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Slowing Time and Shortening Space in a Gravitational Field: Gravitational Blue or Red Shift

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As we know, escape velocity from a celestial mass is calculated by the following equation:

$$v = \sqrt{\frac{2GM}{r}}$$

V is the escape velocity, M is the mass of celestial substance, G is the universal constant for gravity, and r is distance from the centre of masses. Now if we suppose the escape velocity is the same as light velocity, the Schwartzschild radius is defined. This means that distances less than the limiting radius (a black hole), it is not possible for light to escape. In the reverse sense, it means that if an object falls inward towards the core, it appears that its velocity will approach that of light at that distance from the core of the black hole. In this situation, time will approximately slow to a stop and length will approach zero. This location is called the zero point of space–time, idiomatically. This special location can be a suitable origin for calculating and measuring gravitational effects on time and space (space-time). For this, we enter the escape velocity of the object instead of a limited velocity in the following equations, which are subject to changes in time and space according to the Lorentz transformations.

$$t' = t\sqrt{1 - \frac{v^2}{c^2}}$$

$$v = \sqrt{\frac{2GM}{r}}$$

$$t' = t\sqrt{1 - \frac{\left(\sqrt{\frac{2GM}{r}}\right)^2}{c^2}} = t\sqrt{1 - \frac{\frac{2GM}{r}}{c^2}}$$

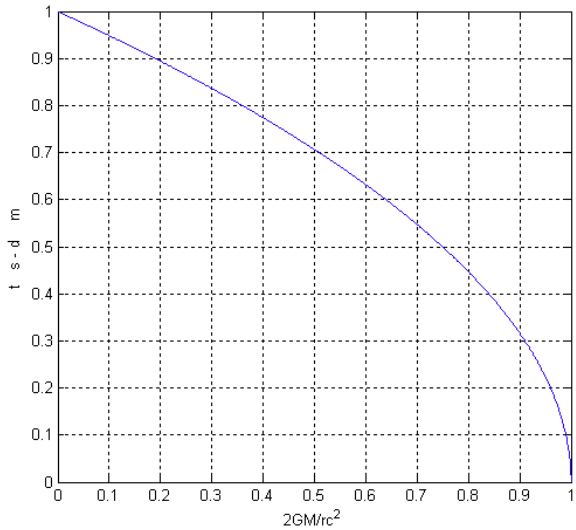
$$t' = t\sqrt{1 - \frac{2GM}{rc^2}}$$

$$d' = d\sqrt{1 - \frac{2GM}{rc^2}}$$

t is standard time, t' is dilated time, c is light speed, d is distance, and d' is relativistic distance. Two of the above attained equations are used to reveal changes in time and space in a gravitational field. So we have according to the definition:

$$1 \geq \frac{2GM}{rc^2} \geq 0$$

Chart for gravitational field intensity, relativistic time and space



Considering that the velocity of light depends on the space–time environment (circumference) and is always measured consistent with each situation, the wavelength will shorten proportional to space. This means:

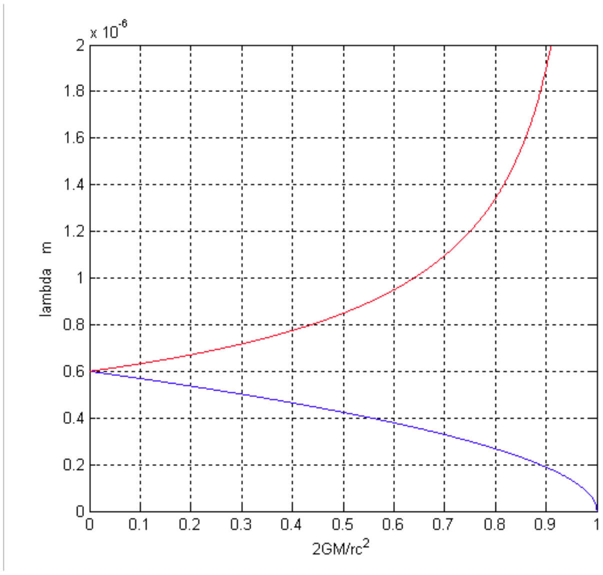
$$\lambda' = \lambda\sqrt{1 - \frac{2GM}{rc^2}}$$

The above equation is consistent with light falling in a gravitational field. But if light escapes from the gravitational field, the following equation applies:

$$\lambda' = \frac{\lambda}{\sqrt{1 - \frac{2GM}{rc^2}}}$$

This is the opposite of the previous situation. λ is the wavelength and λ' is the modified wavelength.

The chart for fallingl or light escape and its change of wavelength (transfer to blue or gravity red)



Consider that the following equations apply in every situation:

$$f\lambda = c \Rightarrow \lambda = \frac{c}{f}$$

$$f'\lambda' = c \Rightarrow \lambda' = \frac{c}{f'}$$

f is the frequency and f' is the modified frequency, resulting in:

