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Light Velocity Changes with the Gravitational Potential of the Reference Frame.

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Einstein has been confused by his concept of invariable light velocity. So Einstein's formula for the energy of a frame when it moves with changing of mass, space and time: $E_{re}=m_o\gamma.c^2$ is incorrect. When the gravitational potential of frame is changed, the light velocity is also changed. This can be calculated from the Textbooks: "**Physics principles & problems**", published by **Merrill Publishing Company – Columbus, Ohio 43216**.

We can see the experimental apparatus to measure time using light at pages 551 and 552:

"Appendix, A: 4 *the meaning of time.*
Einstein noted that these postulates seemed to contradict each other. Taken together, they did not seem to make sense. The problem, wrote Einstein, was that the measurement of position and time had to be considered very carefully. Time, said Einstein, is something measured by clock. Consider a special clock installed on a satellite. At one end of a stick of length L_s is flash lamp and detector. At the other end is a mirror. The light flashes and the mirror. The light flashes and the mirror reflect the flash to the detector. The detector triggers the lamp, producing another flash. Each flash is like the tick of a clock. Now, this is not a practical clock, but it is one that illustrates the principle. An astronaut at rest with respect to the clock would find that the time between ticks, t_s , would be equal to the distance traveled, $2L_s$, divided by the speed of light, c . That is, $t_s = 2L_s/c$. In other words, $ct_s = 2L_s$.

If the satellite is moving with velocity v in a direction perpendicular to the stick, consider what an observer on the earth would see. The lamp would flash, but in the time it takes the flash to reach the mirror, t_m , the mirror would have moved a distance vt_m. As shown in Figure A-2, the path taken by the light is the hypotenuse of a right triangle. The altitude is L_s , or $ct_s/2$ and the base is vt_m. Because light moves at the same velocity c for all observers, the distance traveled by the light is ct_m . The Pythagorean theorems states

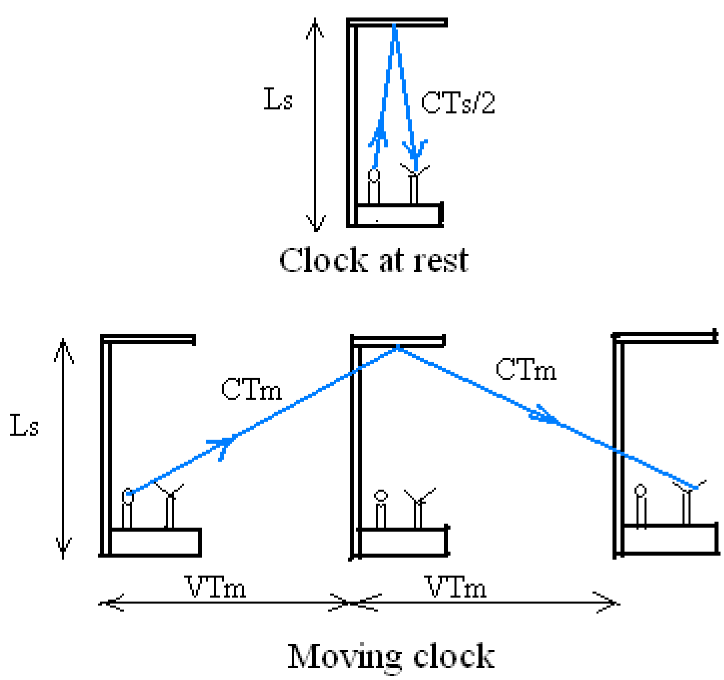
$$\left(\frac{ct_s}{2}\right)^2 + (vt_m)^2 = (ct_m)^2 \qquad\qquad t_m = \frac{ct_s}{2\sqrt{c^2 - v^2}}$$

The return trip to the detection takes the same amount of time. Let t_e be the time between "ticks" measured by the observer on the earth. Then $t_e=2t_m$, which is

$$t_e = \frac{t_s}{\sqrt{1 - \frac{v^2}{c^2}}}$$

The velocity is always smaller than c , so the denominator is always smaller than one. Thus t_e is always larger than t_s . That is, the moving clock on the satellite runs slowly as measured by an observer on the ground. This is called time dilation."

Figure A-2 . *Experimental apparatus to measure time using light*



Note: We realize that t_s is a time passing of frame at rest (Clock at rest) and t_e is a time passing of the moving frame (Moving clock).

$$t_e = \frac{t_s}{\sqrt{1-\frac{v^2}{c^2}}} \quad , \quad \text{because:} \quad \gamma = \frac{1}{\sqrt{1-\frac{v^2}{c^2}}} \quad . \quad \text{So} \quad t_e = t_s.\gamma$$

(γ is shrinkable coefficient of Lorenzt)

Since *Figure A-2* is an experiment apparatus to measure time using light, we find that l_e=c.2t_m=c.t_e is distance of translation of light in the moving frame and l_s=2L_s=c.t_s is distance of translation of light in the frame at rest.

We call l_s=300,000km_o and t_s=s_o are components of unit of light velocity: c=c_o in the frame at rest. Then c=c_o=300,000km_o/s_o. And if we call l_e=300,000km_r and t_e=s_r are components of unit of light velocity: c_r in the moving frame. Then c_r=300,000km_r/s_r.

