# Imaginary Inertia in Special Relativity

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**Abstract** The concept of inertia used in Special Relativity is imaginary, not real. Parallel imaginary worlds are created by the principle of relativity for the imaginary inertia. By Special Relativity, each reference frame is a center of the universe; observed from each reference frame all other reference frames are imaginary worlds. Observing the imaginary worlds, everything is inertial, including electromagnetic waves. Newton's laws are not an approximation of the special theory of relativity; the two theories are discontinuous and parallel.

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## Introduction

In section "§ 6" of [1], Lorentz coordinate transformation and Einstein state transformation are used to construct Lorentz Covariance of Maxwell's equations (LCM), that is, we get the same Maxwell's equations in two reference frames which are in relative motion at a constant velocity. Because "same equations = being inertial", LCM leads to a conclusion that the electromagnetic wave is inertial. We know that the concept of inertia is tied with the concept of mass. In [2], Einstein deduced that the electromagnetic wave is inertial because the wave energy acts as mass. Since the electromagnetic waves are inertial, it explains the null result of Michelson-Morley experiment (MME).

Since LCM already works on its own in explaining MME then why is the principle of relativity introduced?

It turns out that LCM does not lead to an inertial electromagnetic wave as we thought. Instead, it leads to an imaginary inertia in an imaginary world, which is created by the principle of relativity.

The word "inertia" does not appear in paper [1]. In its place is the principle of relativity. [1] and [2] use the following logic:

1. "the same equations" = being inertial
2. "the same equations" = the principle of relativity
3. The principle of relativity = being inertial

The above logic is described in paper [2].

Paper [2] says that "The results of the previous investigation lead to a very interesting conclusion", and the conclusion is that "the inertia of a body depends upon its energy content", and for "plane waves of light", "radiation conveys inertia between the emitting and absorbing bodies".

Thus, paper [2] says that paper [1] leads to a conclusion that light is inertial, and the reason for light being inertial is that energy and mass are equivalent.

In section 6 of [1], the principle of relativity is applied to Maxwell's equations. From that application in section 6 of [1], we know that "the same equations" is interpreted differently than the traditional concept of the inertia, I'll use the word "imaginary" to identify the difference:

1. “the same equations” interpreted traditionally = real inertia
2. “the same equations” interpreted by the principle of relativity = imaginary inertia

Later I’ll justify the use of the word “imaginary”.

# Imaginary inertia vs real inertia

## Real inertia

Let’s see how real inertia interprets “the same equations = inertia”.

For real inertia, we need a concept of a rest reference frame. By Newton’s law, at the rest reference frame when a force *F* acts upon a mass $m$ , the mass gets an acceleration $a$:

$$F = am \tag{2.1}$$

The velocity and distance equations are

$$v(t) = \frac{F}{m}t + v(0)$$
$$s(t) = \frac{1}{2}\frac{F}{m}t^2 + s(0) \tag{2.2}$$

Now suppose we have a reference frame moving at an acceleration of $a_0$, for example, an accelerating car. Equivalently, a force is acting upon all masses in the moving frame; for example, if we have seat-belts on then the force is upon our body. If we take off the seat-belt and jump up then the force disappears the moment our body disconnects with the car.

In the moving frame, suppose a force $F'$ acts upon a mass $m'$ , if the mass is free then the mass gets an acceleration by $\frac{F'}{m'}$ relative to the rest frame. If we are considering the movement caused by $F'$ then that means we take off the seat-belt and jump up; thus $a_0$ disappears for the mass. Relative to the moving frame, the total acceleration for the mass is $\frac{F'}{m'} - a_0$. The velocity and distance equations at the moving frame are

$$v'(t') = \left(\frac{F'}{m'} - a_0\right)t' + v'(0)$$
$$s'(t') = \frac{1}{2}\left(\frac{F'}{m'} - a_0\right)t'^2 + s'(0) \tag{2.3}$$

State equations (2.2) and (2.3) are different, showing that the moving frame is not inertial.