$$\lambda' = \lambda\sqrt{1 - \frac{2GM}{rc^2}}$$

$$\frac{c}{f'} = \frac{c}{f}\sqrt{1 - \frac{2GM}{rc^2}}$$

$$\frac{1}{f'} = \frac{\sqrt{1 - \frac{2GM}{rc^2}}}{f}$$

$$f = f'\sqrt{1 - \frac{2GM}{rc^2}}$$

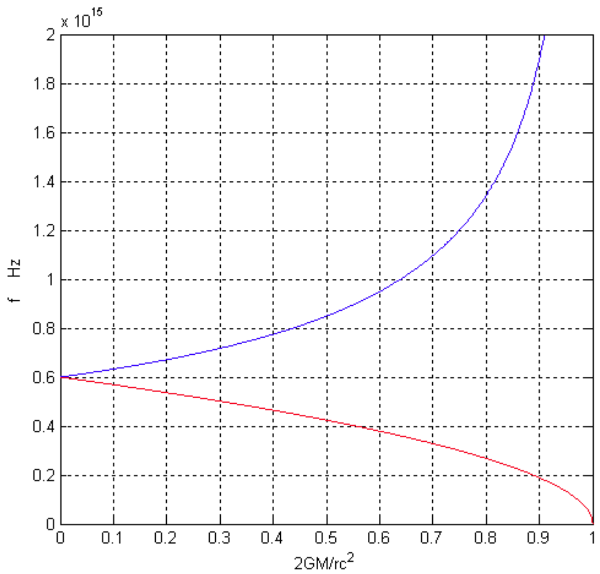
$$f' = \frac{f}{\sqrt{1 - \frac{2GM}{rc^2}}}$$

The above equation is correct when the light falls into the gravittational field, but at escape from the field, the following equation applies:

$$f' = f\sqrt{1 - \frac{2GM}{rc^2}}$$

This is opposite to the previous situation. These, both, are events which are called transfer to gravitational red or blue.

The chart for capture or light escape and its frequency changes (transfer to blue or to red)



$$\frac{2GM}{rc^2} = 1 \Rightarrow \; rc^2 = 2GM$$

$$r = \frac{2GM}{c^2} = \frac{2 \times 6.672 \times 10^{-11}}{\left(3 \times 10^8\right)^2} M$$

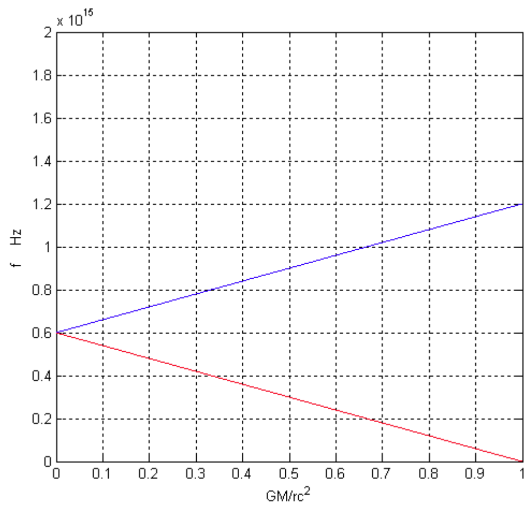
$$r = 1.48 \times 10^{-27} M (meter)$$

In fact, the escape velocity at this location is the speed of light where the Schwartzschild equation will apply. This means that at this location, the wavelength tends towards zero and the frequency of the wave tends to the extreme. Time and space (space-time) tends towards zero.

It is interesting to note that relativity theory suggests the same equations in regard to time slowing and space shortening. But for frequency changes, the following equation is inferred:

$$f' = f\left(1 \pm \frac{GM}{rc^2}\right)$$

The chart for the above equation follows:

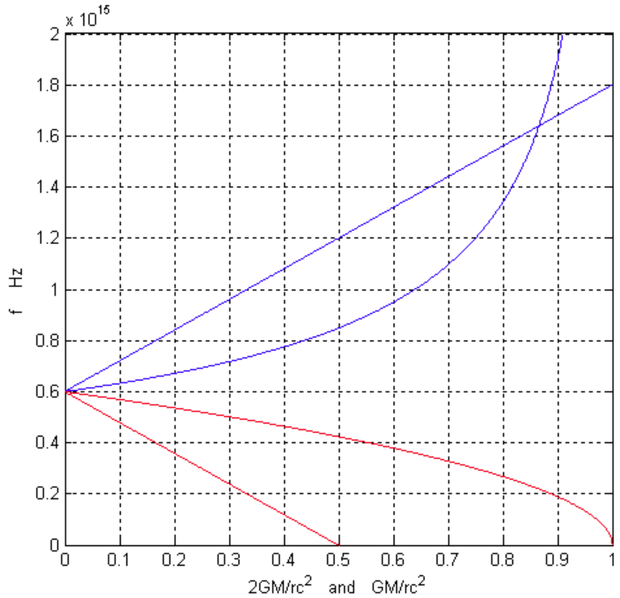


The proposed equation in general relativity and quantum mechanic raises two serious problems or objections:

1. The chart is linear instead of being curved.

2. The equation in light escape from Schwartzchild radius (using the negative) seems correct, because the light frequency becomes zero. But in the fall of light into the gravity field (using the positive), light frequency is doubled finally and cannot be greater. The inconsiderable and small amount that light energy and frequency exceeds these amounts at the time light drops into a black hole, can not be calculated by this formula.

Now to merge, compare and check the above charts:



It is very clear that the equations in this discussion are more applicable than those of Einstein's general relativity or those of quantum mechanics. This objection to general relativity theory or quantum mechanics is therefore pertinent and justified.

Now calculate the electromagnetic wave energy at the time of decent into the gravitational field:

$$E = hf$$

$$E' = hf'$$

$$E' = \frac{hf}{\sqrt{1 - \frac{2GM}{rc^2}}}$$

E is primary electromagnetic quantum energy, E' is the secondary energy, and h is Plank's constant. The above equation applies at the time light falls into the gravitational field, but the following equation is applies when light escapes it:

$$E' = hf\sqrt{1 - \frac{2Gm}{rc^2}}$$

This is the opposite situation of that previous. These new equations apply at the time of light energy or frequency transfer to gravitational blue or red; and the precise tests can determine their accuracy and precision.

The chart for light absorption or escape and its energy changes (transfer to gravitational blue or red)