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Measurement of Source of Propagation Using Light Rays

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Abstract

This paper describes method to measure and calculate speed, time dilation, and length contraction of the source through using the observed differences in the vector of a ray compared to the vector of a solid projectile emanating from the same source, aimed in the same direction.

This method can be used to measure motion even in absence of a reference body and has identified an inertial reference frame that has properties unlike any others. This contradicts the principle of relativity.

Keywords: Speed; Gravity; Light; Collision; Bullet; Special Relativity, Absolute Motion; Time Dilation, Length Contraction; Privileged Rest Frame

Introduction

This paper explores how the differences in the vector of light ray versus the vector of a solid projectile can be used to measure the motion of the source and differentiate inertial frames.

The thought experiment utilizes important differences in the behavior or a matter projectile versus the behavior of a light ray. Unless affected by gravity, or by encountering an object, a ray of light moves away from a source in a straight line once propagated, and the motion of the source has no effect [1,2]. However, a matter projectile is subject to the addition of velocities of the source [2].

Measuring the differences in vectors of matter and light propagated in equal directions allows us to measure the motion of the source in absence of a reference body. From this analysis, a privileged frame of absolute rest, with unique qualities, is derived. This contradicts both Galileo's and Einstein's principles of relativity and confirms Newtons and Aristotle's notions of absolute motion [3-6].

Primarily Thought Experimental Method

Alice and Benny are inside two separate, identical ships in space, far from any significant gravitational field. All of both ships systems, except propulsion and communications, are inoperable. Alice and Benny are concerned their ships could collide, but neither can observe the other ship or any reference bodies, and neither knows the speed or direction of their respective ships.

Each occupies a room that is a square, 100 meters on each side. Assume the interior of the ships are a vacuum, and there is no spin. They cannot see outside.

Alice has a rifle that has two modes of fire. One mode uses lead bullets while the other uses discrete laser bolts. We use laser light in this thought experiment, instead of another source such as a light bulb, because the directional and coherent properties [7] allow us to define a discrete ray. Within a small margin of error associated with beam divergence, and the dimensions of the bolt, the laser bolts will strike a discrete point as compared to light from a bulb.

Alice uses a measuring rod to align her rifle onto the center of a target on the ship wall, 50 meters from her (Figure 1) and perpendicular to the target wall. Alice wants to measure the motion of her ship and to avoid a collision with Benny in his ship. She faces the wall along the Y-axis, but in absence of an external reference, this direction is arbitrarily chosen and only meaningful inside of the ship.

She fires the first shot using a bullet. As expected, it strikes the center of the target. Then she locks the rifle in place on a tripod. The rifle barrel is confirmed as mechanically aligned with the target, along the positive Y-axis as she has defined it. The barrel is perpendicular to the X-axis.

She still knows nothing regarding the motion of the ship. This is due to the addition of velocities [2] affecting the bullet. With a fixed target and rifle, both the target and the bullet are subject to identical addition of velocities because both are on board the same ship. This first shot only proves that the rifle barrel was correctly placed mechanically perpendicular to the target wall through the use of a measuring rod.

She fires a second shot with the rifle anchored in the same place, but this time she uses the laser setting. The bolt strikes the center of the target, in the exact same spot the bullet did. Thus, the path of the light ray and the bullet equals the angle of the rifle barrel for both shots.

What does this tell us about the motion of the ship? We know that the source (rifle) and the target are on board the ship together and are therefore moving with equal velocities. This is because the velocity of a ray of light is unaffected by the motion of the source once propagated [8]. Unlike light, the velocity of matter is subject to addition of velocities. Therefore, if no deflection is observed, the ship is not moving in the X or Z direction relative to the path of the laser bolt. The only possible motion of the ship is either directly forward or backward, in line (direction Y) with the motion of the laser bolt.

So, now Alice knows, the net motion of the ship, relative to the laser bolt during the time it traveled from rifle to target, was zero along the X-axis (left/right) and the Z-axis (up/down).

