The Lorentz Transformation Equation for Tachyon Particles Moving Faster Than Light

Muhammad Yasin (md.yasin@ymcontents.com)
https://orcid.org/0000-0001-7303-8390

Research Article

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The Lorentz Transformation Equation for Tachyon Particles Moving Faster Than Light

Muhammad Yasin*

Researcher in Bangladesh, Savar,Dhaka

Email: md.yasin@ymcontents.com

Abstract

The Lorentz transformation of a particle that travels faster than light is the trajectory of the particle. When a particle travels faster than light, ordinary Lorentz transformation is not applicable to it, so a different Lorentz transformation is required. Some scientists have published Lorentz transformations for fast-moving particles from light, but to me, the Lorentz transformation given by A Rachman, R Dutheil did not seem appropriate enough. This is because the trajectory of tachyon particles is not clear from their equations. In this article, Lorentz transformation has been proven without violating the theory of relativity, which is the trajectory for faster particles than light. This article shows the Lorentz transformation equation for particles moving at a faster velocity than light (v> c) under a v <c or static observer without violating the theory of relativity.

***Keywords*:** Lorentz transformation, Faster than light, Tachyon particles.

1. Introduction

In 1905, Einstein published the theory of relativity[1]. According to the theory of relativity, the velocity of any particle through a vacuum cannot be greater than light. If the velocity of an object of mass m is v<c, then it is never possible to make that object v> c by increasing the acceleration continuously. But in 1962, scientists like George Sudarshan, Olexa-Myron Bilaniuk, and Vijay Deshpande theorized that there is a possibility that particles can travel faster than light (v> c)[2]. Particles moving faster than light are called tachyon particles[3]. Scientists are trying to capture the tachyon particle in the lab in different ways. It seems to me that in order to find a tachyon particle in the lab, we must first find out the Lorentz transformation equation of the reference frame particle running at a velocity of v <c relative to the reference frame running at v <c, because knowing the trajectory of a particle will tell us about the properties of the particle. Our main purpose in this article is to determine Lorentz transformation for an object moving faster than light. This article shows the Lorentz transformation equation for particles moving at a faster velocity than light (v> c) under a v <c or static observer without violating the theory of relativity. A Rachman, R. Dutheil mentioned the Lorentz transformation equation[4] in their research paper. The trajectory of tachyon particles is not clear from their equations

2. Methodology

In this article, the Lorentz transformation equation for particles moving faster than light (v> c) will be called Imagine Lorentz transformation (ILT) and Imagine Inverse Lorentz transformation (IILT). Although some scientists have used superluminal

Lorentz transformation to name faster particles than light. The main discussible subject of Imagine Lorentz transformation (ILT) is the Lorentz transformation (LT) for a particle moving at a speed of v> c relative to an observer moving at a speed of v <c. First, we consider two reference frames. One of the two reference reference frames is the inertial reference frame of the observer which is Less dynamic than light (v <c) or static (v=0) and the other reference frame is for the particles moving faster than light (v> c). Suppose the inertial reference frame is S for an observer with a velocity less than light (v <c) or static (v=0), and the S' is an reference frame for a particle with a velocity faster than light v>c. The S' frame is moving along the X-axis relative to the S frame at v> c velocity.

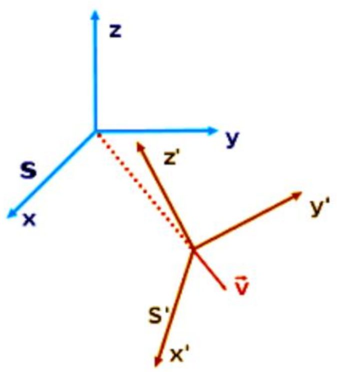

Figure:1

According to the second postulate of the theory of relativity, the speed of light is constant for all reference frames in a vacuum.

