The understanding of space-time and mass and their deep connection in the universe _

(written by Getanjli Kumar, 16 years old, Germany)

ABSTRACT :

Is it not possible to determine the mass of an object by gravity?
And that is my research question. On the next pages I will provide the answer and develop different approaches that lead to a detailed solution, both experimentally and theoretically . It should be possible to calculate the mass of objects above gravity. Since it is not possible above the definition of gravity of Sir. Isaac Newton to find out the mass of the object, I have solved at the problem above the definition of Einsteins gravitational term. Because he defines gravity as space-time curvature, which means that each mass can be assigned an exact space property. To find out how this space property is, I created two large experiments. In which one works with photons and in the other one with light waves. The experiment can then be used to determine the properties of space in more detail. But since I can't do these experiments because I can't meet the necessary conditions, I've studied everything theoretically. The second experiment can also be calculated theoretically, so I developed a new formula, with which I can calculate the mass of any objects, with the formulas of the red and blue shift formula. At the end I calculated with my new formula the mass of the sun, moon and saturn. If you want to know if the formula works,then stay curious and have fun travelling through my idea
Why all this is important now is easy to explain, because it is simply beautiful to see how you can calculate the mass of an object above gravity after Einstein. Above all, the idea that every mass has an exact space-time property and this can be wonderfully transmitted in the entire universe.

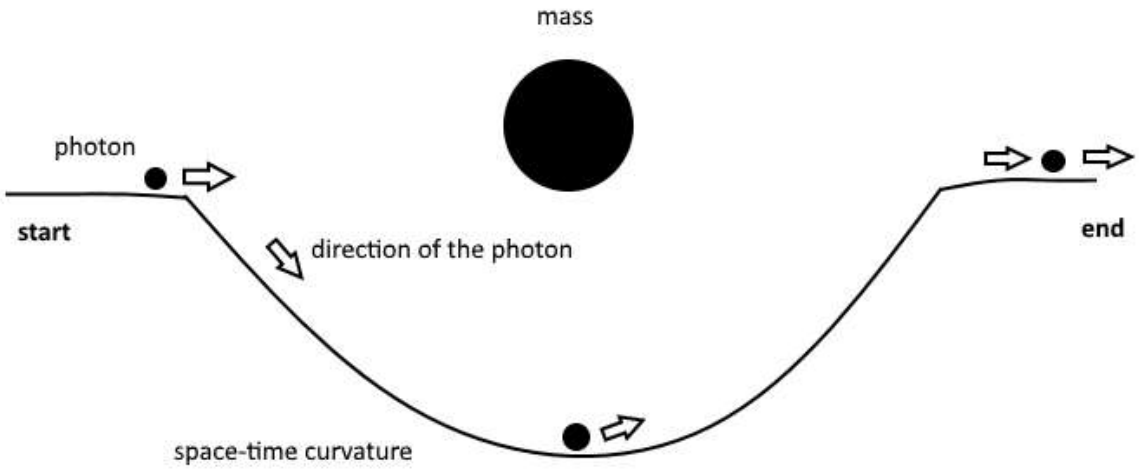
INTRODUCTION:

I was in my physics classes and listened enthusiastically to the teacher as she taught us Newton's law of gravity. We wondered how Newton arrived to the law of gravity and learned how Newton defines gravity.
We wanted to apply this self-derived law ourselves and so we got tasks from the teacher. For some tasks, Newton's law of gravity had to be equated with Newton's second axiom. Each time, the mass of the object, which rotates around another, was shortened. That was the case all the time. Then I asked why the mass of the body, which revolves around another, has to shorten. The teacher said that it is not possible to calculate the mass of the object that revolves around another solely through gravity. This statement from her brought me to this elaboration. Even in class, I couldn't let my thoughts go away from why it is not possible to calculate this mass from gravity alone. Immediately Einstein came into my mind. Why not use his definition of gravity? Knowing that gravity has a space-time curvature, each mass must be able to be assigned an exact, unique corresponding space-time curvature. So I thought of the following theory to find a basic property of the masses, so that one can manage to calculate the mass of the body that revolves around another, just by gravity.

THEORY:

In the classroom, we calculated tasks in which Newton's law of gravity had to be equated with the second axiom of Newton in order to find the desired variable.I found that each time the mass of the object orbits another one is shortened on both sides of the equation. This is also logical, because on both sides it is the same mass and if you want to put it on one side then it shortens itself away. This means that you always get out the mass of the object that is being circled.
Newton gives gravity the property that each particle attracts every other particle in the universe with a force that is directly proportional to the product of its masses and inversely proportional to the square of the distance between its centers.
We were also able to derive this consideration in physics lessons ourselves. Another consideration that also supports Newton's consideration, but we didn't discuss it at school, is the Cavendish experiment. Here, too, it becomes clear that the mass, which is heavier, attracts the other mass. However, it takes a longer time to see the results in the Cavendish experiment. But one can see them.
In class, we didn't learn anything else. Only Newton's view of gravity. As mentioned at the beginning, I asked why it is not possible to calculate the mass of this object, which orbits around another, solely by gravity. My teacher said it was just not possible.
But there is another view of gravity. That's when I came up with the idea that one has to look at it from Einstein's point of view. Einstein defined gravity as space-time curvature. This means that each mass or energy causes a space-time curvature. One has to imagine this curvature in such a way that if one has a mass or an energy, then the space bends around it. Consequently, the time where the mass is very large, as for example with a black hole, has to pass more slowly. One has to imagine this in such a way that one looks at a mountainous landscape as an observer. On the right and left, two mountain peaks rise in total. This mountain peaks are connected with a valley. Now, as a viewer, one sees a person standing on the left top of the mountain. This man, let us call him: The walker, now wants to go to the right mountain. He can only run straight out. What would the observer see? One would see that the hiker is forced to walk through the valley to arrive on the other side at the right mountain tip. However, it would be much faster if it simply „fly“ parrallel to the ground. But since he cannot fly, he has to go through the valley. Besides, he can only run straight out, which he did. Only the room was curved, but he just ran out. That's how you have to imagine this space-time curvature. At first the room was flat, but when the mass came in, the room was curved. The hiker is the photon. A photon also feels the space-time curvature. Gravity is therefore now a space-time curvature caused by masses or energy. This space-time curvature was also confirmed this year by the first image of the black hole. Now this property of masses, that they have a space-time curvature is used in my theory.
Considering that a mass causes the space-time curvature, every mass in the entire universe must do so. Masses have the property of curving space-time. We also know that space-time near a black hole is more curved than, for example, a mango. Consequently, each mango with different mass has a different space-time curvature. But what is the same with every mango is the property of curving space-time.
From these considerations it is inferred that each mass has an exact space-time curvature or that an exactly unique mass can be assigned with each space-time curvature. Now there is only the task to determine to which mass which space-time curvature belongs to it.
To do this, you have to visualise it as shown in the following picture.

1.)



