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Train and Helicopter Thought Experiment

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Abstract:

- When wireless remote control toy helicopter is in steady state in air ,in moving train, why it cannot be strike behind the wall of the train?
- But when the same toy helicopter gets out of window, train will leave behind the helicopter, why?

Keywords:-Helicopter, Train, 1st Observer,2nd Observer.

I. INTRODUCTION

When toy wireless helicopter is in steady state in air in the moving train, then the helicopter is in the motion with the train, but the same helicopter get out of the window then train can easily leave behind the helicopter.

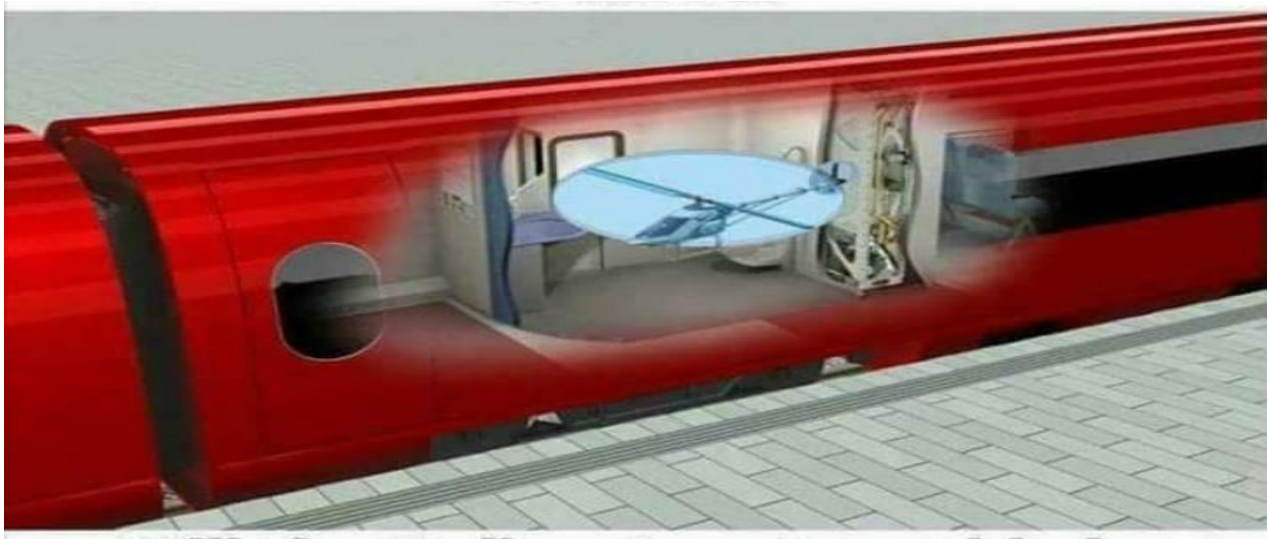
Suppose one observer is in a train having a toy helicopter remote in his hand and he give height to the helicopter and make it steady state in air. Now the speed of the train is far greater than the helicopter and there is no part of the helicopter is connecting with the train, even though the helicopter is in the motion with the train (means with the same speed as train has). Helicopter will not strike behind the wall of the train.

But when observer get the helicopter out of the window with the help of the remote control then train surly leave behind the helicopter.

II. HYPOTHESIS

- Small RC wireless toy helicopter.
- Maximum speed of the helicopter is 20 km/hr.
- Real bullet train.
- Maximum speed of the train is 500 km /hr.
- The person who is control the helicopter with the help of remote control is sitting in a train.
- One observer is standing on street out of the train and can observe the motion of helicopter in train.