That is, in the inertial reference frame S, x=c 1

And in the reference frame S', x'=ct' 2

If S' reference frame moves with velocity v <c relative to S inertial reference frame then we can write Lorentz factor, x '= k (x-vt). 3

And if S' reference frame moves with velocity v> c relative to S inertial reference frame then we can write lorentz factor[5] x '= Υ (x-vt) 4

Now we will find out ILT and ILT from Equation 4 in terms of S', S frame. We know, Lorentz factor in the case of particles faster than light[5].

$$\Upsilon = \frac{1}{i\sqrt{\frac{v^2}{c^2} - 1}}$$

Now get by multiply the diagonally. And we get by calculate,

$$i\Upsilon\sqrt{\frac{v^2}{c^2} - 1} = 1$$

Get by squaring on both sides of the equation,

$$i^2\Upsilon^2\left(\frac{v^2}{c^2} - 1\right) = 1$$

Now we get by calculate,

$$i^2\Upsilon^2(v^2 - c^2) = c^2$$

get multiplying by $i^2\Upsilon^2$ on the left side of the equation

$$i^2\Upsilon^2v^2 - i^2\Upsilon^2c^2 = c^2$$

$$=> i^2\Upsilon^2v^2 = c^2 + i^2\Upsilon^2c^2$$

Get by taking c^2 common from the right hand side,

$$i^2\Upsilon^2v^2 = c^2(1 + i^2\Upsilon^2)$$

Dividing by Υvc on both sides of the equation,

$$\frac{i^2\Upsilon v}{c} = \frac{(1 + i^2\Upsilon^2)c}{\Upsilon v}$$

Let's addition the Υ constant on both sides of the equation,

$$\Upsilon + \frac{i^2\Upsilon v}{c} = \Upsilon + \frac{(1 + i^2\Upsilon^2)c}{\Upsilon v}$$

Now we get by calculate And Multiplying by ct on both sides of the equation

$$ct\left[\frac{\Upsilon + \frac{i^2\Upsilon v}{c}}{\Upsilon + \frac{(1 + i^2\Upsilon^2)c}{\Upsilon v}}\right] = ct$$

We know x=ct from equation 1

$$x = \frac{ct\left(\Upsilon + \frac{i^2\Upsilon v}{c}\right)}{\Upsilon + \frac{(1 + i^2\Upsilon^2)c}{\Upsilon v}}$$

$$=> x\left[\Upsilon + \frac{(1 + i^2\Upsilon^2)c}{\Upsilon v}\right] = ct\left(\Upsilon + \frac{i^2\Upsilon v}{c}\right)$$

Multiplying by x on the left side and ct on the right side of the equation,

$$\Upsilon x + \frac{(1 + i^2\Upsilon^2)cx}{\Upsilon v} = ct\Upsilon + i^2\Upsilon vt$$

Now we get by calculate,

$$\Upsilon x - i^2\Upsilon vt = ct\Upsilon - \frac{(1 + i^2\Upsilon^2)cx}{\Upsilon v}$$

Get by taking common factor by k on the left side and c on the right side of the equation,

$$\Upsilon(x - i^2vt) = c\left[t\Upsilon - \frac{(1+i^2\Upsilon^2)x}{\Upsilon v}\right] \quad 5$$

But from equation 2 we know that X '= ct' So, We can write by comparing Equation No. 2 and Equation No5,

$$X' = \Upsilon(x - i^2vt) \quad 6$$

And $t' = t\Upsilon - \frac{(1+i^2\Upsilon^2)x}{\Upsilon v}$ 7

Get from Equation 6,

$$X' = \Upsilon(x + vt) \qquad [i^2 = -1] \quad 8$$

From equation 7 we get,

$$t' = t\Upsilon - \frac{(1 + i^2\Upsilon^2)x}{\Upsilon v}$$

Now we get by calculate

$$\Upsilon t'v = \Upsilon^2vt - (1 + i^2\Upsilon^2)x$$
$$=> \Upsilon t'v = \Upsilon^2vt - x - i^2\Upsilon^2x$$
$$=> x = \Upsilon^2x + \Upsilon^2vt - \Upsilon t'v \qquad [i^2 = -1]$$
$$=> x = \Upsilon[(x + vt) - vt']$$
$$\therefore x = \Upsilon(x' - vt') \quad 9$$

