The Relative non-locality

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…To investigate the mathematical and physical applications of relative non-locality in general relativity and using it to bridge the gap between general relativity and quantum mechanics without the need for a new unifying theory, in fact both theories are compatible when we put the relative non-locality in perspective, it's first introduced by Einstein in 1911, the relative non-locality is the illusion of superluminal speed phenomena due to the difference in spacetime gravity potential between two points in space, this illusion of superluminal speed is a direct indicator of spacetime curvature difference between two intervals in space such that the conditions of curvature difference is the key element to solve the compatibility problem between general relativity and quantum mechanics, then by following this line of work I found that Einstein field equation is compatible with uncertainty principle in a way that the stress energy tensor could be extract from the momentum uncertainty in the uncertainty principle, this happened only when we have a quantum entangled system of collective masses of bigger than or equal to half Planck-mass as minimum requirements to bend spacetime, then by using quantum entangled system with a rest mass of half Planck mass or more and then by using this knowledge I put the requirements for an experiment to generate artificial gravitational singularities in particle accelerators as a good way to test this paper and its very promising way for both nuclear fusion and superluminal space travel.

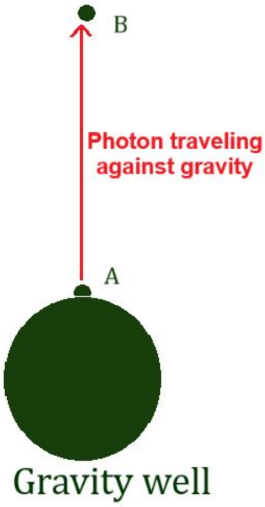
Introduction:

There are two kinds of non-locality in physics, real non-locality and relative non-locality, the real non-locality is a cause and effect carried from outside spacetime since it's contradict light cone of relativity and does not obey Lorentz factor, it simply involves a spontaneous information transition between two points in spacetime[1],[2],[3],[4],[5],[6],[7], real non-locality could even involve quantum information traveling from the future to the past such that the reality could change in correlation to the observer[8],[9],[10],[11],[12],[13],[] all this happens without any hidden variables inside spacetime, it is all well verified by Bell's inequality test experiments[14].

And then we have the relative non-locality it's an act appear to us as a faster than light but in reality it's not, it's only appeared to us in this form if we take our measurements between two spacetime intervals or more with a gravitational potential difference between these two intervals, in fact, this is an illusion[15] of faster than light due to the shortcoming of measurements because of the difference in spacetime curvature between these two intervals[A].

[A] Very important alert to remove any misconceptions may occur regards the speed of light "From now on when ever I mention a non-constant speed of light or faster than light travel or information transition faster than light, then it's all exclusively and strictly in the context of illusion of superluminal speed, and it would never be in the context of Lorentz invariance violation of speed of light such that the principle of the

Now let's consider a two point in space (A & B) such that point (A) is very close to a surface of a gravity well and point (B) is at infinite distance from the same gravity well, then for photon in point (A) moving towards point (B) it should lose energy in this propagation between these two points due to the difference in spacetime curvature i.e. the difference in gravitational potential then the speed of light will be constant only for local observers and different for a non-local observers Einstein concluded that in equation number (3) in his paper "On the influence of gravitation on the propagation of light"[16]in equation number (3) he proved mathematically that the speed of light would be variable in vacuum as long as it's being exclusively measured between two points with a different gravitational potential and only for an outside observer, the equation was as follows. $c = c_0 \left(1 - \frac{MG}{r\, c^2}\right)$ so many follows Einstein work in faster than light some convinced[17],[18],[19],[20],[21],[22],[23],[24],[25] and others speculating[26],[27],[28],[29],[30],[31],[32]



Einstein in this paper managed to predict and calculate the gravitational lensing phenomena for the first time, and it was proved experimentally later by Eddington in 1919[33]

It was a solid framework with an exceptional experimental proof however it was just an approximations and not the whole truth in fact Schwarzschild corrected Einstein work with his famous metric[34] and he came to very close results but not quite the same.

Because his equation indicates that the velocity of light varies within a special sphere, depending on the position, the sphere collapses at a constant mass but increasing density, it transitions to a smaller radius than before and emits radiant energy, the radiation that is emitted from the surface of the massive sphere is red-shifted according to the gravitational red-shift formula[35] as follow

The idea of relative non-locality[36] was used for exploring the false difference in the speed of light between interior and exterior of black hole[37] and in warp drive by Miguel Alcubierre[38]

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speed of light constancy will always hold well regardless of these illusions of measurements that leading to the mirage of superluminal speedand as I will prove later all this illusions of superluminal speed is due to curvature difference between two spacetime intervals or more" such that the speed of light inside a spacetime hyper-surface will be always equal to (c) but since the spacetime hyper-surface itself is moving faster than light, then for outside observer it will appear as if the person inside the hyper-surface is moving faster than light while its not and whats happened is nothing more than spacetime itself is expanding behind the hyper-surface and constrict in front the hyper-surface and we shouldn't forget that the hyper-surface itself is nothing but a spacetime arrangement under the influence of energy density distribution

1.Gravitational blue-shift effect on the electric permittivity of the free-space ($\varepsilon_\circ$):

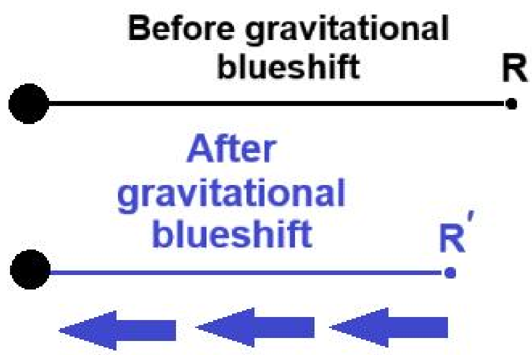
If we have a point like non-moving gravity well and a photon with a wavelength (λ) falling in this gravity well from a fixed point in space with a distance of (R) from the center of the same gravity well such that ($\lambda = \mathrm{R}$) , then the photon should have a gravitational blue-shift in which inverse of gravitational red-shift and it's as follow[39],[40].

$$\lambda_{\text{redshift}} = \lambda \left(1 - \frac{r_s}{r}\right)^{-1/2} \; \& \; \lambda_{\text{blueshift}} = \lambda \left(1 - \frac{r_s}{r}\right)^{1/2} \ldots$$ [41],[42]

∵ (R) is a real point in space separated from the point like non-moving gravity well by a real distance and there is non-relative movement between the source and the gravity well but despite of this the photon suffer a gravitational blue-shift[43] but since photon path is the world line for light cones[44] then it cannot experience any change in proper time since this will lead into causal contradictions[45] i.e., photons experience no time[46],[47] whatsoever[48],[49],[50] then the effects of gravitational time dilation could not be responsible for the changes in photon wave length[51],[52] then this will lead to a very unique outcome[53],[54],[55].