In the moving frame, (in figure: Moving Clock), Einstein has written l_e=2.c.t_m=c.t_e. Because c=c_o=300,000km_o/s_o , so

l_e=300,000km_o/s_o.2t_m or l_e=300,000km_o/s_o.t_e

We realize that km_o/s_o is unit of light velocity: c=c_o in the frame at rest and 2t_m or t_e=s_r is unit of time in the moving frame. The unit of time: t_s=s_o in the frame at rest (in figure: Clock at rest) is different from the unit of time: t_e=s_r in the moving frame (in figure: Moving clock). The distance of translation of light in the moving frame: l_e is only calculated when the unit: km_o/s_o becomes km_r/s_r , or the unit of time t_e becomes t_s.γ . Einstein has been confused by this c=300,000km/s in the moving frame.

However, the experimental apparatus to measure time using light as per **figure: a-2** is correct if we consider c is only c=300,000=constant which correct in all frames of reference and the unit: km/s of c=300,000 will be calculated in space and time of each frame of reference.

Then, because t_e=s_r and t_s=s_o and t_e=t_s.γ and l_e=c_r.t_e , so

l_e=c_r.t_e=300,000km_r/s_r.t_e= 300,000km_r

or l_e=c.t_s.γ =300,000km_o/s_o.t_s.γ =300,000km_o.γ = l_s.γ

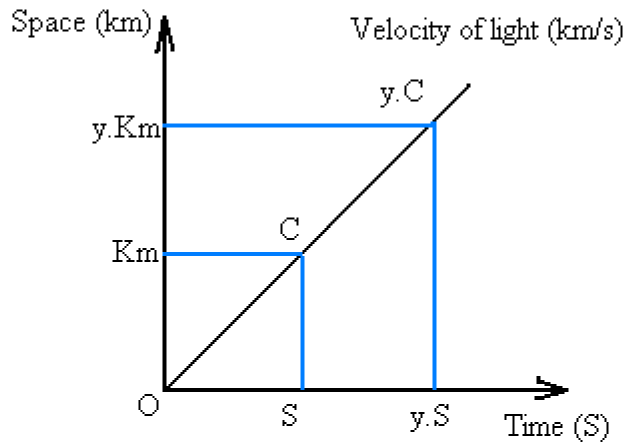
Or the distance of translation of light: l_e can be also calculated as follows:

From $t_m = \frac{ct_s}{2\sqrt{c^2 - v^2}} = \frac{t_s}{2\sqrt{1 - \frac{v^2}{c^2}}} \rightarrow l_e = 2ct_m = \frac{ct_s}{\sqrt{1 - \frac{v^2}{c^2}}}$

$l_s = ct_s$ and $\gamma = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}} \rightarrow l_e = l_s.\gamma$

We find that $c_r = \frac{l_e}{t_e} = \frac{l_s.\gamma}{t_s.\gamma} = \frac{300{,}000km_r}{s_r} = \frac{300{,}000km_o.\gamma}{s_o.\gamma}$ or $c_r = c_o.\gamma$

This is because space and time are components of velocity and we can see graph of the components of space, time and light velocity as follows:



Because $c_r = c.\gamma = c_o.\gamma$, so Einstein's formula: $E_{re} = m_o.\gamma.c^2$ which expresses the energy of frame when it moves with changing mass, space and time has to be $E_r = m_o.\gamma.c_o^2.\gamma^2$ or $E_r = m_o.\gamma^3.c_o^2$.

We can conclude that light velocity: $c = c_o$ in the frame at rest is different from the light velocity: c_r in the moving frame and we can't apply $c = 300{,}000km_o/s_o$ for the frames which move, where the space and time are changed. Einstein's formula: $E_{re} = m_o.\gamma.c^2$ is incorrect and it has to be revised by $E_r = m_o.\gamma^3.c_o^2$.

Einstein has shown the changes of the space and time in the frame when moving rapidly, but he has been confused by his concept of invariable light velocity. The light velocity in the frame at rest is similar to the light velocity in the moving frame, but the light velocity in the frame at rest is not equal to the light velocity in the moving frame.

From Einstein' formula of energy of the moving frame with extreme velocity: $E_r=\gamma.m_o.c^2$ and it has to be revised by $E_r=m_o.\gamma.c_o^2.\gamma^2$, we find that the mass of the frame at rest is m_o and the mass of the moving frame with extreme velocity is $\gamma.m_o$. If the mass of the frame at rest (in the figure A:2 is Clock at rest) is m_o and its gravitational potential is G, then the mass of the moving frame with extreme velocity (in the figure A:2 is Moving clock) is $\gamma.m_o$ and its gravitational potential is $\gamma.G$. The light velocity in the gravitational potential: G of the frame at rest is c_o , but the light velocity in the gravitational potential: $\gamma.G$ of the moving frame with extreme velocity is $c_r= \gamma.c_o$.

So when the gravitational potential of the frame of reference is changed from G to $\gamma.G$, then the light velocity is also changed from c_o to $c_r= \gamma.c_o$.

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