So Equation 8 is imagine Lorentz transformation (ILT) and Equation 9 is imagine inverse Lorentz transformation (IILT). To verify (ILT) and (IILT) we will prove the Lorentz factor with imagine Lorentz transformation (ILT) and imagine inverse Lorentz transformation (IILT).

imagine inverse lorentz transformation (IILT) equation $x' = \Upsilon(x - i^2vt)$ or $X' = \Upsilon(x + vt)$ and imagine lorentz transformation (ILT) equation $x = \Upsilon(x' - vt')$

Again from figure 1, Suppose the inertial reference frame is S for an observer with a velocity less than light (v <c) or v = 0m / s, and the S is an inertial reference frame for a particle with a velocity faster than light v> c. The S 'structure is moving along the X-axis relative to the S structure at v> c velocity.

Now, let us put the value of x of equation 6 in equation 9,

$$x = \Upsilon[\Upsilon(x - i^2vt) - vt']$$
$$=> x = \Upsilon^2x - \Upsilon^2i^2vt - \Upsilon vt'$$
$$=> \Upsilon vt' = \Upsilon^2x - x - \Upsilon^2i^2vt$$

Dividing by Υv on both sides of the equation

$$=> t' = \frac{(\Upsilon^2-1)}{\Upsilon v}x - \Upsilon i^2t \quad 10$$

Now, let us combine the values of x 'and t' in Equation 2, x '= ct'.

$$\Upsilon(x - i^2vt) = c\left[\frac{(\Upsilon^2 - 1)}{\Upsilon v}x - \Upsilon i^2t\right]$$

Multiplying by Υ on the left side and c on the right side of the equation,

$$\Upsilon x - i^2v\Upsilon t = \frac{(\Upsilon^2 - 1)}{\Upsilon v}cx - \Upsilon i^2tc$$
$$=> \Upsilon x - \frac{(\Upsilon^2 - 1)}{\Upsilon v}cx = i^2v\Upsilon t - \Upsilon i^2tc$$
$$=> x\left[k - \frac{(\Upsilon^2 - 1)}{\Upsilon v}c\right] = i^2v\Upsilon t - \Upsilon i^2tc$$

Get by taking x common On the left hand side of the equation. And we get by calculate,

$$x = \frac{i^2v\Upsilon t - \Upsilon i^2tc}{\left[k - \frac{(\Upsilon^2 - 1)}{\Upsilon v}c\right]}$$

Get by taking i^2ct common factor from the right hand side

$$x = \frac{i^2ct\left(\frac{\Upsilon v}{c} - \Upsilon\right)}{\left[\Upsilon - \frac{(\Upsilon^2 - 1)}{\Upsilon v}c\right]}$$

But we know from equation 1, x = ct

$$ct = \frac{i^2ct\left(\frac{\Upsilon v}{c} - \Upsilon\right)}{\left[\Upsilon - \frac{(\Upsilon^2 - 1)}{\Upsilon v}c\right]}$$

Dividing by ct on both sides of the equation And we get by calculate,

$$\left[\Upsilon - \frac{(\Upsilon^2 - 1)}{\Upsilon v}c\right] = i^2\left(\frac{\Upsilon v}{c} - \Upsilon\right)$$
$$=> \Upsilon - \frac{(\Upsilon^2 - 1)}{kv}c = i^2\frac{\Upsilon v}{c} - i^2\Upsilon$$
$$=> \Upsilon - \frac{(\Upsilon^2-1)}{\Upsilon v}c = \frac{i^2\Upsilon v}{c} + \Upsilon$$
$$i^2 = -1$$