"the space itself gets shortened due to gravity potential difference between two points by a factor of $\left(\sqrt{1 - \frac{r_s}{r}}\right)$ ".[56],[57],[58],[59],[60]

$$\therefore \lambda_{\text{blueshift}} = \lambda \left(1 - \frac{r_s}{r}\right)^{1/2} \therefore\Rightarrow \left(\mathrm{R}^{`} = \mathrm{R}\sqrt{1 - \frac{r_s}{r}}\right)$$



…[61],[B]

[B] The gravitational lensing of the Cosmic Horseshoe is the best example for gravitational blue and red shift i.e., some photons enter in a shorter path of spacetime and some others enter a longer path of spacetime for no reason other than the differnce in shortining spacetime between two regions of spacetime with difernt gravity potential

Where (R) is a real fixed point in space as measured by a local observer i.e at (R) itself or from a point has the same gravity potential and $\left(R^{`}\right)$ is the same real point in space as measured by a non-local observer i.e. observer in a point with less gravity potential[C][62].

Then, if we have an electric charge in the center of this point like non-moving gravity well in an empty space

Then due to gravity influence and since the imaginary photon of electric field of this electric charge is affected by gravity as we know from general relativity[63] then the electric field will occupy a smaller space due to a shortening in its radius only in respect to non-local observer such that it will change the electric flux only in respect to a non-local observer as follows

$$\because (\Phi_E) = E4\pi R^2 \;\therefore\Rightarrow \Phi_E{}' = \frac{E4\pi r_\circ{}^2}{\left(1-\frac{r_s}{r}\right)} \text{ [D]}$$

Since the electric charge here is conserved, then for a non-local observer this will affect the electric permittivity of the free space ($\varepsilon_\circ$) as follows:

$$\because \varepsilon_\circ = \frac{q}{\Phi_E} = \frac{q}{E4\pi R^2} \therefore \text{ under gravity} \Rightarrow \varepsilon_\circ{}' = \frac{q}{\frac{E4\pi R_\circ{}^2}{\left(1-\frac{r_s}{r}\right)}} \text{ [E]}$$

$$\Rightarrow \varepsilon_\circ{}' = \varepsilon_\circ\left(1-\frac{r_s}{r}\right) \because r_s < r \therefore\Rightarrow \varepsilon_\circ{}' < \varepsilon_\circ$$

; ($\varepsilon_\circ{}'$) ≡ Vacuum permittivity under gravity as only observed from flat spacetime

This does not apply to the magnetic permeability of the free space since it is a fully geometrically characterized entity as follows[64],[65].

$$\because \mu_\circ = \frac{B}{H} \;\therefore H = \frac{B}{\mu_\circ} \;\therefore\Longrightarrow H = \frac{\left(\frac{B}{\left(1-\frac{r_s}{r}\right)}\right)}{\mu_\circ}$$

$$\therefore\Longrightarrow \mu_\circ{}^{`} = \frac{\left(\frac{B}{\left(1-\frac{r_s}{r}\right)}\right)}{\frac{\left(\frac{B}{\left(1-\frac{r_s}{r}\right)}\right)}{\mu_\circ}} \therefore\Longrightarrow \mu_\circ{}^{`} = \mu_\circ \frac{\left(\frac{B}{\left(1-\frac{r_s}{r}\right)}\right)}{\left(\frac{B}{\left(1-\frac{r_s}{r}\right)}\right)} \therefore\Longrightarrow \mu_\circ{}^{`} = \mu_\circ$$

Since the speed of light is not a vector quantity and it is a scalar quantity that is independent on the direction of the moving source nor the observer and it is only dependent on the nature of the empty space itself[66]:

[C] If the photon was falling in the gravity well then we use gravitational blue-shift but if the photon was leaving the gravity well then we use gravitational red-shift , here we have afalling photon in a gravity well then we use gravitational blue-shift.

[D] Don't let the comen sence desive you, gravity will compress more space-time inside a smaller space such that under gravity for the same space you will have more space-time inside space than what apparently there without gravity then you have to use factor of $\left(\frac{1}{\left(1-\frac{r_s}{r}\right)}\right)$ and not $\left(1-\frac{r_s}{r}\right)$

[E]Under gravity we will have a much crowded space with virtual photon than without gravity and since the electric charge is conserved then this will affect the electric permittivity of the free space and will create the illusion of superluminal speed in which a direct indicator for the spacetime curvature difference between the two points of measurements.

$$\because c = \frac{1}{\sqrt{\varepsilon_\circ \mu_\circ}}$$

$$\therefore \Rightarrow c` = \frac{1}{\sqrt{\varepsilon` \mu_\circ}}$$

from low gravitational potential to high gravitational potential in spacetime perspective as follows

$$\Rightarrow c` = \frac{1}{\sqrt{\varepsilon_\circ \mu_\circ \left(1 - \frac{r_s}{r}\right)}}$$

$$\therefore \Rightarrow c` = c_\circ \left(1 - \frac{r_s}{r}\right)^{-1/2} \ldots . \boxed{1.1}$$

And from high gravitational potential to low gravitational potential in spacetime perspective as follows

$$\Rightarrow c` = \sqrt{\varepsilon_\circ \mu_\circ \left(1 - \frac{r_s}{r}\right)} \ldots . \boxed{1.2}$$

This equation is nothing but an illusion of superluminal speed[67], and it's a direct useful indicator of spacetime curvature difference between two intervals, such that the principle of the speed of light constancy holds well, but in a different form from that which usually underlies the special theory of relativity, this illusion led to a serious attempt to find a new solution by upgrading spacetime to include these faster than light instead of accepting the fact that it's only an illusion of faster than light and not a real thing[68],[69],[70],[71],[72],[73],[74],[75],[76],[77],[78],[79],[80],[81],[82],[83],[84],[85],[86],[87],[88].

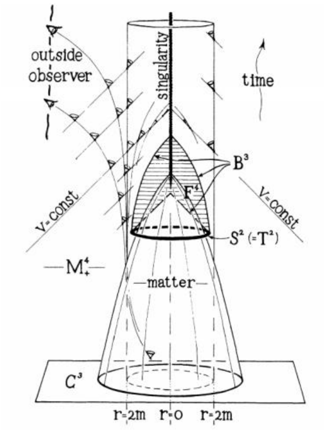
This idea of the illusion of faster than light is due to the shortcoming of measurements because of the difference in spacetime curvature between two intervals, this has been used before in many forms and approaches so many times by a well respected mainstream physics, This idea of illusion of faster than light in which doesn't contradict special relativity is really a useful indicator too[89],[90],[91],[92],[93],[94],[95],[96],[97],[98],[99].