Alice rotates the rifle ninety degrees to fire along the X-axis and uses a measuring rod to ensure it is perpendicular to the shots she took along

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the Y-axis, and directly at the center of the target wall. She fires a bullet, and it hits the center, confirming mechanical alignment.

Then she fires the laser bolt, despite the laser barrel remaining in mechanical alignment, it deflects to the left of the bullet's impact point, which is the negative Y-axis (Figure 2). As before, there is no observed deflection up or down (the Z-axis).

The second bolt and the bullet traveled different paths, despite being mechanically aligned. This gives us insight into the current state of ship motion.

Alice measures the distance from the rifle to the center of the target as 50 meters, and the deflection of the laser bolt at -24.71 meters. This gives us the results shown in Figure 2.

The laser barrel is mechanically aligned to the target and is parallel to the rifle barrel that hit the center of the target. But from Alice's point of view, the bolt deflected 24.71 meters in the negative Y direction. Because light follows the shortest path between two points [8], and the barrels are aligned at zero, the observed deflection of the bolt from zero degrees has come solely from the motion of the observer.

From Alice's viewpoint, the laser bolt traveled the hypotenuse of 55.77 meters. We know that speed of the bolt equals c. This gives us the following calculation for the speed (S) of the ship, expressed as a decimal of c.

$$S = \frac{24.71}{55.77} \quad [2.1]$$

S= 0.443

The ship is moving at 0.443 c in direction +Y. This equals the sine of angle a, which is 26.3 degrees. Therefore, the sine deflection angle of a light ray mechanically aimed perpendicular to the direction of motion equals the sources speed expressed as a proportion of c.

The length contraction of an object moving at 0.443 c is [2]:

$$é = é_0\sqrt{1 - \frac{õ^2}{c^2}} \quad [2.2]$$

Which gives us: l' = 1√1- 0.443²/1²

l' = 1√1-(.1962/1)

l' = 1 √1-.1962

l' = √.803

l' = 0.9

Results

We have calculated the length contraction as 0.9, which equals the cosine of 26.3 degrees. Therefore, the cosine of the deflection angle of a light ray mechanically aimed perpendicular to the direction of motion equals (or compared to a matter projectile fired in the same direction, excluding friction and) the sources length contraction.

The time dilation of an object moving at 0.443 c is derived through the same calculation [2]:

$$t^1 = t_1\sqrt{\frac{1 - v^2}{c^2}} \quad [2.3]$$

Which gives us: T' = T√1- 0.443²/1²

T' = T√1-(.1962/1)

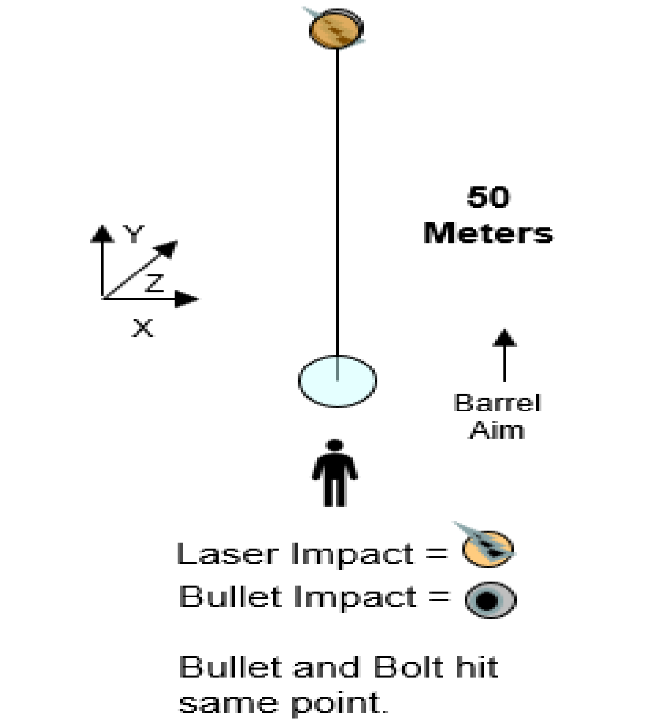
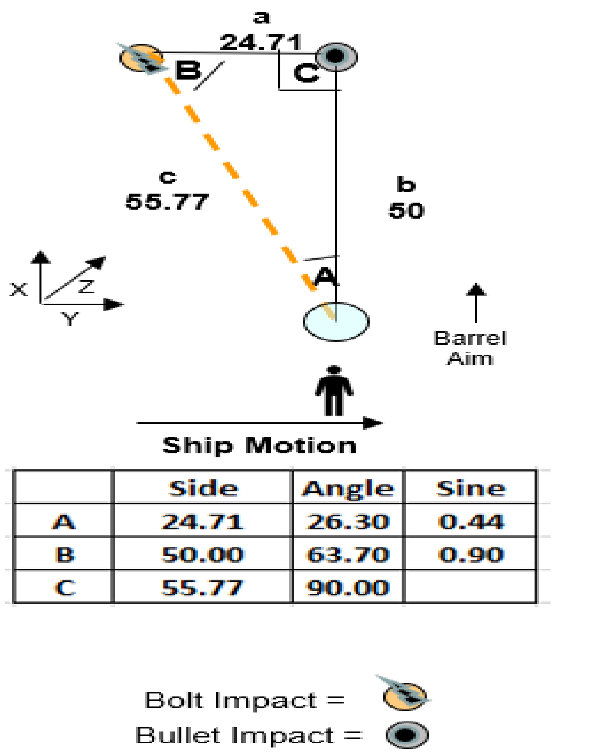