Subtraction the Υ constant on both sides of the equation

$$\frac{(1 - \Upsilon^2)}{\Upsilon v}c = \frac{i^2\Upsilon v}{c}$$

Now get by multiply the diagonally. And we get by calculate,

$$(1 - \Upsilon^2)c^2 = i^2\Upsilon^2v^2$$
$$c^2 - \Upsilon^2c^2 = i^2\Upsilon^2v^2$$
$$=> c^2 = i^2\Upsilon^2v^2 + \Upsilon^2c^2$$

Let's find out the value of Υ

$$\Upsilon^2 = \frac{c^2}{c^2 + i^2v^2}$$

$$=> \Upsilon^2 = \frac{1}{1-\frac{v^2}{c^2}}$$

get from square roots on both sides of the equation

$$\Upsilon = \frac{1}{\sqrt{1-\frac{v^2}{c^2}}} \qquad 11$$

Equation 11 is the Lorentz factor for particles of v<c velocity. But if the velocity of the particle were v>c then we could write the equation 11,

$$\Upsilon = \frac{1}{i\sqrt{\frac{v^2}{c^2}-1}}$$

Finally, we write the equations together, where imagine Lorentz transformation (ILT) is,

$$x' = \frac{(x+vt)}{i\sqrt{\frac{v^2}{c^2}-1}} \qquad \text{And} \qquad t' = \frac{t+\frac{xv}{c^2}}{i\sqrt{\frac{v^2}{c^2}-1}}$$

And imagine inverse lorentz transformation (IILT) is,

$$x = \frac{(x'-vt)}{i\sqrt{\frac{v^2}{c^2}-1}} \qquad \text{And} \qquad t = \frac{t'-\frac{xv}{c^2}}{i\sqrt{\frac{v^2}{c^2}-1}}$$

If there are particles faster than light, then there is a possibility that the trajectory of the tachyon particle will be according to the imagine Lorentz transformation (ILT) equation given by me. Suppose S and S 'are the two reference frames, and the distance of the station from S and S's reference frame is x. If the S frame is a static observer and the S train is moving at v<c speed, then the distance between the train and the station will decrease by x' over time t according to the Lorentz transformation $x' = \Upsilon(x - vt)$ and the distance between the station and the static observer will be x over time t. But if the speed of the train is v>c then according to $x' = \Upsilon(x + vt)$ the train will pass through the station like magic after a while and move away and the station will be at a distance of x to the stationary spectator. From this, it can be concluded that a particle moving at a velocity of v> c relative to a static frame or v <c frame travels additional distances within a complex trajectory. A tachyon particle is a particle that travels faster than light and if the train is a tachyon particle then the train will pass the station like magic and travel more vt distance at t time.That is, the distance of this universe to the tachyon particle is zero and it crosses the vt distance in the imaginary world after t time.

3. Result

It is a hypothesis that tachyon particles travel faster than light. The Lorentz transformation equation for tachyon particles given by A. RACHMAN and R. DUTHEIL isx'= kx-vt But from this article, the Lorentz transformation equation for tachyon particles is x'= kx+vt. If the velocity of a particle is v <c then the Lorentz transformation equation,x'=kx-vt In the above equation, the distance of x' will decrease over time t and k is the real constant number. But if the particle travels faster than light then the k will be complex constant and the distance x' will not decrease over time according to the equations given by A. RACHMAN and R. DUTHEIL but, it will increase according to the equation of imagine Lorentz transformation (ILT). As a result of increasing the distance of x' over time t, the motion of the tachyon particle will not be the same as in the equation given by A. RACHMAN and R. DUTHEIL

4. Consultation

Lorentz transformation can be used to determine the properties of particles moving faster than light. After Gerald Feinberg proposed the idea of the existence of tachyon particles in 1986, various scientists have studied tachyon particles. Some of these studies were on the Takion Lorentz transformation equation. But the Lorentz transformation equation c>v given by A. RACHMAN and R. DUTHEIL is not the trajectory for tachyon particles. So I came up with the new Lorentz transformation equation of tachyon particle which is the trajectory of tachyon particle.