Now let me explain about the illusion of faster than light in a way that will clear any suspicions or confusions about the speed of light constancy

Let's consider two photons, photon (A) and photon (B) where photon (A) is propagating in a flat spacetime while photon (B) is propagating under the influence of gravity from point (x_1) to point (x_2) in a way such that (x_1) is in flat spacetime and (x_2) is a Schwarzschild black hole, then as I proved earlier in equation $\boxed{1}$ we will have an illusion of superluminal speed as follows

$$\therefore \Rightarrow c` = c_\circ \left(1 - \frac{r_s}{r}\right)^{-1/2} \ldots . \boxed{1.1}$$

Such that when photon (B) approach event horizon let's say point in between (x_1) and (x_2) let's name it($x_{1/2}$) then the event horizon itself will run away from the photon(B) in the same ratio and this chasing will continue to the singularity to the point of spacetime itself collapsed into gravitational singularity of radius equal to zero



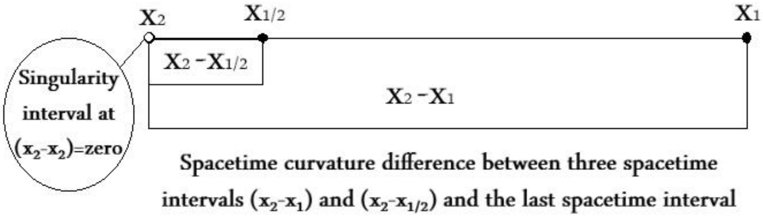
Spherically symmetrical collapse (one space dimension surpressed). The diagram essentially also serves for the discussion of the asymmetrical case. [100],[F]

This is the illusion and not reality, in reality when photon (B) reach near event horizon at some point let's cal it point ($x_{1/2}$) then it will be in less gravitational curvature difference in comparable to his original states wen it was in point (x_1) because in point (x_1) the difference in curvature was equal to curvature at point (x_2) minus the curvature at point (x_1) but since point (x_1) is flat spacetime and point ($x_{1/2}$) has greater gravitational potential i.e., higher curvature then the curvature difference in this situation is less

When the photon reach point ($x_{1/2}$) then it will has less potential difference i.e., less curvature difference since some of the curvature right now is in and behind point ($x_{1/2}$), it's like taking measurement for acceleration due to gravity at sea level then take it again at the bottom of the Mariana trench[101],[G],then when photon approach Schwarzschild black hole due to change in curvature difference between the different spacetime intervals in the photon path there will be a smaller curvature difference in front of the photon and as a sequence the Schwarzschild radius will be shorter and shorter and the black hole in relative to the falling photon will be gradually smaller and smaller until it will vanish in the end, and we will always have (c) constant and the mass of the black hole is conserved, but the curvature difference is gradually changing to smaller and smaller here until it become zero at the singularity and that's what's give us the illusion of superluminal speed, thus nothing could ever cross the event horizon

[F] This is [figer-1] in Penrose paper , Phys. Rev. Lett. 14, 57 – 18 January 1965, Gravitational Collapse and Space-Time Singularities. It's proves that spacetime at (r=0) will collapse in to nothing and this is my exact argument here i.e., $[(x_2) - (x_2) = 0]$ is the singularity interval with zero curvature difference(r=0)
https://link.aps.org/doi/10.1103/PhysRevLett.14.57
[G] This paper (Geophysical tests of the gravitational red shift and ether drift) is comparing the gravitational redshift with ether by comparing gravitational redshift between sea level and the Mariana trench bottom around 11 km depth.

$$(x_2)-(x_1) > (x_2)-\left(x_{1/2}\right) > [(x_2)-(x_2)=0] \Rightarrow r_s` = \sqrt{\frac{2MG}{c^2}\left(1-\frac{r_s}{r}\right)} \;....\; \boxed{1.3}$$ [102 , H]



Spacetime curvature difference between three spacetime intervals $(x_2\text{-}x_1)$ and $(x_2\text{-}x_{1/2})$ and the last spacetime interval the gravitational singularity interval $[(x_2\text{-}x_2)\text{=zero}]$ this difference between these intervals is the source of the illusion of superluminal speed in general relativity

[103],[104],[105],[106]

Spacetime curvature difference between three spacetime intervals[107] (x2-x1) and (x2-x1/2) and the last spacetime interval the gravitational singularity interval [(x2-x2)=zero] this difference between these intervals is the source of the illusion of superluminal speed in general relativity

The term$\left(1-\frac{r_s}{r}\right)$ is not changing the speed of light nor the mass it's represent the changing of the effect of the spacetime curvature difference[108] on photon that's falling in a Schwarzschild black hole and this is the true source of superluminal speed illusion and how to calculate it, and it's highly valuable significant way to deal with and to understand spacetime curvature

In less accurate way photon (B) is like a man walking on a travelator[109],[110],[111],[112] his speed in reality is exactly the same[113],[114] to the same man walking on ordinary side walk [115]i.e., its just an illusion of superluminal speed because its causally disconnected from the outside the hyper-surface that's such effects could be produced[116].

2-Schwarzschild's Gravitational singularity:

To understand a Schwarzschild black hole we need to address it from two perspectives first from illusion free perspective i.e., a falling photon perspective then from spacetime perspective then we could solve the gravitational singularity without having indeterminate forms of dividing by zero since dividing by zero is an indication for a mathematical failure[117].

At first the falling photon perspective is very useful to calculate the ratio of shortening of spacetime coordinates due to gravity through calculating the illusion of superluminal speed due to the change in curvature difference between two spacetime intervals .

we could make things strictly basic by considering an empty universe with nothing in it except a single photon and a Schwarzschild black hole and let the photon falling from infinity towards

[H] Equation number (3) $\left[\lambda_{redshift} = \frac{GM_e}{c^2}\left(\frac{1}{R_e}-\frac{1}{r}\right)-\frac{1}{2}\left(\frac{v_s}{c}\right)^2\right]$ in this paper⇒ (An orbiting clock experiment to determine the gravitational red shift. *Astrophys Space*) is very close to my argument here its show the curvature difference between two spacetime intervals. https://articles.adsabs.harvard.edu/cgi-bin/nph-iarticle_query?1970Ap%26SS...6...13K&defaultprint=YES&page_ind=2&filetype=.pdf

the Schwarzschild black hole, and we take the measurements for the photon from infinity to the event horizon of the non-rotating black hole.

Spacetime interval for Schwarzschild metric is as follows

$$\because ds^2 = -\left(1-\frac{r_s}{r}\right)c^2dt^2 + \frac{dr^2}{\left(1-\frac{r_s}{r}\right)} + r^2(d\theta^2 + \sin^2\theta d\varphi^2\ )$$

As I proved earlier due to the change in curvature difference then

$$(x_2)-(x_1) > (x_2)-\left(x_{1/2}\right) > [(x_2)-(x_2)=0] \Rightarrow r_s` = \sqrt{\frac{2MG}{c^2}\left(1-\frac{r_s}{r}\right)} \ \ldots . \boxed{1.3}$$

Since this is a photon falling in Schwarzschild black hole then Schwarzschild radius will be keep shrinking until it become zero i.e, spacetime interval here equal to zero then we have here radial null geodesic then Schwarzschild metric should be like the following

$$\because ds^2 = 0 = -\left(1-\frac{r_s}{r}\right)c^2dt^2 + \frac{dr^2}{\left(1-\frac{r_s}{r}\right)}$$ [118], [119]

But since we are tacking first the photon perspective and photons experience zero time due to special relativity effects of relative time dilation of Lorentz factor[120],[121]then it will experience no difference whatsoever regardless of his path, in fact photons are stranded in time and experience nothing until it's observed by another field force or observer[122],[123] then this will lead to a local observer effect i.e, the photon will not experience illusion of superluminal speeds whats soever since the photon itself is the messenger of causality i.e., for photon (c`=c) i.e., photons are illusion free, then at event horizon we could neglect safely the line element for time and we pretend it doesn't exist and equal zero then for photons at event horizon and at singularity and for all in between, time line element equal zero.

$$\because \text{time line element} = -\left(1-\frac{r_s}{r}\right)c^2dt^2 \because r_s = r \therefore\Rightarrow \text{time line element} = \text{zero}$$

This is photon perspective to the curvature of spacetime such that time in spacetime is there and present and not absence but photons just don't get it they just don't interact with time dimension in spacetime, photons do not feel time in spacetime then it's fair to remove it from the perspective of the photon.