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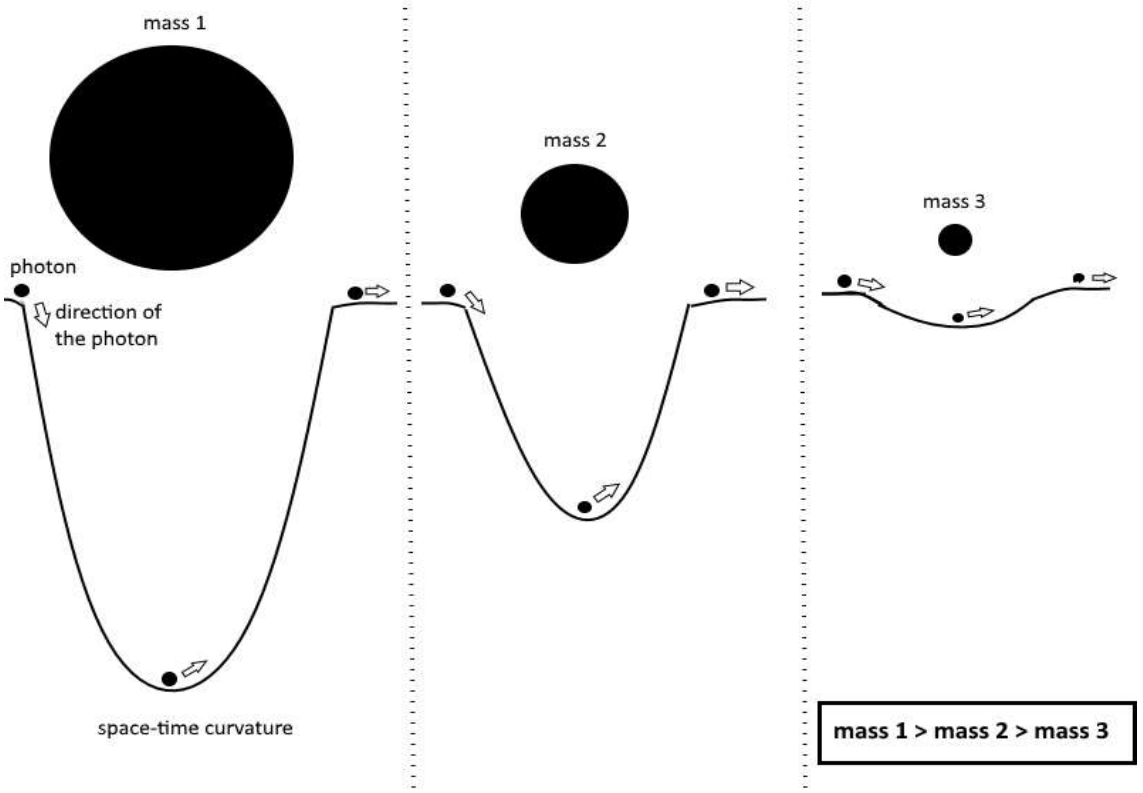


You have a mass that bends the space-time. The task is to learn more about the space-time curvature and what mass it caused. For this purpose, a photon is sent that snaps directly towards the mass, but this photon must move on the mass in such a way that it is forced by the gravity of the mass to "bend" its direction. Photons can only go straight out and this makes it here too. Therefore, the photon must necessarily follow the path of space-time curvature.

If the mass of the object were to be increased, the space-time curvature would also be increased.
This means that the path the photon has to go to get around the mass has become longer.
When the mass of the object is reduced, the path of the photon to pass the mass becomes shorter.
Therefore, in the following model, the photon must be considered under the change of mass, which then has an effect on the space-time curvature.

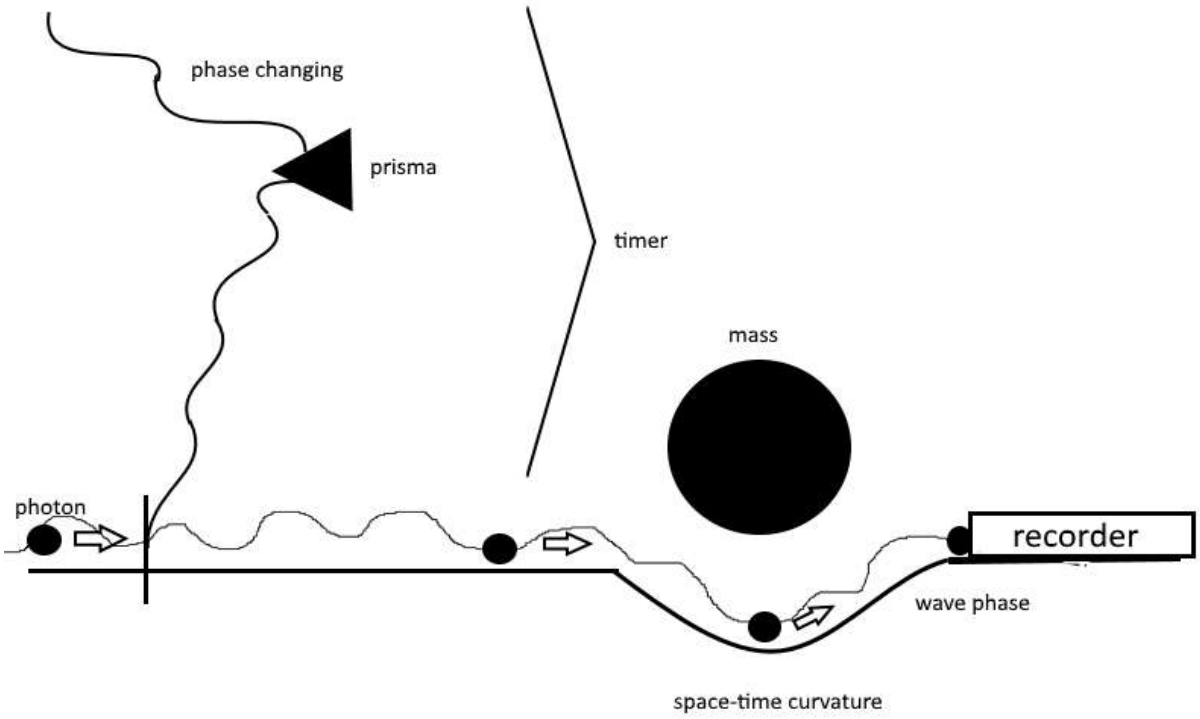
If one has found a general indication, one can apply this information to all masses. This means, for example, that one has to consider how long it takes a photon to fly past a 1 kg mass. If one now knows the time of the photon that it takes to fly past this general mass, then one can clearly assign this time with the mass of 1 kg.
If one now sends a photon to another mass, but one does not know the mass of the object, but knows that the photon takes twice as much time as with the general indication, for example, that of 1 kg. So we know that the mass must also be double from the general indication we know. In this case, then 2 kg.
You can now assign the time of this photon to the mass on the one hand or the distance of the photon on the other. So if one knows how large the distance of the photon is, for example, when it flies at the object with a mass of 1 kg, it can be said that if the distance of the photon is, for example, half of that of the 1 kg object, then the new object must weigh 500 g.

There is another option that also works with space-time curvature. It's gravitational lensing. There you can also see that the path of light is curved. Depending on how strongly the path of the photon bends, one can also say something on the mass of the object.
This possibility of gravitational lensing is also used in science. In my theory, however, an attempt is made to find properties that are present by the presence of masses, which can be found only in space and time, which are made visible by photons and then assigned to the respective masses. So that one only has to shoot photons afterwards in order to determine the mass of the object.
This means that one trys to find two memory cards to each other. On one is the property of space, which has been determined by the behavior of the photon near an object, and on the other card is the mass.
Basically, it is a question of being able to conclude on the mass by looking at space-time. Because mass and space-time curvature belong together. They belong together and are clearly to each other. If one were to have a uniform indication, one could derive from the masses of all other objects in our cosmos, simply by knowing how space-time and thus how the photon in this space is getting tangled up.
Basically, one needs a uniform indication from which one can then derive different values. Moreover, it is not yet entirely clear whether twice the time is also double the mass. That is why we now have to put the theory into practice so that one can work with concrete values.