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Figures

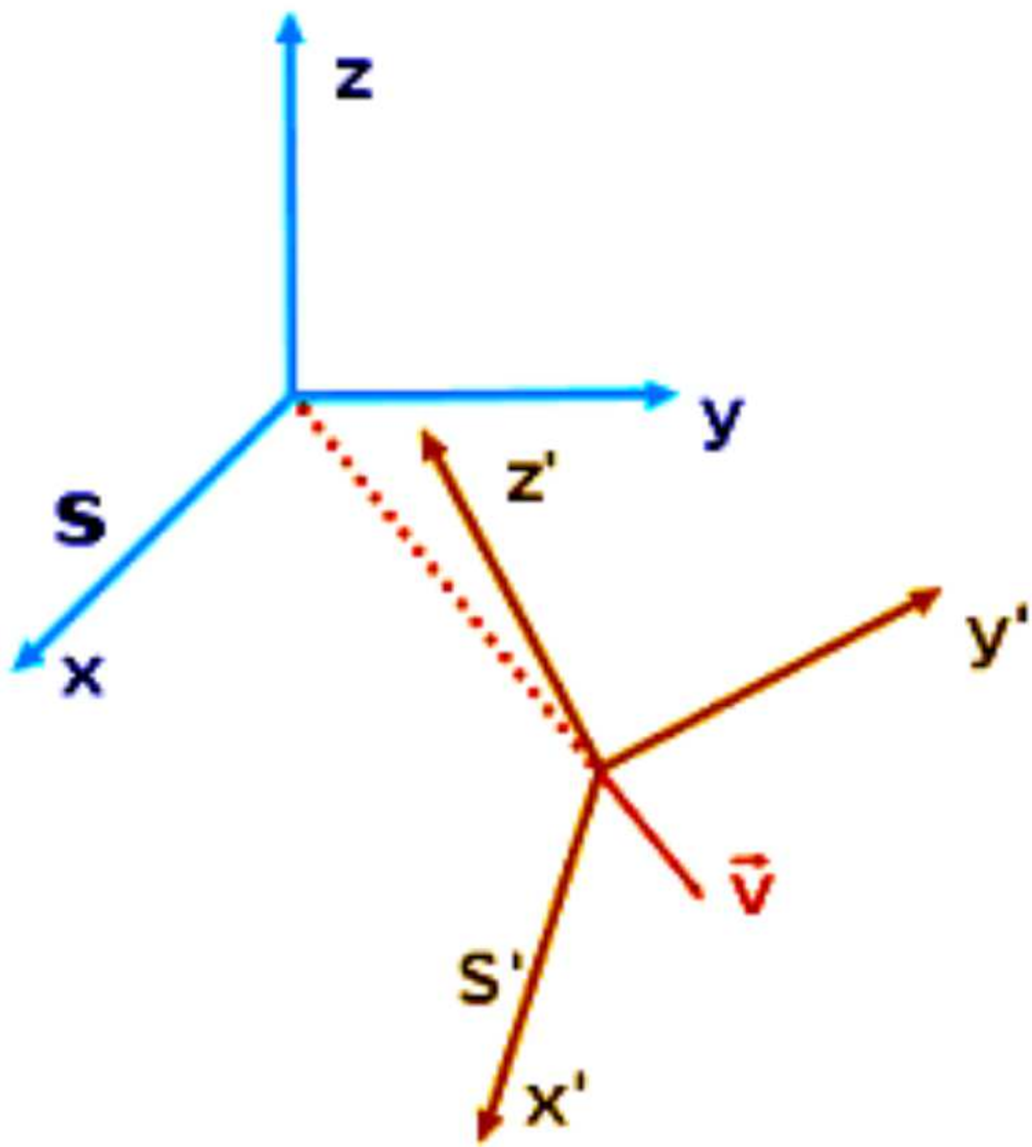

Figure 1

Legend not included with this version