Due to the change in curvature difference in the path of the falling photon in the Schwarzschild black hole

$$\because ds^2 = 0 = \frac{dr^2}{\left(1-\frac{r_s}{r}\right)}$$

$$\text{But } \frac{dr^2}{\left(1-\frac{r_s}{r}\right)} \neq \text{zero}$$

Previously we conclude that

$$(x_2)-(x_1) > (x_2)-\left(x_{1/2}\right) > [(x_2)-(x_2)=0] \Rightarrow r_s` = \sqrt{\frac{2MG}{c^2}\left(1-\frac{r_s}{r}\right)} \ \ldots . \boxed{1.3}$$

Since event horizon is collapsing from (r_s) to zero due to the change in curvature difference between two spacetime intervals and since event horizon of a Schwarzschild black hole is a perfect sphere surface then

$$\therefore\Rightarrow \text{at } (r = r_s) \Rightarrow r_s` = 0 \therefore\Rightarrow 0 < r_s` < (r = r_s) \;\; \therefore\Rightarrow 0 \le ds^2 \le 4\pi \; r_s^2 \therefore\Longrightarrow \; ds^2 = 4\pi \; r`_s{}^2$$

$$\therefore\Rightarrow \frac{dr^2}{\left(1-\frac{r`_s}{r_s}\right)} = 4\pi \; r`_s{}^2 .... \boxed{2.1}$$

$$; r_s` = \sqrt{\frac{2MG}{c^2}\left(1-\frac{r_s}{r}\right)} ; 0 < r_s` < (r = r_s), \text{i.e.}, r, r_s \& \, r_s` \text{ are like a steps counter}$$

This is not unprecedented it’s somehow similar to idea used before by Kruskal-Szekeres coordinates and by De Sitter among others to solve the problem of coordinates singularity at event horizon[124],[125],[126],[127].

$$\because \; \left(dr_s{}^2\right) = dr_s . dr_s \;\; \therefore\Longrightarrow \frac{dr_s . dr_s}{\left(1-\frac{r_s`}{r_s}\right)} = 4\pi \; (r_s`)^2 \;\;\; \therefore\Longrightarrow \frac{dr_s . dr_s}{\left(1-\frac{r_s`}{r_s}\right) 4\pi (r_s`)^2} = 1$$

$; r_s' \equiv$ Schwarzschild upgraded radius due to nonlocality i.e., illusion of VSL[128],[129],[130]

$$\therefore\Longrightarrow \frac{dr_s}{2\sqrt{\pi}\, r_s` \sqrt{\left(1-\frac{r_s`}{r_s}\right)}} = 1 \;\therefore\Longrightarrow dr_s = 2\sqrt{\pi}\, r_s` \sqrt{\left(1-\frac{r_s`}{r_s}\right)} \;\; \therefore\Longrightarrow dr_s \equiv \text{line element}$$

$$, \text{let } r_s = x \; \& \; r_s` = y$$

$$\therefore\Longrightarrow \frac{dx}{2\sqrt{\pi}\, y \sqrt{\left(1-\frac{y}{x}\right)}} = 1$$

By integration $\Longrightarrow \dfrac{y \ln\left(\sqrt{\left(1-\frac{y}{x}\right)}+1\right) + 2x\left(\sqrt{\left(1-\frac{y}{x}\right)}\right) - y \ln\left(\left|\sqrt{\left(1-\frac{y}{x}\right)}-1\right|\right)}{4\sqrt{\pi}} + C = x + D$

We have here two possibilities C≠ D & C=D then if C≠ D then this is inconvenient for us so we overlook it and we take the other less likely possibility since it's much easier to work with i.e., C=D

$$\therefore\Longrightarrow y \ln\left(\sqrt{\left(1-\frac{y}{x}\right)}+1\right) - y \ln\left(\left|\sqrt{\left(1-\frac{y}{x}\right)}-1\right|\right) \; = 4\sqrt{\pi}\, x - 2x\left(\sqrt{\left(1-\frac{y}{x}\right)}\right)$$

$$\therefore\Longrightarrow \; e^y e^{-y} \frac{\left(\sqrt{\left(1-\frac{y}{x}\right)}+1\right)}{\left(\left|\sqrt{\left(1-\frac{y}{x}\right)}-1\right|\right)} = e^{\left(4\sqrt{\pi}\, r_s - 2x\left(\sqrt{\left(1-\frac{y}{x}\right)}\right)\right)}$$

$$\text{We substitute back for x\&y by } (r_s = x \; \& \; r_s` = y)$$

$$\therefore\Longrightarrow \frac{\left(\sqrt{1-\frac{r_s`}{r_s}}+1\right)}{\pm\left(\sqrt{\left(1-\frac{r_s`}{r_s}\right)}-1\right)} = e^{\left(4\sqrt{\pi}\, r_s - 2r_s\left(\sqrt{\left(1-\frac{r_s`}{r_s}\right)}\right)\right)}$$

At the singularity:

Each time a photon reaching the event horizon due to the change in curvature difference as I proved before in equation $\boxed{1.3}$ so we have here something like a step counter (r_s& ${r_s}^{`}$) so when the photons reach (${r_s}^{`}$) it's become the new (r_s) until the collapsing steps reach the center of the black hole.

At the center of Schwarzschild black hole for local observer we have the following

$$(r_s = 0) \therefore \left(c^{`} = c\left(1 - \frac{0}{r}\right)^{-\frac{1}{2}}\right) \therefore c^{`} = c \ldots \boxed{2.1}$$

$$\because c' = c \Rightarrow {r_s}^{`} = 0 \therefore\!\Rightarrow \left(1 - \frac{0}{r_s}\right) = 1 \ldots \boxed{2.2}$$

$$\text{The singularity for local observer } (\, r_s = {r_s}^{`}) \therefore\!\Rightarrow \left(1 - \frac{{r_s}^{`}}{r_s}\right) = 0 \ldots \boxed{2.3}$$

$$\because \frac{\left(\sqrt{1 - \frac{{r_s}^{`}}{r_s}} + 1\right)}{\pm\left(\sqrt{\left(1 - \frac{{r_s}^{`}}{r_s}\right)} - 1\right)} = e^{\left(4\sqrt{\pi}\, r_s - 2r_s\left(\sqrt{\left(1 - \frac{{r_s}^{`}}{r_s}\right)}\right)\right)}$$

$$\text{at singularity } \therefore\!\Rightarrow \frac{\left(\sqrt{(1-1)} + 1\right)}{\pm\left(\sqrt{(1-1)} - 1\right)} = e^{\left(4\sqrt{\pi}\, r_s - 2r_s\left(\sqrt{(1-1)}\right)\right)}$$

$$\left(\text{for non–local observers only}\right) \therefore\!\Rightarrow \pm 1 = e^{(4\sqrt{\pi}\, r_s)}$$

$$\therefore\!\Rightarrow \begin{cases} \text{from Euler's identity } (1 = e^{2i\pi}) \therefore\!\Rightarrow e^{2i\pi} = e^{4(\sqrt{\pi})r_s} \therefore\!\Rightarrow r_s = i\frac{\sqrt{\pi}}{2} \\ \qquad\qquad \text{or} \\ \text{from Euler's identity} (-1 = e^{i\pi}) \therefore\!\Rightarrow e^{i\pi} = e^{4(\sqrt{\pi})r_s} \therefore\!\Rightarrow r_s = i\frac{\sqrt{\pi}}{4} \end{cases}$$

$$\because\ r_s > {r_s}^{`} \therefore\!\Rightarrow r_s = i\frac{\sqrt{\pi}}{2}\ ,,,\ {r_s}^{`} = i\frac{\sqrt{\pi}}{4}\ ;\ i\frac{\sqrt{\pi}}{2} \,\&\, i\frac{\sqrt{\pi}}{4} \equiv \text{ratio radii i. e. line element,}$$

