i} = \frac{c}{u}\sin\hat{f}_0 = 1.52\sin\hat{f}_0 \tag{49}$$

7.4 Refraction in vacuum-glass for V > 0

$$\sin\hat{i} = \frac{c}{u_{CMB}}\sin\hat{f} \tag{50}$$

where $\hat{i}$, $\hat{f}_0$, $\hat{f}$ are the angles respectively of incidence, refraction for $V = 0$ and refraction for $V > 0$. The angles are in relation to the normal of the glass, see Fig. 4.

7.5 The Michelson Morley experiment

The Michelson Morley experiment is composed of one semi-transparent mirror, 16 mirrors, a lens and a telescope. In Fig. 8 we substitute 16 mirrors for 2 mirrors.

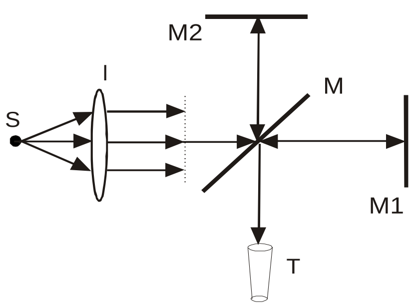

Figure 8 - The Michelson Morley experiment with one semi-transparent mirror, 2 mirrors, a lens and a telescope.

From Fig. 8 we have S, l, M, M1, M2 and T respectively the light source, lens, semi transparent mirror, mirror 1, mirror 2 and telescope.

For calculus simplification we substitute the lens l by the sun or star light which has the wave front practically plane when it reaches the earth. The interchange between sun or star lights and laboratory sources in no way altered the results [5-7].

The telescope we substitute by a screen B and we have the Fig. 9.

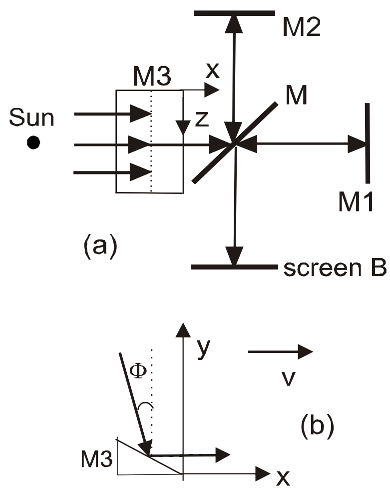

Figure 9 – Michelson Morley experiment with sun light and a secreen B. (a) is the plane x-z and (b) is the plane x-y.

Where M3 is a mirror to capture the sun or star light.

So, it is necessary to make the calculations of the displacement of interference fringes using the equations above.

Conclusion

New equations for bodies motions are derived for inertial and non-inertial frames.

For this we use:

c) some special relativity equations (but derived from newtonian physics)
d) non-instantaneous forces
e) the galilean transformations and a preferred frame (the cosmic microwave backgound).

The same special relativity equations of mass variation, kinetic energy and mass-energy relation are derived by newtonian physics and we have true the conservation of mass, energy and momentum.

The time dilation by new newtonian physics is showed the initial equations and it is necessary to continue the development to derive the complete equations.

For the Michelson Morley experiment is derived equations for refraction and reflection in glass (the MM experiment uses a semitransparent mirror, lens and telescope) and is necessary to to continue the development for the complete equations.

References

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