

Light and Projectiles

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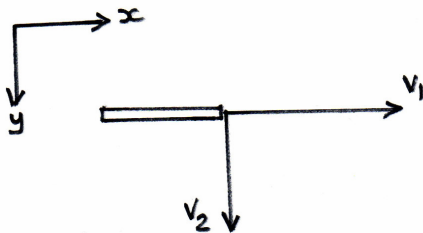
There has been unfortunately a mistake made with how projectiles have been mathematically modelled; it is a subtle problem and has carried over into our treatment of light. The way that the mathematical model has been applied to physical observations has been incorrect, i.e. a mistake made by many using the mathematical modelling process for Newtonian physics. It is also tied to a second mistake when dealing with Special Relativity (SR).

1. Introduction

I will start from building up to what I consider a subtle error made by some people when they deal with velocities of objects. (I will not bother with the issue of the difference between velocity and speed in this article; velocity is speed and direction. I hope it's clear what I mean in this article.)

Starting from a Newtonian physics perspective: Considering first a scenario of v_1 and v_2 as uniform velocities (i.e. that have acceleration as zero). The scenario of treating acceleration as non- zero to be considered later.

See fig (a)



Object is being emitted with velocity v_1 in the x direction and velocity v_2 in the y direction. When there is nothing affecting the object such as air resistance, so that we can treat these velocities as unchanging in their magnitude, this gives us fig (b)

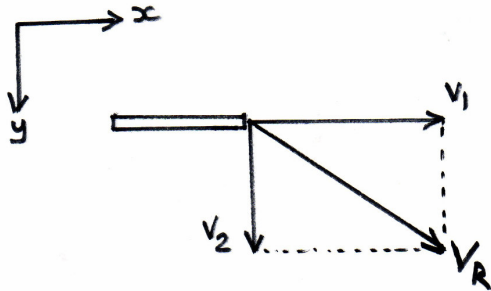


fig (b)

Where have velocity v_R as the resultant velocity of v_1 and v_2 . By Pythagoras theorem we can write:

$$v_R^2 = v_1^2 + v_2^2 \quad (1)$$

When $v_2 = 0$ then we have the following:

fig (c)



And by equation (1) when $v_2 = 0$, then $v_R = v_1$ so we also have the following:

fig (d)



I think – a subtle error occurs and many physicists think in terms of velocity of the object being v_1 when it is of course really v_R .

The object is emitted as v_R (when $v_R = v_1$).

When dealing with v_R - the direction of that velocity (and magnitude) changes as v_1 and v_2 change.

So the math model that they are thinking more in terms of is fig (a), (b) and (c) with velocity v_1 as constant.

When really it's better as fig (a), (b), (d).

Their error becomes more apparent when we deal with acceleration:

Now let acceleration due to gravity be g and this acting in y direction so that $v_2 = gt$, i.e. it is no longer a constant uniform velocity. This corresponds more closely with what we are used to, except we are still treating other factors like air resistance as negligible.

The deception in such a model is to think of v_1 as constant and as the velocity of the object in the forward x direction. But actually the object has velocity v_R as the object, and that velocity v_R is its velocity in the x direction when $v_2 = 0$, when v_2 increases then v_R increases. We are used to g not changing, so in our daily lives we can get away with dealing with v_1 instead of v_R and the error in this mistake being negligible (for most purposes).

If we measure the time for the object to travel a certain distance in the x direction, we can get the value for the velocity v_1 of the object in the x direction. This is not actually the velocity of the object; its true velocity is v_R . But the error way of thinking is to think the object velocity is v_1 with it given an extra velocity v_2 by gravity.

So I contrast-

Model A (model in error) —treat object as velocity v_1 with extra velocity v_2 given to it by gravity giving it a resultant velocity v_R .

Model B (correct model) – treat velocity of object as v_R

For daily lives we can get away with using the model A (error model) even though it's really in error.

What we really have is object with velocity v_1 in x direction and v_2 in y direction with its total velocity v_R .

So dealing with model B, the problem is now what do we do with light. From SR light speed is supposed to be constant. If light were travelling in the x direction such that v_1 was now c ($v_1 = c$) with $v_2 = 0$ there is no problem. But as v_2 increases then so does v_R , meaning v_R would then become greater than c , which SR would seemingly not allow so SR is saying presumably that $v_R = c$ not v_1 (for v_2 non-zero). That seems nonsense because then light would not be acting like a projectile.

It would be two different models – one for projectiles and another for light. I think that is nonsense- it should be the same model of velocity whatever the object, there

has to be a universality of the laws of physics. (It is not one thing one moment and something else the next.)