I will refer to the short ratio radius as r_T

$$\left(r_T = i\frac{\sqrt{\pi}}{4} \equiv dr\right) \ldots \boxed{2.4}$$

$$;\, r_T \equiv \text{length element at the singularity i. e. singularity ratio radius}$$

$$\because\ r_s > {r_s}^{`} \therefore\!\Rightarrow r_s = i\frac{\sqrt{\pi}}{2}\ ,,,\ {r_s}^{`} = i\frac{\sqrt{\pi}}{4} \therefore\!\Rightarrow \frac{{r_s}^{`}}{r_s} = \frac{i\frac{\sqrt{\pi}}{4}}{i\frac{\sqrt{\pi}}{2}} = \frac{1}{2}$$

Now we take a new approach from spacetime perspective and as I proved earlier due to the change in curvature difference.

$$(x_2) - (x_1) > (x_2) - \left(x_{1/2}\right) > (x_2) - (x_2) \Rightarrow {r_s}^{`} = \sqrt{\frac{2MG}{c^2}\left(1 - \frac{r_s}{r}\right)} \ldots \boxed{1.3}$$

Since the Schwarzschild radius will be keep shrinking until it become zero then we have here radial null geodesic then Schwarzschild metric should be like the following[131]

$$\because ds^2 = 0 = -\left(1-\frac{r_s}{r}\right)c^2dt^2 + \frac{dr^2}{\left(1-\frac{r_s}{r}\right)}$$

$$\because \frac{r_s`}{r_s} = \frac{i\frac{\sqrt{\pi}}{4}}{i\frac{\sqrt{\pi}}{2}} = \frac{1}{2} \ \&\ \because\ r_T = i\frac{\sqrt{\pi}}{4} \equiv dr$$

$$\therefore\Longrightarrow ds^2 = -\left(1-\frac{1}{2}\right)c^2dt^2 + \frac{\left(i\frac{\sqrt{\pi}}{4}\right)^2}{\left(1-\frac{1}{2}\right)} = 0$$

$$\therefore\Longrightarrow \left(1-\frac{1}{2}\right)\ dt_s{}^2 = \frac{\left(i\frac{\sqrt{\pi}}{4}\right)^2}{c^2\left(1-\frac{1}{2}\right)}\quad \therefore\Longrightarrow \left(\frac{1}{2}\right)\ dt_s{}^2 = \frac{\left(i\frac{\sqrt{\pi}}{4}\right)^2}{c^2\left(\frac{1}{2}\right)}$$

$$\therefore\Longrightarrow dt_s{}^2 = \frac{\left(i\frac{\sqrt{\pi}}{4}\right)^2}{c^2\left(\frac{1}{2}\right)^2} = \frac{4\left(i\frac{\sqrt{\pi}}{4}\right)^2}{c^2} = -\frac{\pi}{c^2 4}$$

$$\therefore\Longrightarrow ds^2 = -\left(\frac{1}{2}\right)c^2\left(-\frac{\pi}{c^2 4}\right) + \frac{\left(i\frac{\sqrt{\pi}}{4}\right)^2}{\left(\frac{1}{2}\right)} \therefore\Longrightarrow ds^2 = \left(\frac{\pi}{8}\right) - \left(\frac{\pi}{8}\right) = 0 \ldots \boxed{2.5}$$ [132],[I],[133]

$$\therefore \text{ at singularity} \Longrightarrow ds^2 = 0 \equiv \text{the real spacetime interval at singularity}$$

$$\text{since } r > r_s` > 0 \therefore\Longrightarrow r_s - r_s` \neq 0 \therefore\Longrightarrow \Delta r_s \neq 0$$

$$\because c` = \frac{c}{\sqrt{\left(1-\frac{r_s`}{r_s}\right)}}\ ; r_s > r_s`$$

$$\text{i.e.}(\ r_s) \text{ always will be bigger than } (r_s`\ )$$

$$\because 0 < \frac{r_s`}{r_s} < 1 \therefore\Longrightarrow \text{chaing in position } \neq 0 \therefore\Longrightarrow r - r_s' \neq 0 \equiv \text{uncertainty in position}$$

Since we have mass with an uncertain position between zero and one $\left(0 < \frac{r_s}{r} < 1\right)$, then this is could be resulted from a quantum measurements problem[134],[135],[136],[137] and if it was, then this is only happening under the Heisenberg uncertainty principle[138],[139],[J],[140],[141],[142],[143]:

$$\therefore\Longrightarrow\ \triangle\, r_s \triangle\, P_s \geq \frac{\hbar}{2}$$

This is reasonable since we are reaching such a tiny scale then most certainly[144],[K] we will hit a quantum effects[145],[146],[147]:

[I] Here singularity is equal to zero and not a broken mathematics of dividing by zero, it's the end of spacetime this result is completely compatible with Penrose findings in his paper "Gravitational Collapse and Spacetime Singularities (1965)" , he solved the gravitational singularity to be equal to zero and not a mathematical singularity of dividing by zero i.e. no broken mathematics involve, but he solved it with Penrose–Carter diagrams and not with Einstein field equations.

[J] professor Penrose in his paper (On Gravity's role in Quantum State Reduction.1996) re-highlighted the idea that uncertainty in the energy is proportional to the gravitational self-energy, in which is very close to my point here.

[K] Hawking in the abstract of this paper highlighted this idea and I quote his words here " quantum gravitational effects become important. This would not be expected to happen until the radius of curvature of spacetime became about 10^-14c.m" end of quote, well we are reaching here infinity near zero then it's very likely that quantum effects is relevant here.

$$\text{when reaching singularity} \Rightarrow \left(r_s = r_T = i\frac{\sqrt{\pi}}{4}\right) \therefore i\frac{\sqrt{\pi}}{4} = \frac{2MG}{c^2}$$

$$\therefore\Longrightarrow M = ic^2\frac{\sqrt{\pi}}{8G} \text{ ; for a local observer at singularity } \Longrightarrow c` = c$$

$$\text{when } r_s` \to 0 \therefore\Longrightarrow i\frac{\sqrt{\pi}}{4}.ic^2\frac{\sqrt{\pi}}{8G}c \geq \frac{\hbar}{2} \text{ ; } \left(r_s Mc = n\frac{\hbar}{2}\right)$$

$$\therefore\Longrightarrow i\frac{\sqrt{\pi}}{4}.ic^2\frac{\sqrt{\pi}}{8G}c = n\frac{\hbar}{2}$$

$$\therefore\Longrightarrow \frac{c^3}{\hbar G}i\frac{\sqrt{\pi}}{4}.i\frac{\sqrt{\pi}}{4} = n$$