METHOD :

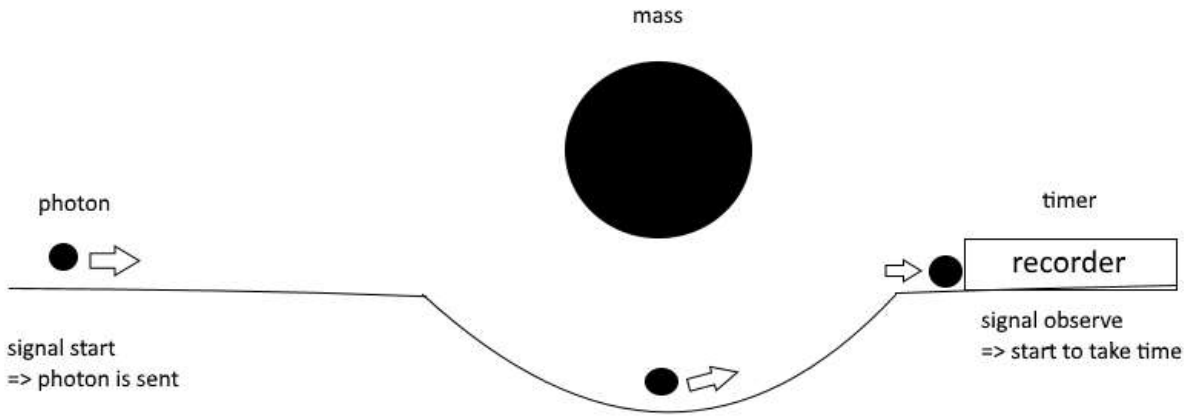
There are two experiments with which the mass of an object can be calculated over gravity. The first model is the harder version and the second model is the easy version.

Harder version)



It simply uses the experiment used to photograph the quantum entanglement. Originally, the experiment was carried out to take a photo of the quantum entanglement. No mass was used. In this experiment, however, a mass is installed. This experiment is the same as for the quantum entanglement only that one has to install a mass here, because one wants to say something about the mass. This means that you can include a time delay. You know the track1 without the mass. With the built-in mass, we would then have a time delay.
The time delay would then provide information about the mass and the phase change will give us information about the time.
You squint photons in the direction of the mass. On their way comes a gap. Some are then steered in a different direction and others continue straight out to the crowd. These, which move towards the mass, are curved on their path because of the space-time curvature and were then recorded at the end by a recorder. The jengens that have been split are steered through a prism and change their phase. Through this route you get the time out. The recorder records when the photon arrives. In addition, you can compare on this route how it would be without the mass and how the distance would be with the mass if you look at the time delay.

Easy version)

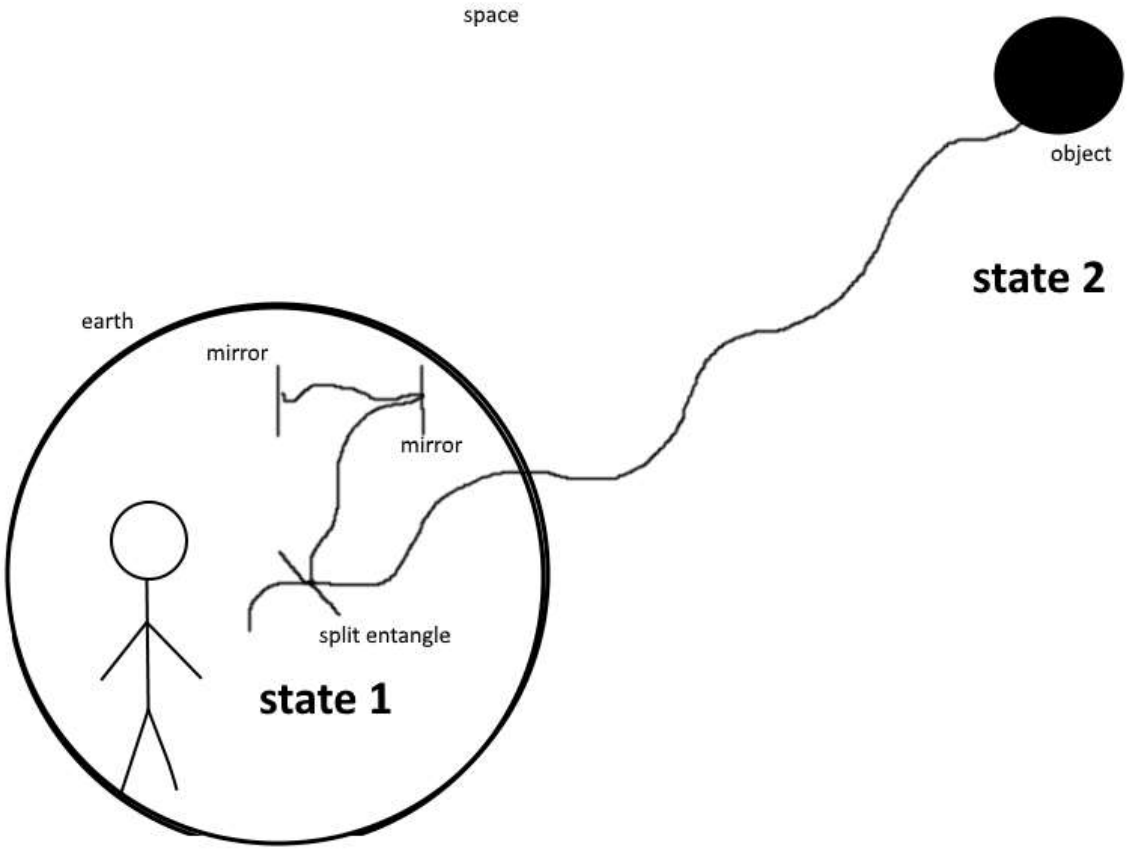


The other experiment is a simpler version. You just shoot a photon. Then when you release the photon, a signal to the recorder is slammed that the phot has now been untamed. A mass will be installed on its route of the photon. Therefore, the space-time curvature caused by the mass re-acts on the photon. The photon flies through this space time curvature and is perceived at the end by a recorder. This recorder picks up the signal that is sent out at the beginning and starts recording the time. But then when the photon arrives, it stops the time. Now we know how long the photon takes to fly past this mass. This experiment is performed at the same distance, but without the mass. Now both time values are considered. Once without the time delay and once with.
One only has to look at the difference values, because they say something about the mass of the object.
If one were to carry out the experiment with different masses, one can then say about the mass and about the space-time.
Nevertheless, the experiment cannot simply be carried out in this way. There are still some conditions that need to be considered.For example anything with mass is a disrupting source for the experiment.The photon can be disturbed by other masses on its orbit, because we know that each mass causes a space-time curvature.Therefore, all conditions must be equated. This means that you have to run the experiment in a place with the same objects. If the conditions are not equated, then the gravitational field would be changed all the time. One could therefore take the experiment through in a vacuum.

And that's the first reason why I'm not able to do the experiment myself. I don't have the necessary materials for it. So unbelievably I would like to put out my theoretically considered considerations practically and then come up with facts with which one can continue to work. Since I can't do it, I'll calculate it. After all, all that remains is the wonderful theory. That's why we'll calculate it mathematically/physically.