Let $a_0 = 0$ , we have

$$a_0 = 0 \tag{2.4}$$

$$v'(t') = \frac{F'}{m'}t' + v'(0)$$
$$s'(t') = \frac{1}{2}\frac{F'}{m'}t'^2 + s'(0) \tag{2.5}$$

State equations (2.2) and (2.5) are the same, showing that the moving frame is inertial.

The concept of inertia is tied with mass. If the mass is 0 then the above state equations are invalid. But we see the following 3 statements are equivalent.

- The reference frame is inertial
- The state equations are the same
- The acceleration is 0

Using “same equations = being inertial”, we have the definition of inertia without using mass. For example we can apply the concept of inertia to sound waves and electromagnetic waves.

Now we need to be careful about the rules used in interpreting “same equations = being inertial”. Suppose we observe the states of the rest frame from the moving frame, we need to apply a coordinate transformation to (2.2).

Suppose Galilean coordinate transformaton is used:

$$s' = s - v_0 t$$
$$t' = t \tag{2.6}$$

where $v_0$ is the frame moving speed. (2.2) becomes

$$v'(t') = \frac{F}{m}t' - v_0 + v'(0) \tag{2.2a}$$

| | |
|---|---|
| $s'(t') = \frac{1}{2}\frac{F}{m}t'^2 - v_0 t' + s'(0)$ | |

The formats of equations (2.2a) and (2.2) are different. It tells us that observing from a **different** frame the state equations are **different** when Galilean transformation is used.

Suppose Lorentz coordinate transformation is used:

| | |
|---|---|
| $\gamma = \frac{1}{\sqrt{1-\frac{v_0^2}{c^2}}}$<br>$s' = \gamma(s - v_0 t)$<br>$t' = \gamma(t - \frac{v_0}{c^2}s)$ | (2.6b) |

We have

| | |
|---|---|
| $v'(t') = \frac{ds'}{dt'}$<br>$s'(t') = \frac{1}{2}\gamma\frac{F}{m}\left(\gamma\left(\frac{v_0}{c^2}s' + t'\right)\right)^2 + \gamma s(0) - v_0\gamma^2\left(\frac{v_0}{c^2}s' + t'\right)$ | (2.2b) |

The formats of equations (2.2b) and (2.2) are different. It tells us that observing from a **different** frame the state equations are **different** when Lorentz transformation is used.

Now we have the following very important rules about interpreting "same equations = being inertial".

**Rule 1 of real inertia**: For "same equations = being inertial" to hold, the observer and the states to be observed must be in the same reference frame.

**Rule 2 of real inertia**: To an observer the state equations for different reference frames are different no matter which coordinate transformations are used.

Because we are going to talk about inertia of waves, let me use sound waves to show what is the concept of real inertia for waves. The principle of relativity applies to everything, including sound waves.

Inside a commercial airplane flying at a constant speed, sound waves of passenger conversations are inertial. Here "same equations = being inertial" means the following rules.

**Real inertia rule example 1:** the following two sets of equations are the **same**
1. the sound wave equations for airplane passenger conversations measured by the passengers.
2. the sound wave equations for people talking on a street measured by people on earth.

And the following sets of equations are **NOT THE SAME**.

**Real inertia rule example 2:** the following two sets of equations are **different**
1. the sound wave equations for airplane passenger conversations measured by the passengers.
2. the sound wave equations for the airplane engine noises outside measured by the passengers.

Also, the following two sets of equations are **NOT THE SAME**.

**Real inertia rule example 3:** the following two sets of equations are **different**
1. the sound wave equations for people talking on a street measured by people on earth.
2. the sound wave equations for airplane passenger conversations measured by people on earth.

To apply "same equations = being inertial", the observer and physical states to be observed must be in the same reference system. If one observer observes physical states of two different frames then the equations will be different. That was the reason the non-null result of Michelson-Morley experiment was expected.

Mimicking Michelson-Morley experiment using sound waves, let's consider one observer measuring two sound waves, one wave goes along with and the other goes perpendicular to the airplane flying direction. The observer is a passenger, so the observer's reference frame is the airplane.

**Case 1**: the two waves are inside the cabin; the equations for the two waves are the same; for example, passenger conversations; this is the real inertia. The two waves use the same reference frame as the observer's. The airplane is their reference frame.