; n is the number of Schwarzschild radii steps of the event horizon

The idea of illusion of superluminal speed is not new it was approached before as a mirage observation in the relativistic jets of supermassive black hole[148]

$$\text{at } n = 1 \therefore\Longrightarrow \frac{c^3}{\hbar G}\left(i\frac{\sqrt{\pi}}{4}\right)^2 = 1$$

$$\therefore\Longrightarrow \frac{\left(i\frac{\sqrt{\pi}}{4}\right)^2}{{l_p}^2} = 1 \therefore\Longrightarrow i\frac{\sqrt{\pi}}{4} = l_p \text{ ; } l_p \equiv \text{Planck length} \cdots \boxed{2.6}$$ [L], [149], [150], [151]

$$\therefore\Longrightarrow n = \frac{r_s}{l_p} \text{at } n = 1 \therefore\Longrightarrow \frac{r_s}{l_p} = 1 \therefore\Longrightarrow \frac{2GM}{c^2 l_p} = 1$$

$$\frac{2GM}{c^2 l_p} = 1 \therefore M = \frac{c^2}{2G}\sqrt{\frac{G\hbar}{c^3}} = \frac{1}{2}\sqrt{\frac{c\hbar}{G}} \therefore\Longrightarrow M = \frac{m_p}{2} \text{ ; } m_p \equiv \text{Planck mass,}$$ [152]

$$\therefore\Longrightarrow \frac{m_p}{2} \text{ is the least required mass to form a black hole}$$ [153,M]

$$\therefore\Longrightarrow \frac{m_p}{2} \text{ is the least mass considered as a gravity well}$$

since energy is quantized[154][155,N]

$$\therefore\Longrightarrow M = n\frac{m_p}{2} \text{ ; } n = 1,2,3.... \text{ \& } \therefore\Longrightarrow \frac{2M}{m_p} \equiv \frac{r_s}{l_p} \cdots \boxed{2.7}$$

Half Planck mass is the least mass condition required to curve spacetime and as a consequence to form a black hole if condensed in the smallest area possible i.e., area of Planck length, I will refer to this condition from now on as (T) condition.

[L] Since this is a quantized energy then it's most certainly it would obey Heisenberg uncertainty principle and as we approach the lower limits of Heisenberg uncertainty principle then most certainly we will reach Planck length because there is no energy or momentum could exist in time and length lower than Planck length nor time because Heisenberg uncertainty principle forbid that.

[M] Stephen Hawking predict that the least mass required to form a black hole is Planck mass because he didn't take in to his considerations the effects of relative non-locality, in fact his results were defected because when you have a black hole then the mass should be in center then due to Heisenberg uncertainty principle the mass will occupy a Planck length i.e., half Planck length as a radius by default

[N] This paper (Emergence of cosmic space and minimal length in quantum gravity: a large class of spacetimes, equations of state, and minimal length approaches) show that energy is bounded by the uncertainty principle such that we need to modify it to over come the big bang singularity.

The heaviest particle in the Standard Model is the top quark it's around 172 (G.eV/c^2)[156] to 176 (G.eV/c^2)[157] this is 17 orders of magnitude less than half Planck mass then its most certainly gravity wont work without quantum entanglement because quantum entanglement will make a group of particle to behave as collective masses of half Planck mass or more acting as one mass because it all has the same wave function. then breaking quantum entanglement and making wave function collapses for any amount of masses to be less than (T) condition i.e., half Planck mass then as sequence to this it will make the total mass is incapable of bending spacetime and thus the gravity of such a system will vanish .

In theory switching off quantum entanglement will switch off gravity, but not for black holes it's a little bit complected.

Now the illusion of superluminal speed at singularity for an observer at infinity is:

$$\therefore\ \mathrm{c.(T)} = \frac{\mathrm{c}}{\left(\sqrt{1-\frac{1}{2}}\right)^{\frac{2M}{m_p}}} = \frac{\mathrm{c}}{\left(\frac{1}{\sqrt{2}}\right)^{\frac{2M}{m_p}}}\ ;\ (\mathrm{T}) = \left(\sqrt{2}\right)^{\frac{2M}{m_p}} \equiv (\mathrm{T}) = \left(\sqrt{2}\right)^{\frac{r_s}{l_p}}$$

$$\therefore\!\Longrightarrow \mathrm{c_T} = \mathrm{c}\left(\sqrt{2}\right)^{\frac{2M}{m_p}} \equiv \mathrm{c_T} = \mathrm{c}\left(\sqrt{2}\right)^{\frac{r_s}{l_p}} \ldots \boxed{2.8}$$

⟹A black hole is any spacetime curvature that will increase from a non-local perspective the speed of light on its outer surface by at least a factor of $(\sqrt{2})$

A gravity well is any mass is equal to or bigger than half Planck mass.

Gravitational time dilation for a black hole is as follow

$$\Rightarrow \mathrm{t_g} = \mathrm{t_{ob}}\left(\sqrt{2}\right)^{\frac{2M}{m_p}} \ldots \boxed{2.9}$$

$$;\ \mathrm{t_g}\ \text{isproper time at event horizon from non} - \text{local perspective}$$

$$;\ \mathrm{t_{ob}}\ \text{is proper time for observer at flat spacetime perspective}$$

Gravitational time dilation in general relativity is as follow

$$\mathrm{t_g} = \mathrm{t_{ob}}\sqrt{1 - \frac{r_s}{r}}$$

It was a necessity because at event horizon if we take it to be like time dilation of special relativity then we will have indeterminate form due to dividing by zero, and this put a real doubts about the existence of time since it would be zero in non-zero intervals of spacetime like event horizon but since I introduced the relative non locality it's not a problem anymore because due to the relative non-locality you just cannot cross event horizon and eventually event horizon become singularity at the center of the black hole

This equation told us that time is a real thing i.e., $\mathrm{t_g} = \mathrm{t_{ob}}\left(\sqrt{2}\right)^{\frac{2M}{m_p}} \ldots \boxed{9}$

3.Acceleration due to gravity:

To drive acceleration due to gravity, we have to take two measurements for the speed of light at the surface of the gravity well due to the difference in space-time curvature.