Figure 1: In a truly motionless reference frame, both a bullet (matter projectile) and a bolt of laser light will strike the same point if the rifle barrel and the laser projector are mechanically aligned.



	Side	Angle	Sine
A	24.71	26.30	0.44
B	50.00	63.70	0.90
C	55.77	90.00	

Figure 2: In moving reference frame, a bullet (matter projectile) and a bolt of laser light will strike different points if the rifle barrel and the laser projector are mechanically aligned. The impact points can be used to measure the motion of the reference frame.

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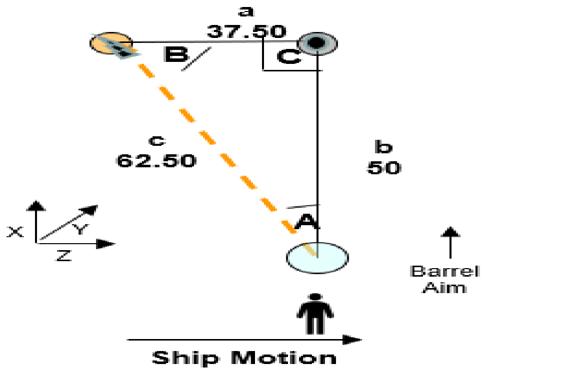

	Side	Angle	Sine
A	37.50	36.87	0.60
B	50.00	53.13	0.80
C	62.50	90.00	

Figure 3: In moving reference frame, a bullet (matter projectile) and a bolt of laser light will strike different points if the rifle barrel and the laser projector are mechanically aligned. The impact points can be used to measure the motion of the reference frame.

$T' = T\sqrt{1-.1962}$

$T' = \sqrt{.803}$

$T' = 0.9$

Therefore, the angle of deflection of a light ray, relative to the mechanical angle of alignment of the laser or the path of a matter projectile fired in the same direction, can be used to calculate the speed of the source. From there, we can also calculate time dilation and length contraction, which equals the cosine of the angle of deflection.

Back to the problem at hand, Alice and Benny wish to avoid a collision. Knowing that her speed is 0.443 c in direction Y on her ship does not help her yet, because she knows neither the speed, nor or vector, of Benny's ship.

Even if she did, she still does not know the relative speed and velocities of the ships compared to each other because the X, Y, and Z directions are meaningful only inside her own ship. Thus, even if Benny could determine, for example, that his ship is also moving at 0.443 c in direction Y on his own ship, directions X, Y and Z are not necessarily equivalent on both ships.

Is there a way for Alice and Benny to guarantee no collision will occur in absence of observation of the other ship?

Discussion

Using a unique rest frame for collision avoidance

Benny's ship is identical to Alice's in every way, and so is his rifle. He follows the procedures as described by Alice and obtains the results illustrated in Figure 3.