**Case 2**: the two waves are outside the cabin, for example, airplane engine noises; the two waves use the earth as their reference frame. Since the observer and the physical states use different frames, to the observer, the sound waves are not inertial; sound waves of different directions will be different.

**Case 2a**: for Case 2, now imagine some passenger actually measures the two waves and does not see the difference between the two waves. For sound waves, this cannot happen; let's imagine it happened. But that was what actually happened with the Michelson-Morley experiment, or so we thought.

Now the question is how to explain Case 2a. By Special Relativity, the answer is a new concept of imaginary inertia.

## Imaginary inertia

The reason for Case 1 is that the air inside the cabin moves with the reference frame. Since the air outside the airplane does not move with the airplane, Case 2a cannot occur with sound waves.

But Case 2a occurred with lights. Therefore, someone proposed that "light medium" moves with the earth, making the lights inertial; this idea was rejected.

Special Relativity keeps the idea that the light is inertial but removes the idea of "moving light medium", and replaces the existing concept of inertia with a new concept of inertia which does not need "light medium", instead, it changes the way "the same equations = inertia" is interpreted. That is, Special Relativity changes the definition of the inertia.

To create a new concept of inertia, the first step Special Relativity makes was to remove the use of the rest frame.

Without the rest frame, Special Relativity needs to create two separate frames for the two waves. Let's see how these two reference frames are created for case 2a, according to the way section 6 of [1] uses.

The wave going perpendicular to the direction of airplane flying is assumed to be using the same reference frame of the earth, let's call it the stationary frame just to identify it; the wave going along the airplane flying direction is assumed to be using the airplane as its reference frame, let's call it the moving frame just to identify it.

For the stationary frame, the wave equations are known. What are the wave equations for the moving frame? The principle of relativity gives an answer, which says:

"The laws by which the states of physical systems undergo change are not affected, whether these changes of state be referred to the one or the other of two systems of co-ordinates in uniform translatory motion."

In section 6 of [1], "The laws … are not affected, … two systems of co-ordinates" is interpreted as that the state equations for the two reference frames are identical. Applying this principle to the sound waves, it is to say that the wave equations in the moving frame are the same as the wave equations in the stationary frame. It doesn't matter who the observer is with which reference frame.

By the principle of relativity, as it is interpreted in section 6 of [1], we have the following results for sound waves. From these results we can see that a new concept of inertia is created. Let's call it imaginary inertia.

**Imaginary inertia rule example 1**: The following sets of equations are **the SAME**.
1. the sound wave equations for airplane engine noise perpendicular to flying direction.
2. the sound wave equations for airplane engine noises parallel to flying direction.

We do not need to specify that the waves are measured by which observers because by the principle of relativity the results are the same. The above rule explains the null result of Michelson-Morley experiment, or so claimed by Special Relativity.

**Imaginary inertia rule example 2**: The following sets of equations are **the SAME**.
1. the sound wave equations for airplane passenger conversations measured by the passengers.
2. the sound wave equations for the airplane engine noises measured by the passengers.

and,

**Imaginary inertia rule example 3**: the following two sets of equations are **the SAME**.
1. the sound wave equations for people talking on a street measured by people on earth.
2. the sound wave equations for airplane passenger conversations measured by people on earth.

I specify the observers in the above two rules so that we may compare them with the real inertia.

"**Imaginary inertia rule example 2**" is directly opposite to "**Real inertia rule example 2**".
"**Imaginary inertia rule example 3**" is directly opposite to "**Real inertia rule example 3**".

Therefore, the imaginary inertia is incompatible with the real inertia.

Now we know that the principle of relativity and LCM does not lead to the real inertia. The concept of real inertia does not interpret "same equations = being inertial" in the ways the imaginary inertia does.

The difference between the real inertia and the imaginary inertia are conceptual, not quantitative. The concepts do not change with the changes of the speed value of the moving frame.

But the imaginary inertia actually cannot be created in the real world. An imaginary world is created in section "§ 6" of [1] as a home for the imaginary inertia. I'll describe it in the next section.