CALCULATION:

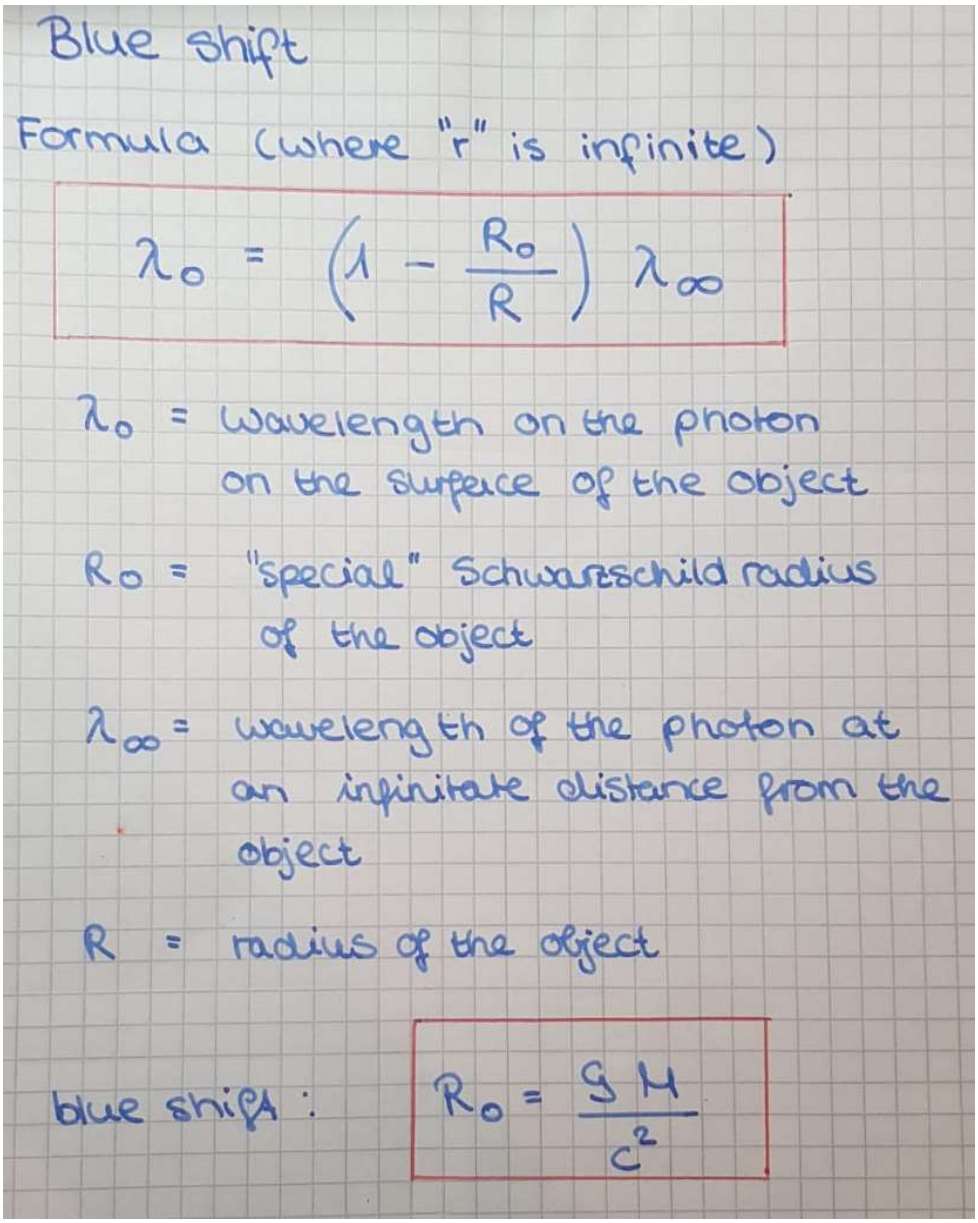
In theory:

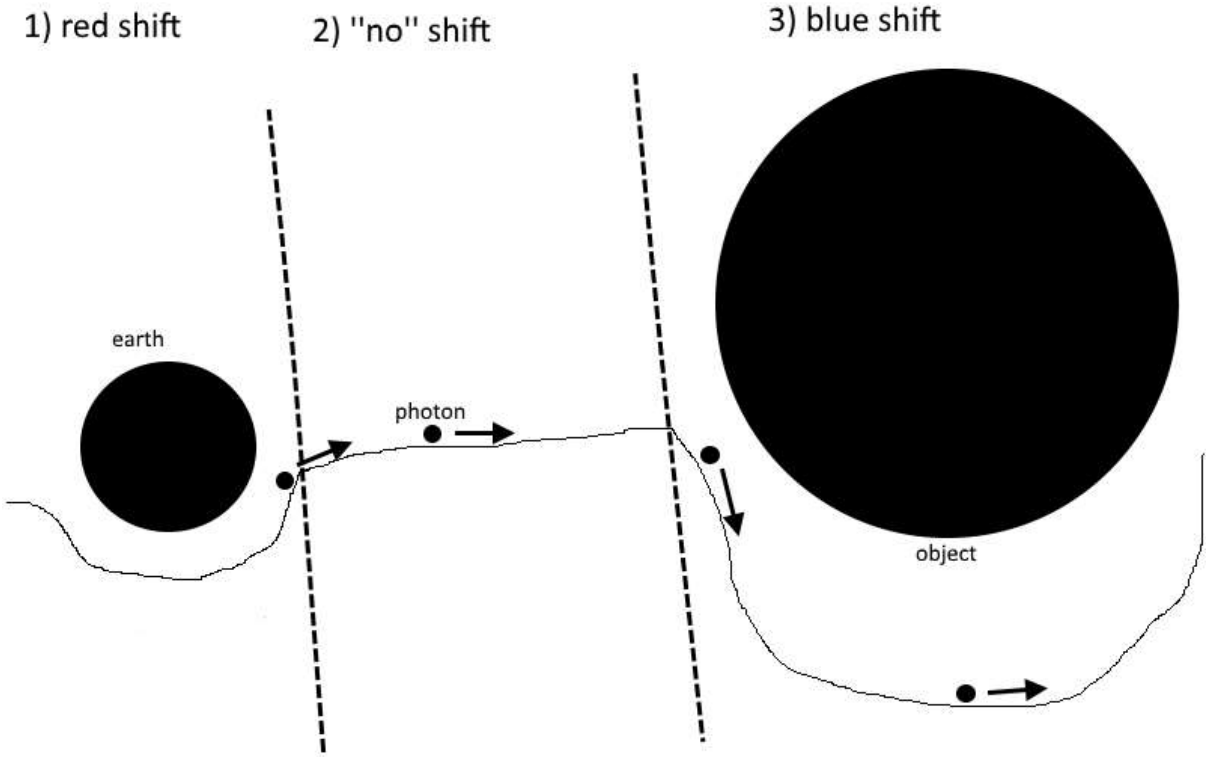


One looks at the energy of the photon, i.e. the color. This is done by looking at the wavelength. One sends a photon (state 1) with some energy that one knows of course. Then this photon is split once. A part is sent further to the object. The other part is captured on Earth between 2 mirrors. If the photon that has been sent to the object is shifted blue, it must also be able to be observed in the captured photon on Earth. It must be moved in blue because of the gravity of the object and the time delay.

