One Way Speed Of Light Based on Fizeau's Experiment

Eric Su
eric.su.mobile@gmail.com
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Based on Fizeau's experiment, the single cogwheel is replaced with two rotating disks to measure the one-way speed of light. A single slit is cut out in the radial direction on each disk for the light to pass through the disk. With both disks rotating at the same angular speed, the light can pass through both disks only if the second slit is in a different radial direction from the first slit. The light takes time to travel from the first disk to the second disk. With both slits rotating into the straight path of light, the one-way speed of light can be calculated from the distance between two disks, angular speed of the disks and the angular difference between two slits.

I. INTRODUCTION

In 1849, Armand Hippolyte Louis Fizeau carried out an experiment[1] to measure the speed of light. In his experiment, a light source emits light which passes through a rotating cogwheel to a distant mirror. This mirror reflects the light back to the light source through the same rotating cogwheel.

Fizeau had measured two-way speed of light. It is the average speed of light in round trip. It is not the one-way speed of light. However, his experiment can be adjusted to measure the one-way speed of light.

Replace the cogwheel with a thin disk. A single slit is cut out in the radial direction near the edge of the disk. Place another identical disk in the path of light and let the light pass through both slits.

By rotating both disks at the same angular speed but aligning the second slit in a different radial direction from the first slit, the speed of light can be determined if the light passes through both slits

II. PROOF

Let the position of the center of a rotating disk D_1 be (x_1,0,0). Let its axis of rotation point to the positive x direction. Its angular velocity is ω. Place another identical disk D_2 at (x_2,0,0). Its angular velocity is also ω. Its slit is in the same radial direction of the slit of D_1.

$$x_2 > x_1 > 0 \tag{1}$$

Let a light source be at the origin and emit light toward D_1.

A. Stationay Disks

The light passes through the slit of D_1 but can not pass through the slit of D_2 because it takes time for the light to travel from x_1 to x_2. The slit of D_2 has rotated out of the straight path of the light by the time the light reaches D_2.

In order for the light to pass through the slits of both disks, the slit of D_2 can not be in the same radial direction of the slit on D_1. Let this angular difference between the slits of D_1 and D_2 be θ_0.

At the time when the slit of D_1 is in the path of the light, D_2 needs to rotate an extra angle of θ_0 in order for the slit on D_2 to be in the straogjt path of the light.

Let T be the time required for this extra rotation of θ_0.

$$T = \frac{\theta_0}{\omega} \tag{2}$$

T is also the time duration for the light to travel from x_1 to x_2

$$T = \frac{x_2 - x_1}{C} \tag{3}$$

Therefore,

$$\frac{\theta_0}{\omega} = \frac{x_2 - x_1}{C} \tag{4}$$

The one-way speed of light can be determined from equation (4).

$$C = (x_2 - x_1) * \frac{\omega}{\theta_0} \tag{5}$$

B. Moving Disks

Let F_1 be the rest frame of the light source. Let both D_1 and D_2 move at the same speed v relatively to F_1 in the positive x direction.

Let the time when the light passes through the slit of D_1 be t_1. At this moment, the x position of D_1 is x_1 while the x position of D_2 is x_2. By the time the light reaches D_2, D_2 has moved away from x_2.

Let the time be t_2 when the light reaches D_2. T is the difference between t_1 and t_2.

$$T = t_2 - t_1 \tag{6}$$

R is the difference between x_1 and x_2.

$$R = x_2 - x_1 \tag{7}$$

The total distance for the light to travel from D_1 to D_2 is

$$R + v * T = C * T \tag{8}$$

In order for the light to pass through the slit of D_2, the angular difference between the slits of D_1 and D_2 needs to be

$$\theta = T * \omega \tag{9}$$

From equation (8) and (9),

$$\theta = T * \omega = \frac{R}{C - v} * \omega \tag{10}$$

C. Reference Frame

Let F_2 be the rest frame of D_1. Both D_1 and D_2 move at the same speed relatively to F_1. D_2 is stationary relatively to D_1. Therefore, F_2 is also the rest frame of D_2.

Let F_2 be stationary relatively to F_1. The speed of light C_2 in F_2 can be calculated from equation (5).

$$C_2 = (x_2 - x_1) * \frac{\omega}{\theta_0} \tag{11}$$

Let F_2 move at the speed of v in the x direction relatively to F_1. Due to this relative motion, the angular difference θ_0 needs to be θ for the light to pass through both slits.

$$C_2 = (x_2 - x_1) * \frac{\omega}{\theta} \tag{12}$$

θ is of the same value in both F_1 and F_2. It can be determined from equation (10).

$$\theta = \frac{R}{C - v} * \omega \tag{13}$$

Therefore, the speed of light C_2 in F_2 can be calculated from equations (12) and (13).

$$C_2 = (x_2 - x_1) * \frac{\omega}{\frac{R}{C-v} * \omega} \tag{14}$$

$$C_2 = (x_2 - x_1) * \frac{C - v}{R} \tag{15}$$

From equations (7) and (15)

$$C_2 = C - v \tag{16}$$

The speed of light C_2 in F_2 differs from the speed of light in F_1 by v.

III. CONCLUSION

The speed of light depends on the reference frame. The relative motion between two reference frames determines the different speeds of the same light in these two reference frames.

If the light can pass through both slits when both rotating disks are stationary, then the same light can not pass through the second disk if both disks move at the same speed along the axis of rotation.

In the rest frame of the disks, the light may or may not be detected beyond the second disk. The speed of light has changed.

By adusting the alignment of the slit on the second disk, the light can pass through both disks again. This new alignment indicates that the speed of light has changed in the rest frame of the disks. This new speed of light can be calculated from the new alignment and depends on exclusively the relative motion between the light source and the disks.

Lorentz Transformation[2] was proposed on the assumption[8] that the speed of light is independent of inertial reference frame.

As the result of this incorrect assumption, Lorentz Transformation violates Translation Symmetry[3] and Conservation of Momentum[9,10,11,12] in physics. Translation Symmetry requires conservation of simultaneity[4], conservation of distance[5], and conservation of time[6]. All three conservation properties are broken by Lorentz Transformation.

Therefore, Lorentz Transformation is not a valid transformation in physics. Consequently, any theory based on Lorentz Transformation is incorrect in physics. For example, Special Relativity[7]

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