## Creation of an imaginary world

Let's start with the concept of real inertia. Suppose a physical law is represented by state equations (p.1) at the rest reference frame $(x, y, z, t)$.

| | |
|---|---|
| $P(S, x, y, z, t) = 0$ | (p.1) |

where $P$ is a vector function. By term "vector", I simply mean "several functions", I do not attach any vector related operations with it. If you prefer a term of "tensor" then that also will be fine with me. I still just use the meaning of "several". $S$ is a vector representing physical states.

The math condition for being "real inertial" is listed below, where $(x', y', z', t')$ is a moving frame of constant speed:

| | |
|---|---|
| $observe\ S\ from\ (x, y, z, t){:}\ P(S, x, y, z, t) = 0$ | (p.2) |
| $observe\ S'\ from\ (x', y', z', t'){:}\ P(S', x', y', z', t') = 0$ | (p.3) |

For the concept of "real inertia", $S$ and $S'$ are totally unrelated. $S$ may be the sound of street conversations and $S'$ may be airplane passenger conversations. Same symbol of $P$ in (p.2) and (p.3) represents the concept of "same equations = being inertial".

Now, if we observe $S$ from $(x', y', z', t')$ by adopting whatever coordinate transformation then the state equations will change. For example, suppose Lorentz coordinate transformation is used to map (p.2) to the moving frame, we have

$$P\left(S, \gamma(x' + vt'), y', z', \gamma\left(t' + \frac{v}{c^2}x'\right)\right) = 0$$

Let

$$P'(S, x', y', z', t') = P\left(S, \gamma(x' + vt'), y', z', \gamma\left(t' + \frac{v}{c^2}x'\right)\right)$$

We have

| | |
|---|---|
| $observe\ S\ from\ (x', y', z', t'){:}\ P'(S, x', y', z', t') = 0$ | (p.4) |

Note that a new symbol $P'$ is used in (p.4), indicating that the state equations changed, because we cannot guarantee that $P\left(S, \gamma(x' + vt'), y', z', \gamma\left(t' + \frac{v}{c^2}x'\right)\right) = P(S, x', y', z', t')$ holds for all physical state equations, that is, for arbitrary $P$.

Now the physically unrelated states $S'$ are no longer considered: (p.3) is out of our deduction process. We are only considering (p.2) and (p.4). The variable $S'$ is no longer needed. If you still want to use the symbol $S'$ in (p.4) then you **MUST** pay attention that it is no longer the same original meaning as in (p.3). We must re-use the symbol with two equations (p.5) and (p.6) to replace (p.4) because $S'$ is $S$:

| | |
|---|---|
| $S = S'$ | (p.5) |
| $observe\ S\ from\ (x', y', z', t'){:}\ P'(S', x', y', z', t') = 0$ | (p.6) |

Because $S = S'$, due to coordinate transformation it is mathematically impossible to have $P' = P$ for arbitrary $P$. According to (p.2), (p.5) and (p.6) we have not obtained an imaginary inertial conclusion for physical state $S$, yet, because we have not reached $P' = P$, as the principle of relativity requires.

The magic in [1] is performed by removing condition (p.5) tacitly and thus creating a freedom of changing $P'$. This freedom is used by Special Relativity to let $P' = P$:

| | |
|---|---|
| $S\ and\ S'do\ not\ need\ to\ be\ equal$ | (p.7) |
| $observe\ S\ from\ (x', y', z', t'){:}\ P(S', x', y', z', t') = 0$ | (p.8) |

By removing condition (p.5), it is mathematically possible to let $P' = P$ (note the word "**let**" for its subjectiveness and arbitrariness, or inventiveness), the "imaginary inertia" is thus created/invented, expressed by (p.2) and (p.8):

$$observe\ S\ from\ (x, y, z, t){:}\ P(S, x, y, z, t) = 0$$

$$observe\ S\ from\ (x', y', z', t'){:}\ P(S', x', y', z', t') = 0$$

Note that (p.2) and (p.8) define a mapping relation between $S$ and $S'$:

| | |
|---|---|
| $S' = F(S){:}\ P(S', x', y', z', t') = P(S, x, y, z, t)$ | (p.9) |

The above is the mathematical process of applying the principle of relativity to Maxwell's equations in [1] section "§ 6". (p.9) is the mathematical expression of the principle of relativity; applying the principle of relativity is to solve equation

| | |
|---|---|
| $P(S', x', y', z', t') = P(S, x, y, z, t)$ | (p.10) |

for a relation of

$$S' = F(S) \quad \text{(p.11)}$$

By removing condition (p.5), and replacing it with (p.7), a new state $S'$ , an imaginary state, is created/invented. Thus, a new world, an imaginary world, is created/invented.