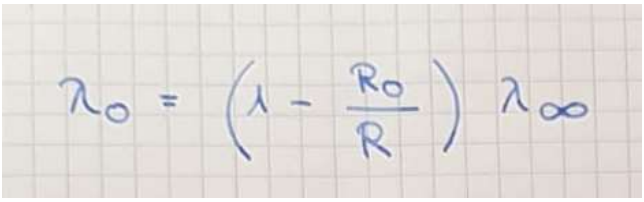
Mathematically/ physically:

First of all, one needs the blueshift formula.

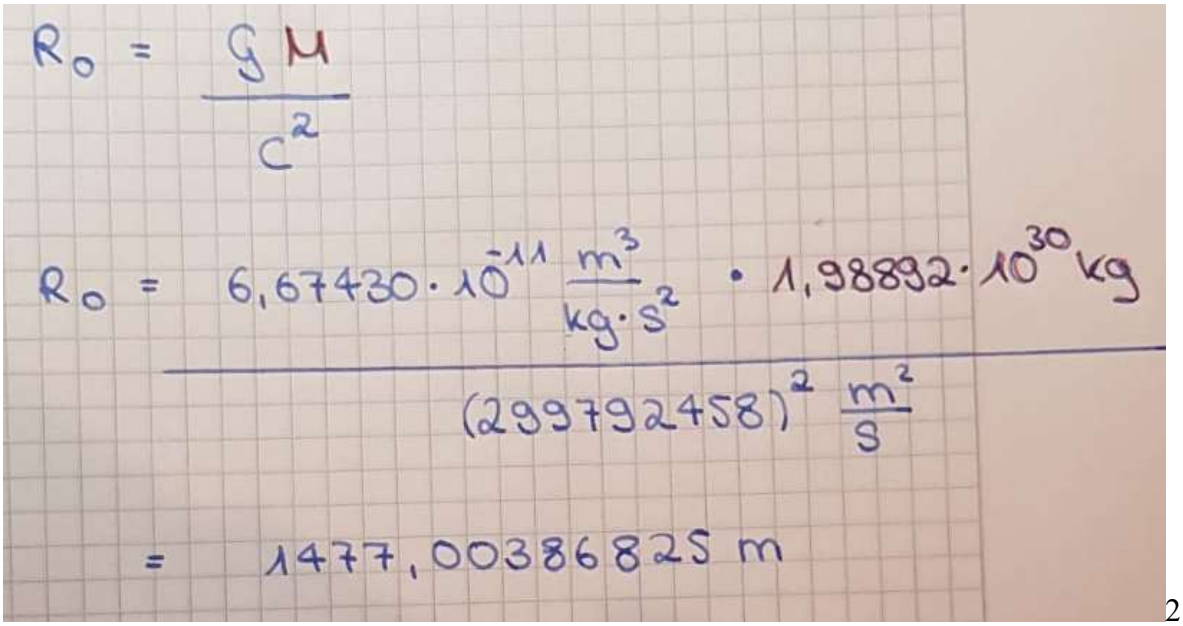




To start one needs the blue shift formula. Now one can see that one has to use R0 in the formula. The second formula is then used for this purpose.



1



2

Note, however, that you must use the desired mass in the formula, because that is what the formula requires. Since one searches for the mass of the sun, it must also be used in the second formula. This one is red-marked here. All other values are constants and can therefore be easily used.

Now the following formula is changed to find out how many percent the wavelength changes.

$$\lambda_0 = \left(1 - \frac{R_0}{R}\right) \lambda_\infty$$

Wavelength infinity is divided on both sides.

$$\frac{\lambda_0}{\lambda_\infty} = 1 - \frac{R_0}{R} \quad \Big| \cdot (-1)$$

Then (-1) is multiplied on both sides.

$$-\frac{\lambda_0}{\lambda_\infty} = -1 + \frac{R_0}{R}$$

Now the following equation is rewritten a bit.

$$-\frac{\lambda_0}{\lambda_\infty} = \frac{R_0}{R} - 1 \quad \Big| +1$$

To bring the -1 to the other side one has to calculate +1 on both sides.

$$-\frac{\lambda_0}{\lambda_\infty} + 1 = \frac{R_0}{R}$$

This can now be rewritten in a different way. One can also rewrite the +1 by simply dividing wavelength infinity by wavelenth infinty, because that results in 1.

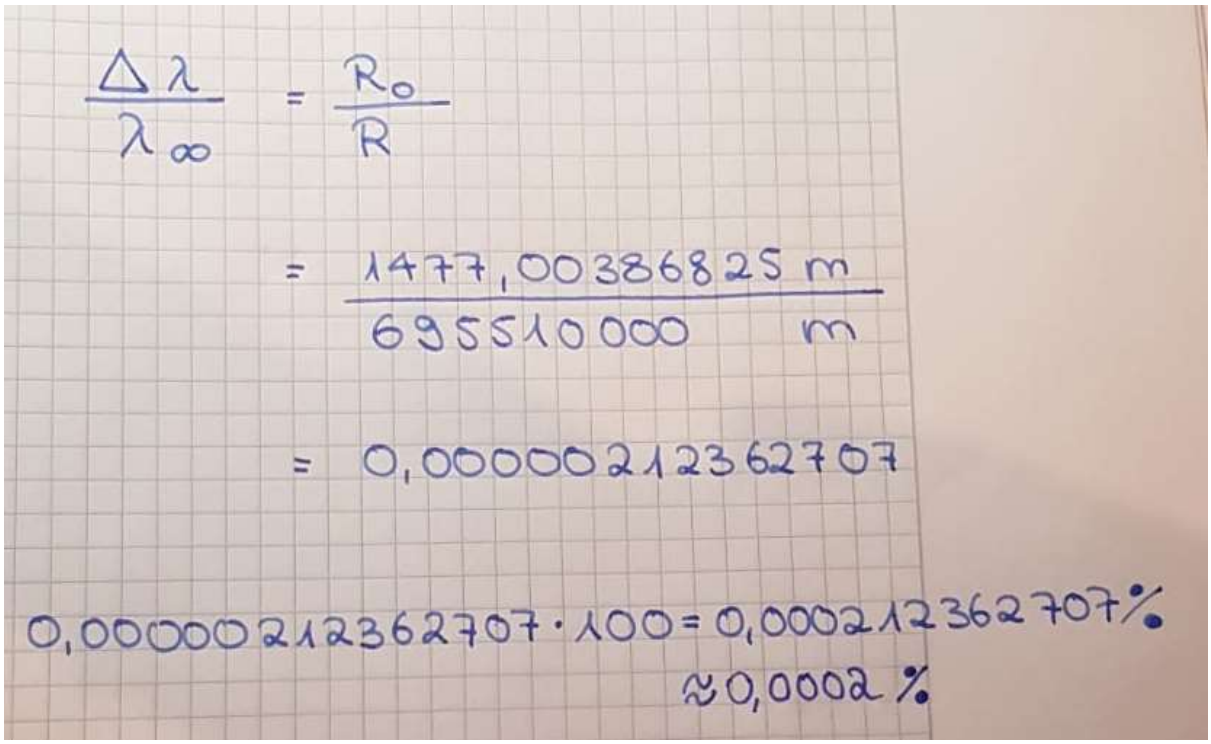
$$+\frac{\lambda_\infty}{\lambda_\infty} - \frac{\lambda_0}{\lambda_\infty} = \frac{R_0}{R}$$

And exactly this rewriting makes sense, because now one sees that wavelength infinity minus wavelength0 can be calculated, because the denominator is equal. This means that the wavelength one sensd minus the wavelength one gets is just the difference. This can be observed wonderfully in the experiment the,. because the "captured" wavelength between the mirrors then gives us the value of the wavelength difference.