III. FIGURE



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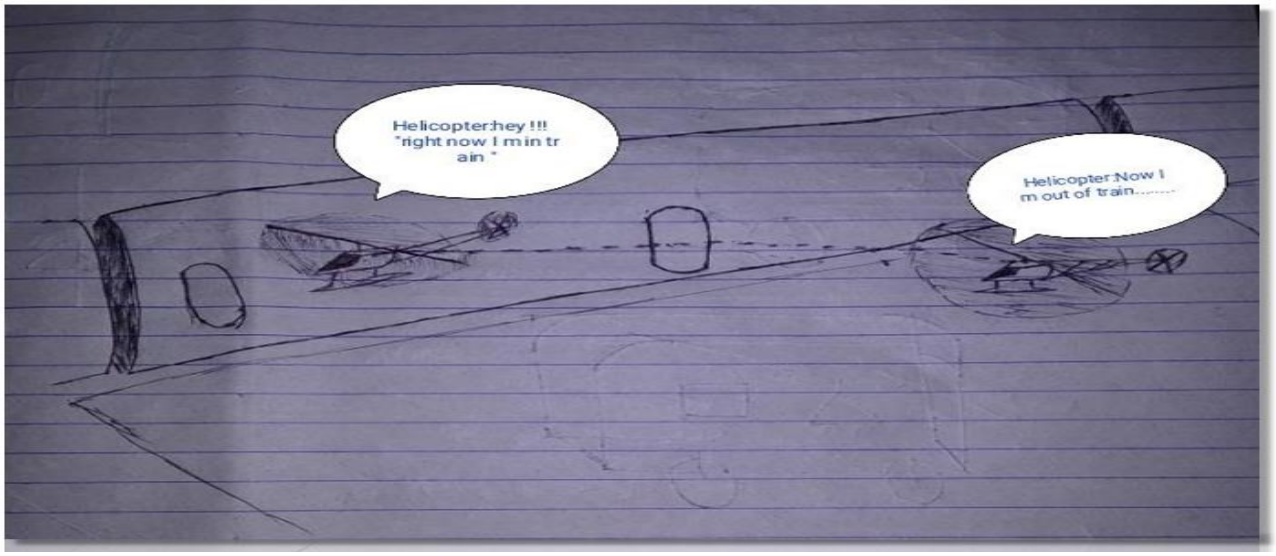
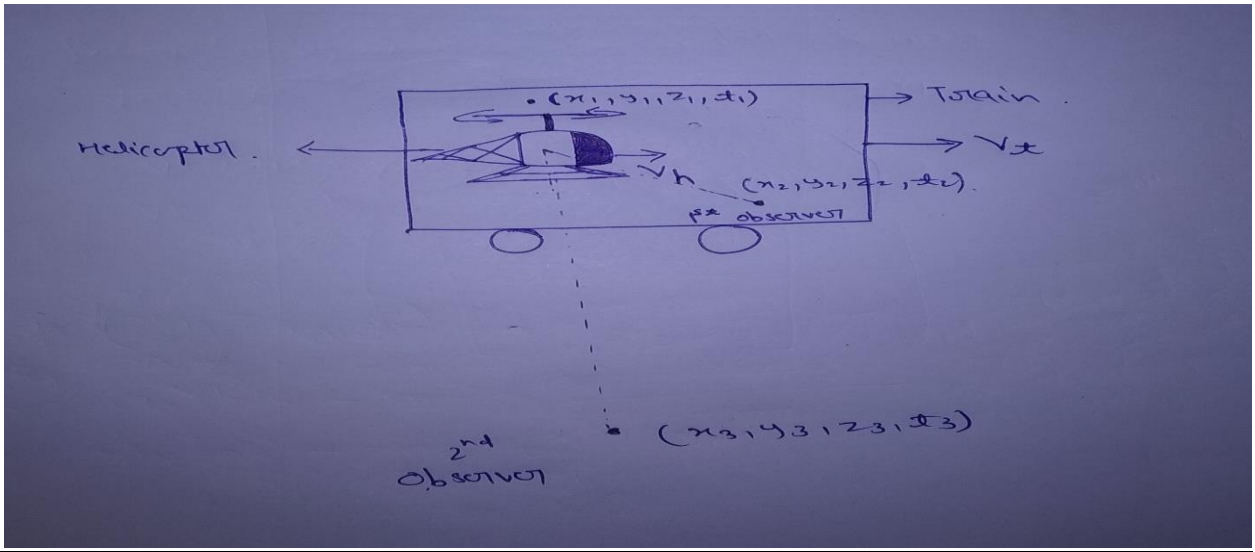
IV. THOUGHT EXPERIMENT