First from local perspective on the surface of the gravity well i.e. $(c = c)$, second from non-local perspective i.e. the speed of light in an infinitely distance point at space i.e. speed of light in a curved space-time i.e.

$$c' = c\left(\sqrt{1-\frac{r_s}{r}}\right)$$

The first is the speed of light from local perspective i.e. on the surface of the gravity well and the second is the speed of light from non-local perspective i.e., from flat spacetime i.e., a far point from the gravity well

Acceleration is the difference between two velocities in time

$$\therefore \Rightarrow g = \frac{(c-c')}{t}$$

$$t = \frac{r}{\bar{v}}; \bar{v} = \text{average velocity} = \frac{(c+c')}{2} \therefore \Rightarrow t = \frac{2r}{(c+c')}$$

$$\therefore \Rightarrow g = \frac{(c-c')}{\frac{2r}{(c+c')}} \Rightarrow g = \frac{(c+c')(c-c')}{2r} \because c' = c\left(\sqrt{1-\frac{r_s}{r}}\right)$$

$$\therefore \Rightarrow g = \frac{\left(c+c\left(\sqrt{1-\frac{r_s}{r}}\right)\right)\left(c-c\left(\sqrt{1-\frac{r_s}{r}}\right)\right)}{2r} = \frac{c^2}{2r}\left(1+\left(\sqrt{1-\frac{r_s}{r}}\right)\right)\left(1-\left(\sqrt{1-\frac{r_s}{r}}\right)\right)$$

$$\therefore \Rightarrow g = \frac{c^2}{2r}\left(1-\left(1-\frac{r_s}{r}\right)\right) \therefore \Rightarrow g = \frac{c^2}{2r}\left(\frac{r_s}{r}\right)$$

$$\therefore \Rightarrow g = \frac{c^2 r_s}{2(r)^2} = \frac{c^2}{2(r)^2}\frac{2GM}{c^2}; M = n\frac{m_p}{2}$$

$$\therefore \Rightarrow g = n\frac{m_p}{2}\frac{G}{r^2} \ldots. \boxed{3.1}$$

For a black hole we don’t have a fix point as a surface to event horizon as we had in the ordinary gravity well.

Then to describe the local and non-local perspective we have only the Schwarzschild radius but since it is a non-reachable region because when you reach it your speed of light will be bigger, then the Schwarzschild radius will be smaller

So to solve this problem we take measurements between two Schwarzschild radii the first is Schwarzschild radius measured from a flat space time and the second is from a curved space-time.

$$g = \frac{c}{\frac{\Delta(r_s)}{c}} \Rightarrow g = \frac{c^2}{\Delta(r_s)}; \Delta(r_s) = \frac{2GM}{c^2} - \frac{2GM}{\left(\frac{c}{\sqrt{2}}\right)^2} = r_s(1-2) =- r_s$$

$$\therefore \Rightarrow g =- \frac{c^2}{r_s} =- \frac{c^4}{2GM} \ldots. \boxed{3.1}$$

I am predicting here double the surface gravity from what's in text books, because in text books we have

$$\left(K = \frac{1}{4M} \equiv \frac{c^4}{4GM} = \frac{c^2}{2\,r_s}\right) \,[158]$$

Now if we integrate the acceleration on time we should get speed of light and our time interval is from constants i.e., speed of light gravitation constant and black hole mass so it's from $\left(\frac{r_s}{c}\right)$ to (0)

$$\int_{\frac{r_s}{c}}^{0} g\,dt = \int_{\frac{r_s}{c}}^{0} -\frac{c^2}{r_s}\,dt = \frac{r_s}{c}\frac{c^2}{r_s} = c$$

My work seems to be closer to the truth

4.Spacetime Hoofing to produce Artificial Gravity and Nuclear Fusion from Artificial Gravitational Singularities:

We established previously that the lowest mass to curve spacetime is half Planck mass such that any less mass would be unable to curve spacetime, well there is a problem in this vision, all elementary particles are under this limit by a lot of orders of magnitude, for example the heaviest elementary particle is the top quark it's lighter than this limit by around 17th orders of magnitude but by the effect of quantum entanglement we will have a group of elementary particles that's all entangled in the same wave function then the system as whole will act as a unit then of the total mass of the system is at (T) condition i.e., half Planck mass and its multiplies then it will be enough to curve spacetime and more so any relativistic mass effects could be added to the total mass in the direction of the movement and this is what I name it the hoofing effect since the shape of the electromagnetic fields around the elementary particles will take the shape of mule or donkey hoof

For local observer in an ordinary gravity well any mass that exceeds $\left(\frac{2M}{m_p}\right)$ condition moving at a relativistic speed then the relativistic mass will be added to the total mass as follows:

$$\therefore c_B = c\,\frac{1}{\sqrt{\left(1-\frac{r_B}{r}\right)}};\, r_B = \frac{2GM_B}{c^2};\ M_B = M\,\gamma\cos(b)\,;\, 0 \le b \le \pi;\, M = n\frac{m_P}{2};\, n = 1,2,3\ldots n$$

$$;\gamma = \frac{1}{\sqrt{1-v^2/c^2}};\, \text{at } b = 0;\, v = \text{velocity of the gravity well}$$

$$\therefore\Rightarrow c_B = c\,\frac{1}{\sqrt{\left(1-\left(\frac{2GM}{rc^2}\frac{1}{\sqrt{1-v^2/c^2}}\right)\right)}}$$

$$\therefore\Rightarrow c_B = c\,\frac{1}{\sqrt{\left(1-\left(\frac{n\,G\,m_P}{rc^2}\frac{1}{\sqrt{1-v^2/c^2}}\right)\right)}} \ldots\ \boxed{4.1}$$

$$\because g_B = \frac{GM_B}{r^2} \quad \therefore\Rightarrow g_B = \frac{G}{r^2} n \frac{m_P}{2} \frac{1}{\sqrt{1-{v^2}/{c^2}}} \dots \boxed{4.2}$$

We will have a different rate of gravitational time dilation that's vary with angle and this will create a gravity difference around the accelerated mass i.e., artificial gravity or artificial antigravity that's will able us moving particles in hoofing effect and this is similar to warp drive but without the need for negative energy or negative mass.

This effect just looks like to me like a mule's hoof or a donkey's hoof pushing in a run since the electric field and the magnetic field of the particle will take a hoof shape.

In regarding the superluminal speed there are two parties the Lorentz invariance party (L.I)[159],[160],[161],[162],[163],[164],[165] and Lorentz invariance violation party (L.I.V)[166],[167],[168],[169],[170],[171],[172],[173],[174],[175], luckily we have an experimental way to settle the debate in this paper through accelerating two beams of protons with (T) condition i.e., $\left(M = n\frac{m_P}{2}\right)$condition to a relativistic velocities and collides them head to head then if Lorentz invariance violation party are correct then the electric field of these protons will travel in higher than the speed of light and the electric field would be accelerated as follows

$$g_B = \frac{GM_B}{r^2} = \frac{GM}{r^2} \frac{1}{\sqrt{1-{v^2}/{c^2}}} \; ; M = n\frac{m_P}{2}$$

$$g_B = \frac{(c^{`} - c)}{t} \therefore g_B t + c = c^{`}$$

$$\therefore\Rightarrow c^{`} = \left(\frac{G\left(n\frac{m_P}{2}\right)}{r^2} t\,\gamma + c\right)$$

Each electric field will collide in higher than the speed of light and this should create a gravitational singularity with a temperature very close to Planck temperature[176] as follows[177],[178]

$$K = \frac{\hbar c(c^2)}{8\pi GMk_B} = \frac{(m_P)^2(c^2)}{8\pi Mk_B}$$

$$\text{at } M = n\frac{m_P}{2} \therefore\Rightarrow K = \frac{m_P(c^2)}{4\pi nk_B} \therefore\Rightarrow K = \frac{K_P}{4\pi n}$$ [0]

This temperature is very close to Planck temperature and it's more than enough to sustain a continuous nuclear fusion[179]

We could test this in the LHC in CERN or in Fermi National Accelerator Laboratory (Fermilab) and the setting of the experiment should be as follow