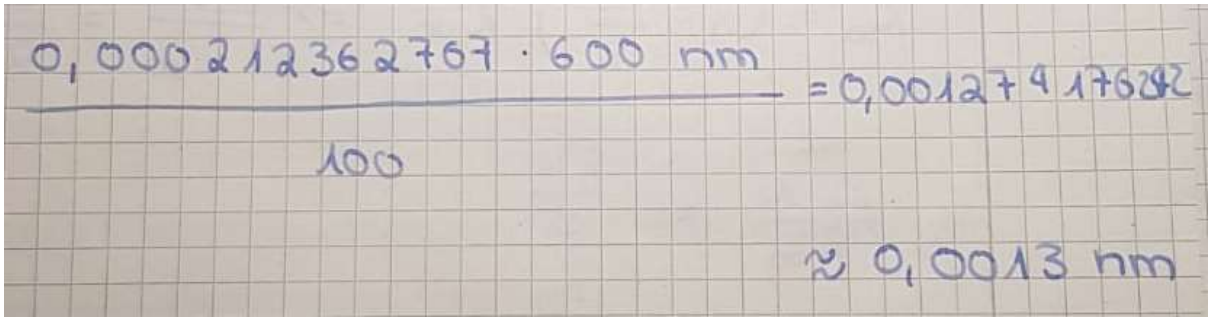
$$\frac{\lambda_\infty - \lambda_0}{\lambda_\infty} = \frac{R_0}{R}$$

$$\frac{\Delta\lambda}{\lambda_\infty} = \frac{R_0}{R}$$

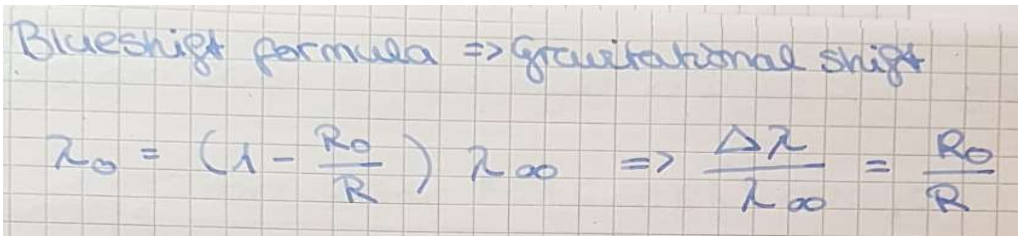
If one now divides R0 by R, one gets how much percent the wavelength changes. However, the result must then be multiplied by 100.This formula is now used for the further calculation.



To get the percentage difference, one has to calculate R0 minus R and then multiply that with 100. However, the values for R0 and R have to be looked up at the moment. As a result one gets 0,0002 % .
This means that if we send light of the wavelength 300nm to the sun, then one will notice a difference of 0.0013 nm where one has captured the light between 2 mirrors..



Now one can access the gravitational shift formula from the Blueshift formula.



The following formula is used in the new formula.

$$R_0 = \frac{GM}{c^2}$$

$$\frac{\Delta\lambda}{\lambda_\infty} = \frac{R_0}{R}$$

$$\frac{\Delta\lambda}{\lambda_\infty} = \frac{\frac{GM}{c^2}}{R}$$

$$\frac{\Delta\lambda}{\lambda_\infty} = \frac{GM}{c^2 \cdot R}$$

$$\frac{\frac{\Delta\lambda}{\lambda_\infty} \cdot c^2 \cdot R}{G} = M$$

$$\frac{\Delta\lambda \cdot c^2 \cdot R}{\lambda_\infty \cdot G} = M$$

$$M = \frac{\Delta\lambda \cdot c^2 \cdot R}{\lambda_\infty \cdot G}$$

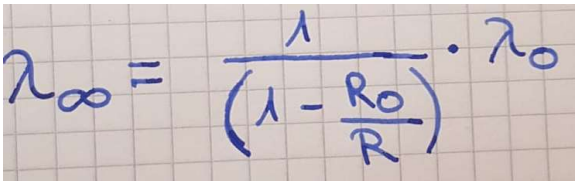
$$M = \frac{(\lambda_\infty - \lambda_0) \cdot c^2 \cdot R}{\lambda_\infty \cdot G}$$

Full experiment for the sun :

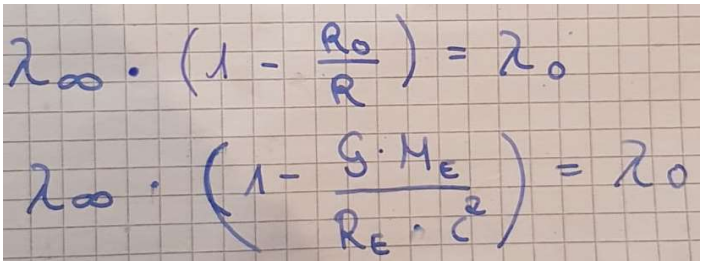
First of all, the question arises which wave length one has to send to the sun, so that it is **600 nm after the red shift ?**

Formula (when r is infinite) ; wavelength measured on earth

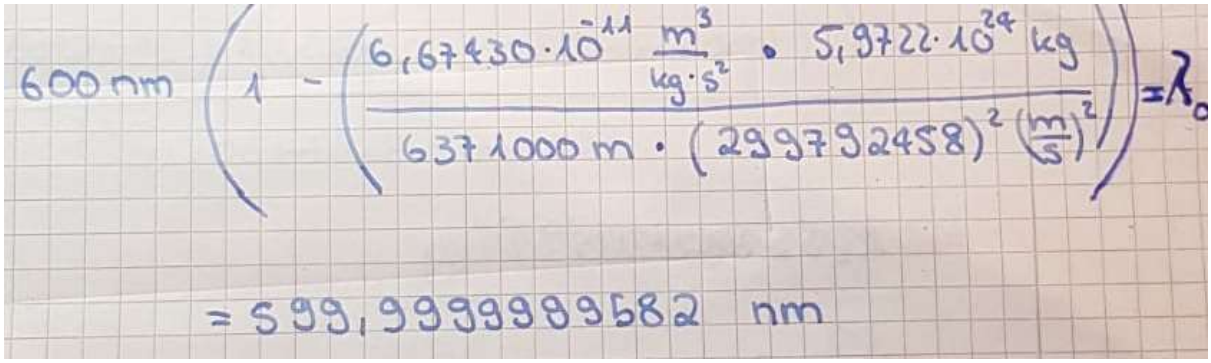
1) Redshift:



One converts the formula and uses the formula for R0. One now needs the earth's mass because one is in the gravitational field from Earth.



Now you just need to insert all values into the formula.



We have to send 599,9999999582 nm from Earth so that it can be 600 nm after redshift.

2)

For short distance between earth and the object, there is then no shift, but if there is a long distance then there is a shift, because of cosmological red shift. That is because the universe is expanding. In my calculation, it is simply assumed that there is no shift available because I choose the distance not so large.