- Imagine the fastest train that you have ever seen (about 500 km/hr).
- You are in train; you have one RC wireless helicopter.
- You put the helicopter on the floor of the train.
- Now with the help of remote control you give the height to the helicopter.
- Now helicopter is in air in steady state position.
- Here u can observe that the helicopter is in motion with the train.
- it will not strike behind the wall of the train even though the speed of the train is far greater than helicopter.
- But now when you get the helicopter out of the window with the help of the remote control, train will leave behind the helicopter.
- Here the person who is inside the train for him helicopter is in motion with the train when the helicopter inside the train ,but the person who is outside the train for him the helicopter leave behind the wall of the train.
- Its means that same scenario can be different for two different person at the same instant.



V. CALCULATION



Where,

Vhht=horizontal velocity of train w.r.t.2nd observer.

Vt=Horizontal velocity of the train w.r.t.1stobserver(who is inside the train).

Vh=horizontal velocity of helicopter w.r.t.1st observer.

Vhh=Horizontal velocity of the helicopter w.r.t.2nd observer.

η=Nit Factor.

(x1,y1,z1,t1) are the co-ordinates of helicopter.

(x2,y2,z2,t2) are the co-ordinates of train or the co-ordinates of the 1st observer.

(x3,y3,z3,t3) are the co-ordinates of the person is at rest position out of the train (2nd observer).

The observer inside the train for him,

Vht=Vhh

So,

x1=x2

y1=y2

z1=z2

t1=t2

Hence the velocity of the helicopter is as same as train for the 1st observer.

Now the observer outside the train for him,

Vhht not equals to Vhh

X3=η[x1-(Vh)t1 ……..(1)

t3=η[t1-(Vh/Vtˆ2)x1] ……(2)

y3=y1

z3=z1

The above co-ordinate can be relate with each other from Lorentz transformation.

Here now, differentiate (1)

dx3=η[dx1-(Vh)dt1] ……(3)

dt3=η[dt1-(Vh/Vtˆ2)dx1] ……..(4)

Where,

η=Nit Factor,

$$\eta=\frac{1}{\left[1-\left(\frac{Vh}{Vt}\right)^2\right]^{\frac{1}{2}}}$$

now, the velocity of the helicopter measure by the 2nd observer is

Vhh=dx3/dt3

$$Vhh=[dx1-(Vh)dt1]/[dt1-\left(\frac{Vh}{Vt^2}\right)dx1]$$

$$Vhh=\frac{\frac{dx1}{dt1}-Vh}{1-\left(\frac{Vh}{Vt^2}\right)\left(\frac{dx1}{dt1}\right)}$$

Now ,

dx1/dt1=Vh

soVhh=0

and

Velocity of the train w.r.t. the 2nd observer,

Vht=dx3/dt3

This is greater than the velocity of the helicopter w.r.t the 2nd observer.

Hence this prove that for the 2nd observer,

The velocity of the helicopter is far less than the velocity of the train hence for the 2nd observer the helicopter moving in the backward direction and for the 1st observer the helicopter is moving with train.

As the train velocity is far greater than the helicopter velocity w.r.t. the observer who is outside the train, you can see that from the final equation the magnitude of the helicopter velocity w.r.t. the 2nd observer (who is outside the train) is less than the magnitude of the velocity of the train w.r.t.the 2nd observer (the helicopter is in the train and the 2nd observer is out of the train).

But the 1st observer who is inside the train for him the velocity of the helicopter is as same as the velocity of the train.

VI. CONCLUSION

Here I can see that same scenario can be different for two different people at the same instant.

REFERENCES

Lorentz transformation.