Condition (p.5) is used in [1] but not explicitly listed in [1]. Thus, removing of (p.5) is not explict in [1], even though removing (p.5) was an extraordinary operation leading to a new imaginary state forming an imaginary world.

It is hard for some people to swallow. Some authors try to reconcile the imaginary world with the real world, by pointing out that observing $S$ from frame $(x', y', z', t')$ $S$ will be different, and thus $S'$ is not imaginary. Some authors use an example of watching through a moving train window, the outside objects look different. Some authors use an example of an electric charge generating a static electric field in a resting frame and generating an electric current for a moving frame. There can be many such examples.

These authors have not noticed that every such example introduces a real world condition to replace the original condition (p.5). We may use a deterministic real world rule $T(S)$ to represent such a real world condition. Condition (p.5) is replaced with a new condition (p.5a).

$$T(S) = S' \quad \text{(p.5a)}$$

It does not affect the math fact that we cannot guarantee that

$$P\left(T(S), \gamma(x' + vt'), y', z', \gamma\left(t' + \frac{v}{c^2}x'\right)\right) \neq P(S, x', y', z', t') \quad \text{(p.12)}$$

does not hold for arbitrary $P$.

No matter what $T(S)$ is, due to (p.12) the imaginary inertia must remove (p.5a) and replace it with (p.11), just that (p.11) is defined by (p.10a) instead of (p.10):

$$P(S', x', y', z', t') = P(T(S), x, y, z, t) \quad \text{(p.10a)}$$

That is, anything from the real world must be removed. The imaginary world does not allow it due to (p.12).

Why is it an imaginary world? Because every $T(S)$ is a solution to a real world problem, but $F(S)$ is a solution to a problem which does not exist in the real world. For details, see section “The problem to be solved by Special Relativity” in [4].

The real world condition $S = S'$ is like an elephant in a room, everyone can see it. The mathematical wonder of Lorentz Covariance of Maxwell’s equations acts as a powerful wand of a great magician; the elephant disappears before anyone, including Einstein and all of us, who is touched by the wand. For how LCM works, see [4].

# Newton’s law vs Special Relativity

Because (p.11), $S' = F(S)$, is the soul of the special theory of relativity, it deserves to have a name. Let’s call it “Einstein state transformation”. It provides a mapping between the real world, represented by state $S$, and the imaginary world, represented by state $S'$. The mapping is defined by the principle of relativity for the purpose of creating the imaginary inertia.

Here, you must not get confused by the symbol $S'$. If you use the symbol $S'$ to represent states in frame $(x', y', z', t')$ then it represents the real states in the real world. If you use the symbol $S'$ to represent states in frame $(x, y, z, t)$ then it represents the imaginary states in an imaginary world. To an observer, physical states in the same frame are real, states in other frames are imaginary.

By the special theory of relativity, no one can see the real world from other reference frames. Anyone walking beside you is in an imaginary world. The imaginary worlds do not follow Newton’s law $F = am$.

For electromagnetic fields, the mapping between the real and imaginary worlds happen to be constant and linear. For other types of states, such as sound waves, Hooke’s law, etc., the mappings do not have to be linear and constant.

Let’s see what is the Einstein state transformation for Hooke’s law.