The problem can be traced back to the claim of SR, its assumption. From Relativity Demystified:

“All observers in inertial frames will measure the same speed of light regardless of their state of motion.” [1]

This claim is ambiguous, and it is ambiguous in most places it is stated not just in the book cited.

It is not being clear as to what it means. Let us consider frame A and frame B both inertial and they are travelling at a different velocity with respect to each other. Both frames have a light source and emit light and measure lightspeed as c . This equates to the same situation as projectiles. If both frames have the same projectile device and it emits a projectile at velocity $p_{\text{projectile}}$ then both will measure the same value of $p_{\text{projectile}}$. So far this is the same as the light case. Projectile device and light source emitting their objects at the same velocity in both frames. (Projectile device emits $p_{\text{projectile}}$ in both frames and light source emits c in both frames.) There is nothing mysterious about that, and it is a universality of the laws of physics that the light and projectile are acting in the same way. The next step is – frame A will claim the velocity of the projectile in his frame is not the same as the velocity of the projectile in the other frame. Similarly frame B will make the same claim. But from many people’s belief in SR they think that A will say that the speed of light in B frame is the same as that of his frame. That I think a fundamental error, the result of not interpreting the ambiguous claim (and related claims):

“All observers in inertial frames will measure the same speed of light regardless of their state of motion.”

Rather the light acts the same way as any moving object. And then we have Newtonian physics recovered!

SR would then create a smokescreen about other issues like clock synchronization. [2] But that is all diversion. And the essential point is that light can be studied through a Newtonian physics perspective. Further upon continuing to work from a Newtonian perspective – Newtonian physics gives same results as GR. (Topic for other articles.)

I now deal again with the issue but in a more complicated way.

2. Standard Projectile motion in gravity



Fig 1

In fig. 1 a gun shoots a projectile. If there is gravity then the projectile falls. Also if there is air resistance the speed of the projectile decreases. Fig 1 represents straight-line motion of the projectile from the gun without any factors affecting that motion; i.e. it is the idealised case of no external forces acting on the projectile causing it to deviate from its constant velocity (call it v_1).

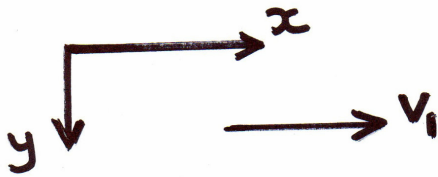


Fig 2

In this fig 2 we show this velocity v_1 of fig1, and we decide to have the x and y coordinates as per shown.

In the next idealised case we wish to consider, let us have a velocity in the y direction in addition to what is in fig 1, let that velocity be v_2 and by Newton's equations of motion for a gravitational acceleration of g in time interval t then $v_2 = gt$. We can then form fig 3:

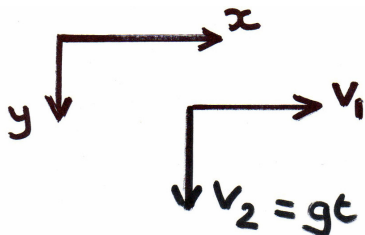


Fig 3

By Pythagoras's theorem we can form a third velocity v_3 thus:

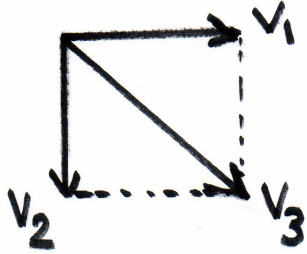


Fig 4

$$\text{Where } v_3^2 = v_1^2 + v_2^2$$

This is the normal way that projectiles in the idealised case of only motion due to that of the projectile and gravity is presented in the usual texts of physics.

What we have is a mathematical model here and we want to apply it to physical observations of this scenario. We do this by trying to compensate as much as possible for factors such as air which would cause deviation from this idealisation.

That is okay up to here. What we are doing is have – the mathematical model being made to fit with physical observations by experiment.

But now a subtle problem arises that is often overlooked as follows-

In fig 1 where we shoot a projectile in the idealised scenario of no influences causing the projectile to deviate from straight line constant velocity motion; the question is – did we actually match that to a physical observation scenario? And the answer is a surprising “no” for most times that this has been approached by the experimentalist.

Instead of obtaining v_1 from the idealised scenario of fig2 and fig 1, the experimentalists have gone straight to fig 3, and from fig 3 might have worked out incorrectly what fig 2 should be.