3) Blueshift:

Now we need the formula that we have just derived for the masse.

$$M = \frac{(\lambda_\infty - \lambda_0) \cdot c^2 \cdot R}{\lambda_\infty \cdot G}$$

This value can be observed

$$= \frac{600\,nm - (600 - 0{,}0013\,nm) \cdot c^2 \cdot R}{\lambda_\infty \cdot G}$$

$$= \frac{600\,nm - (600 - 0{,}0013) \cdot (299792458)^2 \cdot R_s}{600nm \cdot 6{,}67430 \cdot 10^{-11}}$$

$$= \frac{((600\,nm - (600 - 0{,}0013))) \cdot (299792458)^2 \cdot 6955100000m}{600\,nm \cdot 6{,}67430 \cdot 10^{-11}}$$

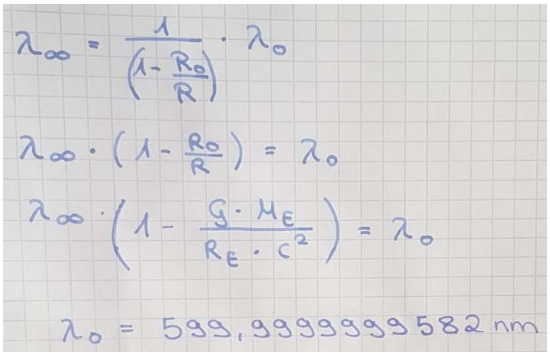
$$= 2{,}0292295 \cdot 10^{30}\,kg$$

If you now use all values you get 2,0292295x10^30 kg. This is close to the real mass of the sun which is 1,98892x10^30 kg.

Full experiment for the moon :

1) Redshift:

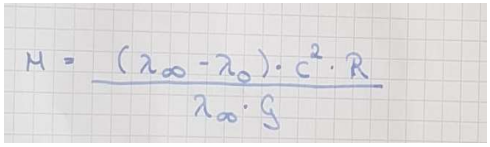
One has to use the mass of the earth in the formula.



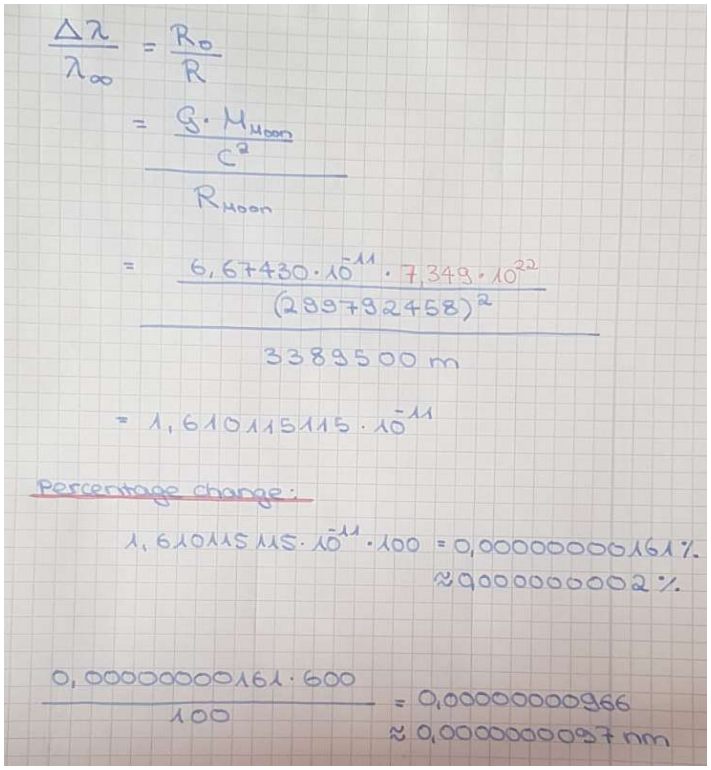
Again, the same comes out as with the sun, since we are still in the field of the earth.
One has to send 599,9999999582 nm wavelenght from the earth in order to get after the redshift a wave of 600 nm.

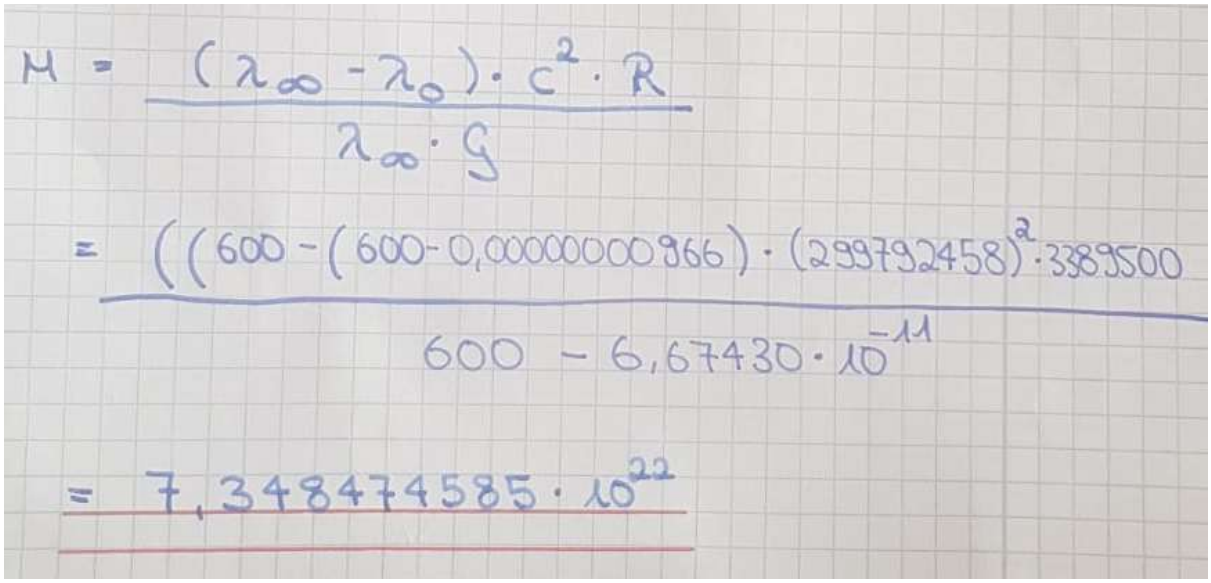
2) No shift, because the distance between earth and moon is small.

3) Blueshift:



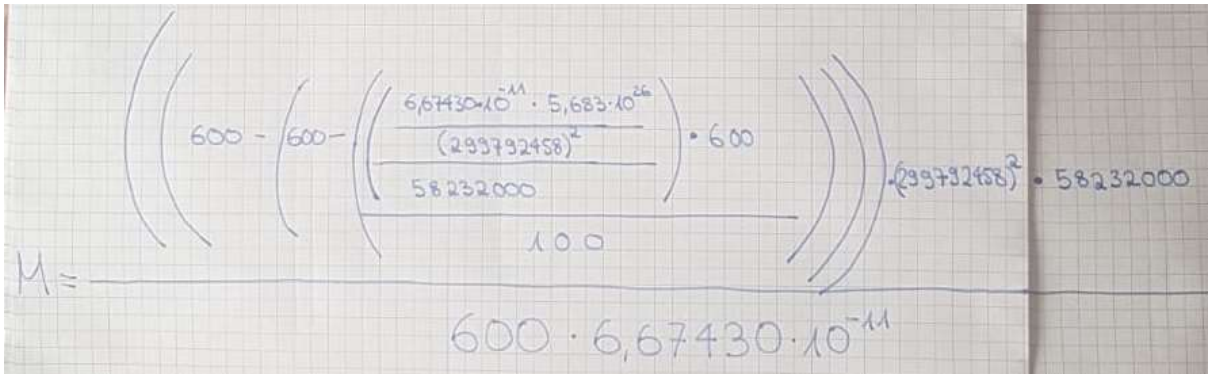
One has to calculate wavelength0. So one needs the following formula. But here the mass of the moon is already used, because I can not do the practical experiment. Later when one does the experiment, one doesn‘t need it to calculate.