By Hooke’s law, the physical state equation is

$$m\frac{\partial^2 x}{\partial t^2} = -x \quad \text{(h.1)}$$

Where $m$ is the mass divided by a spring factor. Apply the principle of relativity, we have

$$m'\frac{\partial^2 x'}{\partial t'^2} = -x' \quad \text{(h.2)}$$

We solve the above equations for a relation of $m' = F(m)$. Apply Lorentz coordinate transformation to (h.2), we have

| | |
|---|---|
| $m'\gamma^3\left(1+\left(\frac{\partial x}{\partial t}\right)^{-2}v^2\right)^2\frac{\partial^2 x}{\partial t^2}=-x+vt$ | (h.3) |

The relativistic $m$, or imaginary $m$, becomes

| | |
|---|---|
| $m'=\frac{x-vt}{\gamma^3\left(1+\left(\frac{\partial x}{\partial t}\right)^{-2}v^2\right)^2 x}m$ | (h.4) |

(h.1) and (h.2) form Lorentz Covariance of Hooke's law. (h.4) is the Einstein state transformation for Hooke's law.

For real inertia, Hooke's law is inertia because of the mass: by Newton's law, null acceleration means no extra forces on the mass. $m$ in (h.1) and $m'$ in (h.2) are totally unrelated.

(h.1) and (h.2) also represent the real inertia. That is where the confusions can arise; the imaginary inertia is mistakenly taken as the real inertia. For real inertia, $m$ and $m'$ are totally unrelated two real objects, $m$ must be a mass in frame $(x,t)$ for (h.1) to hold. $m'$ must be a mass in frame $(x',t')$ for (h.2) to hold.

For imaginary inertia, there can be only one mass observed from both frames. If we let $m$ be at frame $(x,t)$ then we imagine an equation of (h.2) in an imaginary world as an illusion of the real world equation (h.1), $m'$ is an illusion of $m$, and link $m$ in (h.1) and $m'$ in (h.2) by a relation of (h.4) for the purpose of equation symmetry. Such a link never exists in Newton's laws or in any classic physics.

In [2], the "relativistic mass" is given by

| | |
|---|---|
| $m'=\gamma m$ | (h.5) |

Thus, the formula for "relativistic mass" is not unique, showing its illustrative nature.

We can see that the two concepts of inertia are fundamentally different. That is, the special theory of relativity creates its own laws in the imaginary world to replace Newton's law in the real world.

We have been using such a relation to think that the two theories merge at 0 speed:

$$\lim_{v\to 0} m' = \lim_{v\to 0} m$$

Actually by using Galilean transformation, the above relation also holds.

We are talking about basic axioms which do not change with the values of speed; we are not doing pattern-recognitions with data. Let me use math language to describe that the two theories do not merge at 0 speed.

1. Newton's axiom: $F=am$
2. Einstein's axioms:
   a. $(x',y',z',t')^T=L(x,y,z,t)^T$
   b. $P(S',x',y',z',t')=P(S,x,y,z,t)\ \forall P$

Where $(x,y,z,t)$ is coordinate, $L$ is a constant matrix representing Lorentz coordinate transformation, 2.a is equivalent to the postulate of constant light speed; $P$ represents physical laws, $S$ is physical states, 2.b is the principle of relativity.

Let's denote Newton's axiom as a function of speed:

| | |
|---|---|
| $Newton(v), \forall\, v\in\mathcal{R}$ | (n.1) |

Let's denote Einstein's axioms as a function of speed:

| | |
|---|---|
| $Einstein(v), \forall\, v\in\mathcal{R}, v\neq 0$ | (n.2) |

The two theories have the following properties.

The axioms are speed-invariant:

| | |
|---|---|
| $Newton(v_1)=Newton(v_2), \forall\, v_1\in\mathcal{R}, v_2\in\mathcal{R}$ | (n.3) |
| $Einstein(v_1)=Einstein(v_2), \forall\, v_1\in\mathcal{R}, v_2\in\mathcal{R}, v_1\neq 0, v_2\neq 0$ | (n.4) |

We already know that the real inertia by $Newton$ is opposite to the imaginary inertia by $Einstein$. Thus, the two theories are different when speed is not 0:

| | |
|---|---|
| $Newton(v)\neq Einstein(v)\ \forall\, v\in\mathcal{R}, v\neq 0$ | (n.5) |