Thus a mess has been made from matching experiment incorrectly with the idealised mathematical model.

The experimentalist believing himself matching the mathematical models of fig 1, 2 and 3 with his experimental observations can make a fundamental mistake by jumping from experiments dealing with fig 1 (and 2) and fig 3.

The mistake is extremely subtle mistreating of fig 3. He is not in fact really obeying fig 3; he thinks he is obeying fig 3 but is in fact deceived himself.

The experimentalist might for instance be viewing things through the distorted understanding of SR as follows-

Fig 1 and fig 2 remain the same for the idealised scenario of a projectile only experiencing constant velocity.

Instead of fig 3 and 4 let us now have fig 5 for SR-

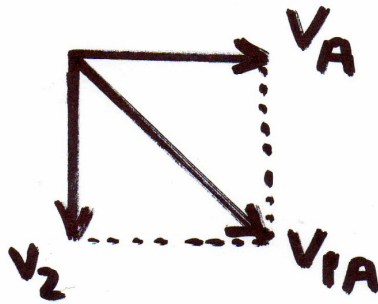


Fig 5

The experimentalist by SR might think v_{1A} of fig 5 equals v_1 of fig2; i.e. this is the hypotenuse of this triangle fig 5.

This is contrary to Newtonian perspective that has v_A as v_1 .

Further, the experimentalist deceived by SR might think v_{1A} as a constant ; also contrary to Newtonian physics.

How can the experimentalist believing in Sr believe such a thing (?) It would be for him – that in order to obtain v_1 properly he needs to do the experiment from fig 1 – when then is no velocity given to the object in y direction. When he actually does the experiment – the object has both velocity in x and y direction, so that when he measures v_A this is not the same as v_1 of fig 1. The v_{1A} would be the speed value of v_1 except that it has been given extra by v_2 .

Either the experimentalist is doing things by Newtonian way of handling projectiles or by SR. Further he might be believing Sr but not be aware that SR is making the demand that he do projectile measurement from a different way than Newtonian way, and thus be mixing models to create a mess.

From fig 5 we have $v_{1A}^2 = v_A^2 + v_2^2$

When $v_2 = 0$ as in the no gravity case of fig 2 then:

$v_A = v_{1A}$ (when $v_2 = 0$)

In other cases v_A does not equal v_{1A} .

Thus a projectile from a gun when falling under gravity has its velocity of v_{1A} directed as per fig 5.

If we had made the experimental observation from fig 1 with measuring the velocity of the projectile in the idealised case of no gravity, no air resistance and other such factors negligible then that velocity would have been carried over into fig 4 when the experimentalist did his observations in that scenario.

3. Light and projectiles

The mistake that has been made with projectiles from guns has been carried over into the context of when considering light under the influence of gravity. Light obeys the same Newtonian math model method as that of projectiles (in the context of Newtonian physics).

Also in the Newtonian context : What we arrive at is – if we consider light velocity as constant (call it c) in the x direction, and it is acted on by gravity in the y direction, then its total velocity (its resultant velocity) v_R is greater than c . (And for increase in gravity, then v_R gets bigger for light, same as it would do for any moving object.) Thus lightspeed is variable not constant, and the deception of mistaking it constant is due to the subtleness of the mistakes made by trying to handle things via SR as highlighted here with the velocities.

i.e lightspeed is variable under the effects of gravity and not constant.

Making the subtle mistake in daily lives with these velocities when carried over to lightspeed scenario has deceived many physicists. Bad identification of the math with physical reality has been made.

Newtonian physics can thus give same bending of light as claimed of General relativity ; an issue picked up further in my article : Newtonian Light bending

References

[1] Relativity Demystified, David McMahon, ISBN 0-07-145545-0 p 9

[2] I think a relevant quote for this issue is Caroline Thompson : "Many prominent scientist have expressed their doubts, but one in particular should have been listened to. Louis Essen, professional metrologist, inventor of the atomic clock and co-author of a book on the experimental estimation of the speed of light thought Einstein's ideas

ridiculous. He may well have forfeited a Nobel Prize for saying this rather too publicly. As he said, Einstein's theories arbitrarily made "space and time intermixed by definition and not as the result of some peculiar property of nature ... If the theory of relativity is regarded simply as a new system of units it can be made consistent but it serves no useful purpose".

<http://freespace.virgin.net/ch.thompson1/History/forgotten.htm>

(i.e. the mess that SR is in is being ignored.)

Update to try to better clarify this issue of the mess made by the split between SR perspective and Newtonian method.

c.RJAnderton2010-12-20

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