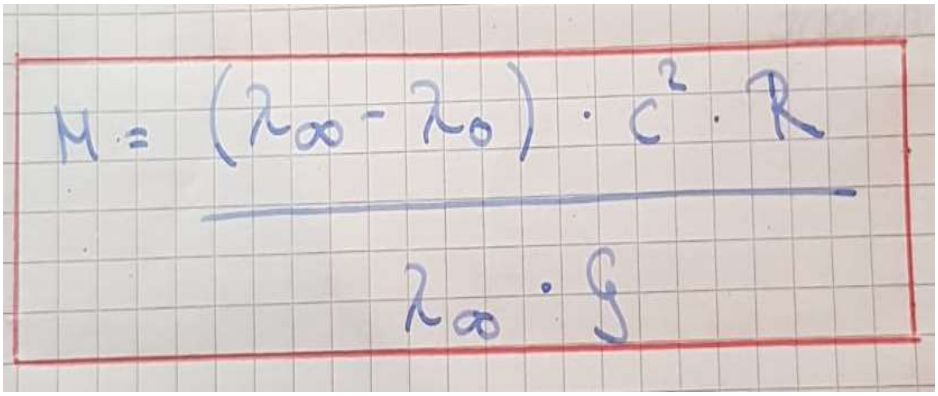
The final result is very close to the value of the measured mass of the moon, which is 7,349x10^22.

Full experiment for saturn :

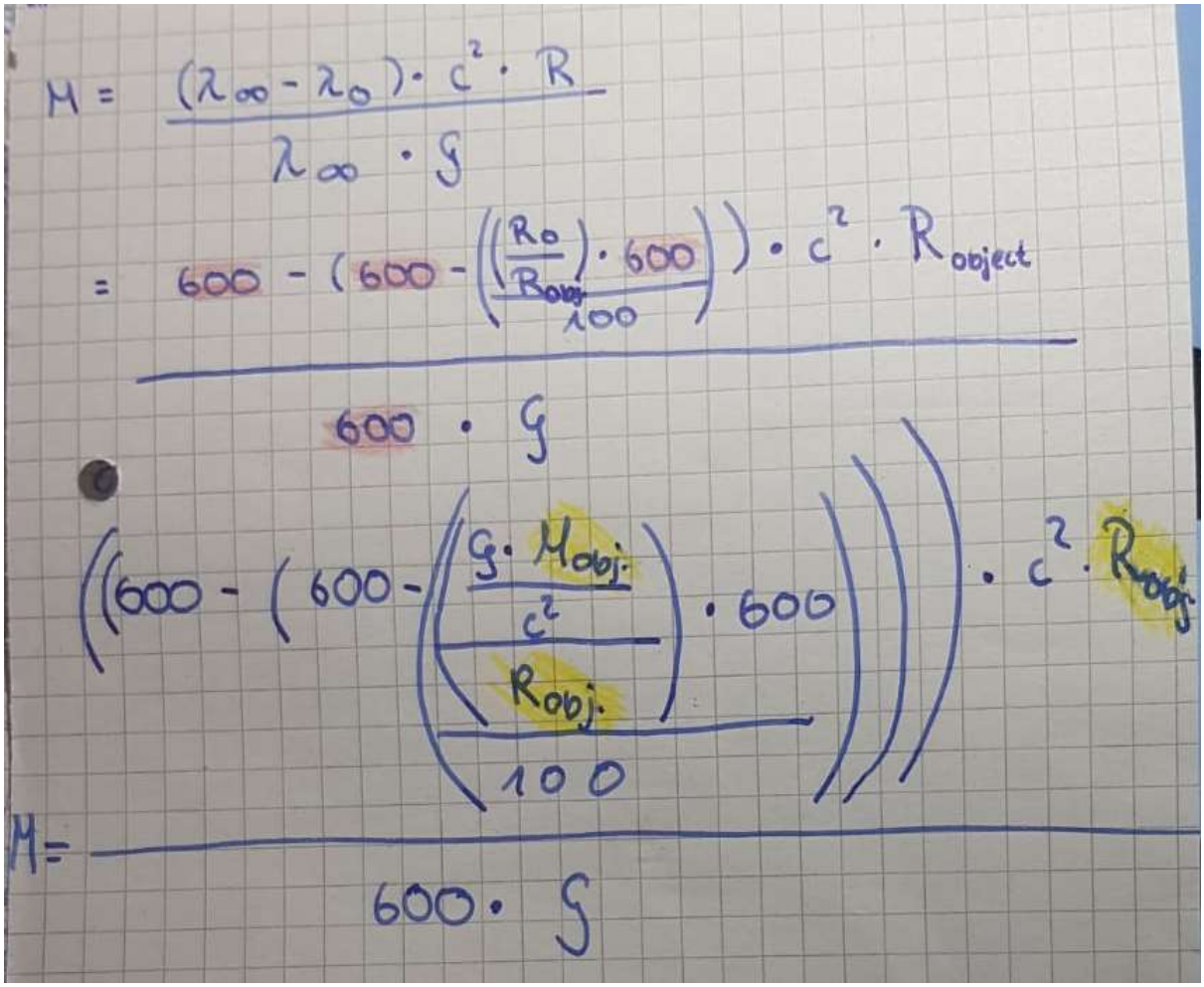


Also the value for the mass of Saturn comes very close to the calculated mass, which is 5,683x10^26.

RESULT:



This is the formula that I get to calculate the mass of a object.



And this is the final result. One only needs the mass-object and radius-object. Mass-object can be found out over the experiment.

DISCUSSION WITH THE RESULT:

As one can see, one can perfectly calculate the mass of an object. In addition, the value is also relatively accurate, for the fact that one has calculated it theoretically. In spite of this, the formula can only calculate masses of which we know the radius. One has to include the values one gained from the experiment, but the formula still requires the radius. Unless I use a different formula for this, and expand that formula further.
But what is also very nice is that one has to try the experiment at different masses and then can definitely conclude from the results what the mass of an object is, just by looking at the space time curvature. Because if you know what, for example, the space-time curvature of the mass of the sun is, and when you look then at another space-time curvature of another mass, that you do not now, and finds out that it is twice the space-time curvature of the sun, then you also know that the mass should be twice the sun's mass. In the end, you have a universal value from which one can derive the masses of any other objects by only knowing the space-time-curvature. **And that's beautiful**.

CONCLUSION:

So I have found an answer to my question. Yes, I can calculate the mass of an object above gravity. But much more I have found out that it is very complex to set up your own theory. You have to consider so much if you want to develop an idea, if you want to make a theory incredible. It often starts with a small thought that comes out of nothing and seems plausible at first, but in the progress with working with it, it makes it even more difficult to get it physically right on paper. Nevertheless, working with my idea was a lot of fun for me. Because I've learned how to work scientifically. I greatly appreciate the work of every scientist. It is very outstanding how to write theories, even whole laws.
With the help of your organization, I have put my own theory on the page and put myself deeper and deeper into it. I have expanded my own knowledge.

REFERENCES:

- https://www.sciencealert.com/scientists-just-unveiled-the-first-ever-photo-of-quantum-entanglement
- vixra.org/pdf/1704.0123v1.pdf
- https://en.wikipedia.org/wiki/Sun
- https://en.wikipedia.org/wiki/Moon
- https://en.wikipedia.org/wiki/Saturn