By (n.3) and (n.4), the two theories are continuous in their respective ranges. Thus their limits at speed 0 exist. There exists a speed $v_0$ such that

| | |
|---|---|
| $\lim_{v \to 0} Newton(v) = Newton(v_0), v_0 \in \mathcal{R}, v_0 \neq 0$ | (n.6) |
| $\lim_{v \to 0^-} Einstein(v) = Einstein(v_0), v_0 \in \mathcal{R}, v_0 \neq 0$ | (n.7a) |
| $\lim_{v \to 0^+} Einstein(v) = Einstein(v_0), v_0 \in \mathcal{R}, v_0 \neq 0$ | (n.7b) |

By (n.5), (n.6) and (n.7), we have

| | |
|---|---|
| $\lim_{v \to 0} Newton(v) \neq \lim_{v \to 0^-} Einstein(v)$ | (n.8) |
| $\lim_{v \to 0} Newton(v) \neq \lim_{v \to 0^+} Einstein(v)$ | (n.9) |

(n.8) and (n.9) tell us that the two theories do not merge at speed = 0.

In another word, Newton's laws are not approximations to the special theory of relativity.

The two theories, the special theory of relativity and Newton's laws, are two parallel theories with no connections with each other.

# Characteristics of imaginary inertia

## Everything is inertial imaginarily

For imaginary inertia, everything is inertial. It does not make sense with real inertia. A WIKI author tries to reconcile the two concepts of inertia by changing the principle of relativity to the following wording:

"The laws of physics are invariant (identical) in all inertial frames of reference (that is, frames of reference with no acceleration)." ([3])

This wording lists the real inertia as the first part, and lists the imaginary inertia as the second parenthetical sentence.

The parenthetical sentence says that all reference frames with no acceleration are inertial frames. This is imaginary inertia not real inertia. For real inertia, an airplane is an inertial frame for sounds inside the cabin but not an inertial frame for engine noises.

The first part of the above new wording of the principle of relativity adds a word "inertia" which is not in wording of [1]. Since "same equations = being inertial", the new wording is equivalent to say: "all horses are white for white horses". It is expressing a definition as a theorem. Using such a theorem to make deductions will lead to fake deductions of "we deduced A=B because we assumed A=B". In [2], deduction starts with a relativistic energy formula. In [1], LCM deduction starts by assuming that the electromagnetic fields are inertial. Let's talk about it in the next section.

## Being imaginary inertial is assumed

The only place in paper [1] where Maxwell's equations are used to do the "same equations" deduction is section 6, where Lorentz Covariance of Maxwell's equations is deduced. Section 6 of [1] is the place where the "very interesting conclusion" of lights being inertial is deduced, referred to in [2]. Let's summarize the deduction process.

1. Deduction basis 1: according to the principle of relativity (or say, for the purpose of Special Relativity), Maxwell's equations are the same for the two reference frames
2. Deduction basis 2: Lorentz coordinate transformation
3. Deduction result: Einstein state transformation, which is constant and linear.

We can see that "the same equations", or being inertial, is not the result of the deduction, it is a basis for deduction.

# Summary

Electromagnetic fields are imaginary inertial in imaginary worlds, not inertial in the real world.

By the special theory of relativity, every observer is at the center of the universe. Observers in relative motion are in different centers of universes. To an observer, all other things in motion are in parallel imaginary worlds; things at same velocity are in the same imaginary world.

The special theory of relativity is not an improvement on Newton's laws. Their fundamental differences do not change with the value of speed. Thinking that the two theories merge at 0 speed is just another imagination.

Why are imaginary inertia and imaginary worlds created? It is because the problem to be solved by Special Relativity does not exist in the real world. See [4].

# References

[1] Albert Einstein, On the Electrodynamics of Moving Bodies, June 30, 1905, from The Principle of Relativity, published in 1923 by Methuen and Company, Ltd. of London. Most of the papers in that collection are English translations by W. Perrett and G.B. Jeffery

[2] Albert Einstein, DOES THE INERTIA OF A BODY DEPEND UPON ITS ENERGY-CONTENT? September 27, 1905, https://www.fourmilab.ch/etexts/einstein/E_mc2/www/

[3] Special relativity, https://en.m.wikipedia.org/wiki/Special_relativity

[4] David Wei Ge, On Special Relativity, 2024