On his ship, Benny observes a deflection value of 37.5 meters in the negative Z direction, while the light beam travelled the hypotenuse of 62.5 meters. His ship is therefore moving at 0.6 c in the positive Z direction (upwards from his perspective) as defined on his ship. He also knows the length contraction and time dilation values are 0.8 which are derived from the deflection angle.

Alice and Bennie now know that their ships are moving in differing vectors as defined within their own ships. But this does not help at all, because they do not know the orientation of the ships or vector of motion relative to each other. IE, they do not know how directions X, Y, and Z on Alice's ship relate to directions X, Y and Z on Benny's ship. For all they know, they could be on a collision course directly towards each other, or directly away. Despite all their work to this point, the relative speed of the two ships remains impossible to know without external observation.

How can they use this data in order to prevent a collision? By placing both ships in a reference frame with zero deflection in all directions, Alice applies an acceleration vector equivalent to 0.44 c in the negative Y direction as defined on her ship, while Benny applies an acceleration vector equivalent to 0.6 c in the negative Z direction on his ship.

After these acceleration vectors are applied, Benny and Alice measure their velocities again using the same method and verify that the vectors of laser bolts fired in any direction, equals the angle of the bullets in every direction. No deflection of light rays is observed in any direction relative to the bullets on either ship.

By using acceleration to bring the laser bolt vectors into equivalency with the bullet vectors in all directions, both ships are now at zero motion. Now they know that their ships cannot collide without any observation of external reference bodies. A collision avoidance problem has been used here as a teaching device – in no other reference frame, can Alice and Benny know for sure they will not collide, in absence of external observation.

This has identified a unique rest frame, which per Einstein and Galileo does not exist. For any two objects where the vector of light equals the vector of aiming, in all directions, relative motion of those two objects is zero. In any other reference frame, where any light ray vector is not equal to the angle of aiming in any direction, there is the possibility of a collision. This violates the principle of relativity [2,3].

However, any two objects with any other combination of deflection angles might collide, even if their observed light ray deflection angles are equal.

Conclusion

The prime reference frame and seven postulates

We have shown that the qualities of the vector of a light ray compared to the motion of the source, allow us to calculate rest frames that can be differentiated without a reference body. Speed, time dilation, and length contraction can all be calculated through the use of this deflection angle.

This **thought experiment** identifies a method to calculate a privileged rest frame that has qualities unlike any other. For an observer in this reference frame, which I call the Prime Reference Frame, the vector of a light ray is equal to the vector of a matter projectile if the barrels are aligned. In all other rest frames, the angle of aiming equals the angle of propagation only when the barrels are aiming parallel to the angle of motion.

First postulate: In the Prime Reference Frame, the vector of a light ray equals the vector of a projectile in every direction from the source, if the barrels are aligned.

Second postulate: In any reference frame other than the Prime

Reference Frame, the vector of a light ray does not equal the vector of a projectile if the barrels are aligned, except when pointed directly ahead or behind the direction of motion.

Third postulate: Objects with equal deflection angles perpendicular to the direction of motion experience equal time dilation and length contraction.

Fourth postulate: The sine of the deflection angle of a light ray mechanically aimed perpendicular to the direction of motion equals the sources speed expressed as a proportion of c.

Fifth postulate: The cosine of the deflection angle of a light ray aimed perpendicular to the direction of motion equals the sources time dilation, and length contraction.

Sixth postulate: We have shown that as the deflection angle increases, so does the speed, time dilation and length contraction. As it decreases, the speed, time dilation and length contraction also decrease. Therefore, it logically follows that when the deflection angle is zero in all directions, then speed, time dilation, and length contraction are also zero. The Prime Reference Frame could therefore be considered a standard for absolute zero motion, time dilation, and length contraction.

Seventh postulate: If the Prime Reference Frame has zero motion, time dilation, and length contraction, then any force applied to an object in this reference frame can only increase speed, time dilation, and length contraction. This is not true in any other reference frame and it is a contradiction to the principle of relativity [2-4].

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