Producing two beams of protons each beam should have two main conditions

I. First condition the beam should go through a unified barrier of electromagnetic fields to provide quantum entanglement between the particles and thus would create a unified wave function for all particles in the beam

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[0] Hawking's work in black hole thermodynamics is an approximation and not the full scope of reality because he did not take into account the relative non-locality, but despite this, his work is acceptable approximation

II. Second condition for the particle beam is that their collective mass should be not less than half Planck mass per beam cross section area i.e., a mole of protons should be enough to fulfil this condition

As test lets' consider the following values

$$0.9\mathrm{c} \leq \ \mathrm{v} \leq 0.99\mathrm{c} \therefore\Rightarrow 2.29 \geq \gamma \geq 7 \therefore\Rightarrow \mathrm{g_B} = \frac{\mathrm{GM}}{\mathrm{r}^2}\gamma; \mathrm{M} = \mathrm{n}\frac{\mathrm{m_P}}{2}$$

$$\text{at } \mathrm{r} = 10^{-6}\mathrm{m}, \mathrm{M} = 1\text{mole protons} \therefore\Rightarrow \mathrm{M} \cong 0.001\ \mathrm{k.g}$$

$$\therefore\Rightarrow \mathrm{g_B} = 6.6743 \times 10^{-2} \times 2.29 = 0.1528\ \mathrm{m.s^{-2}}$$

This is not a usual acceleration, this is acceleration due to gravity then it's velocities could be added to each other i.e., if we collided it with another beam of particle with the same exact conditions then their velocities would be added to each others, the collision does not obey special relativity because this is not a real velocity this is an illusion of superluminal speed due to curvature difference between two spacetime intervals, in reality these two beams of particles under acceleration due to gravity induced further more by relativistic mass will create at the impact point a gravitational collapse area in which will collapse the colliding masses into gravitational singularities Since this is a gravitational acceleration then it is not bound by the speed of light limit, of course it will not exceed the speed of light, but it will achieve to us a gravitational singularity the LHC in CERN[P] or in Fermi National Accelerator Laboratory (Fermilab)[Q] could make this experiment

If the two beams of protons didn't produce a gravitational singularity unless the collision reach the required condition of

$$\therefore\Longrightarrow \mathrm{c_T} = \mathrm{c}\sqrt{2}$$

Then the Lorentz invariance party (L.I) are correct

$$\mathrm{v} = \mathrm{g_B t} = \frac{\mathrm{GM}}{\mathrm{r}^2}\frac{1}{\sqrt{1-\mathrm{v}^2/_{\mathrm{c}^2}}}\mathrm{t}\,;\mathrm{t} \equiv \text{time}\ldots. \boxed{4.3}$$

$$\text{at } \frac{2\mathrm{M}}{\mathrm{m_p}} = 1 \therefore\Longrightarrow \mathrm{v} + \mathrm{c} = \mathrm{c}\sqrt{2} \ \therefore\Longrightarrow \mathrm{v} + \mathrm{c} = \mathrm{c}\sqrt{2} \therefore\Longrightarrow \mathrm{v} = \mathrm{c}(\sqrt{2} - 1) \therefore\Longrightarrow \mathrm{v} = \mathrm{c}(0.41421356)$$

$$\therefore\Longrightarrow \mathrm{g_B t} \ = (0.41421356) = \frac{\mathrm{GM}}{\mathrm{r}^2}\frac{1}{\sqrt{1-\mathrm{v}^2/_{\mathrm{c}^2}}}\mathrm{t}$$

Hoofing effect is not a warp drive since warp drive depends on exotic matter distributed in uneven distribution through spacetime while the hoofing effect depends on adding relativistic mass to the total mass through using the (T) condition i.e., half Planck mass and it's multiplies and since the relativistic mass depends on the direction of movement then we will create artificial gravity could be used in superluminal travel and in creating artificial gravitational singularities that we could use in nuclear fusion.

P https://cds.cern.ch/record/1606826/files/Poster-2013-302.pdf

Q Brown, Bruce. "Current and Future High Power Operation of Fermilab Main Injector". Researchgate. 2009. https://www.researchgate.net/publication/239886364

5.Experimental results:

All experiments made with a (PHYWE 08557-00) Michelson interferometer[180]

Since the speed of light is independent of the direction of the moving source nor the observer i.e., it is only dependent on the nature of the empty space itself:

$$c = \frac{1}{\sqrt{\varepsilon_\circ\, \mu_\circ}}\ ;\ \varepsilon_\circ = \frac{q}{\Phi_E} = \frac{q}{E4\pi r^2}\hat{r}\ ;\ \ \mu_\circ = \frac{B}{H}$$

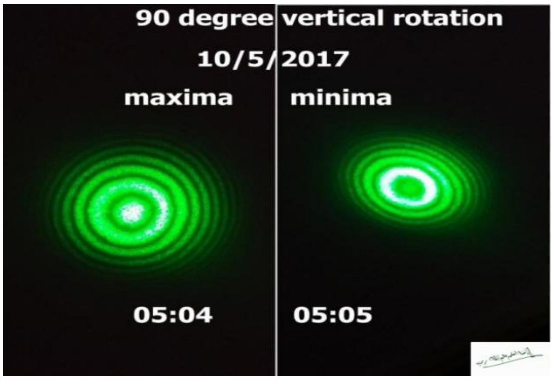
Then, changing the distance from a large gravity well this will change the nature of the empty space itself due to gravitational blue-shift, thus, we should detect a notable interference pattern.

We could detect this by setting up a vertical Michelson-Morley experiment relative to the Earth (and not parallel to the Earth or horizontally). In this way, when we rotate the Michelson's interferometer 90 degrees; we should get a significant change due to gravitational **red-shift** and **blue-shift,** which responds to the change in the speed of light as follows:

$$c` = \frac{1}{\sqrt{\varepsilon_\circ\, \mu_\circ \left(1 - \frac{r_s}{r}\right)}} \therefore\Rightarrow c` = c\left(1 - \frac{r_s}{r}\right)^{-1/2}$$

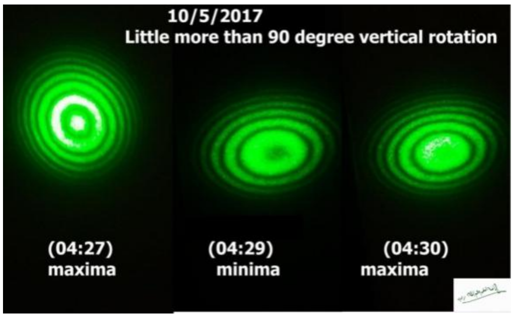
This is not a new thing it's made before in Pound-Rebka experiment.

For the 90°rotation, I have a confirmed positive change in the central interference pattern from maxima to minima[181],[R] as in the next images.



For more than 90° rotation I have a positive change in the central interference pattern from maxima to minima to maxima in the central interference pattern

[R] In fact, there is a german physics enthusiastic his name is Mr. Martin Grusenick he made the second working vertical moving Michelson–Morley experiment in 2009 after (Professor C. Y. Lo) in 2003 and both works of Mr. Martin Grusenick and Professor C. Y. Lo should be noticed but both of them couldn't figure it out Mr. Martin Grusenick even put a full demonstration and documentation on YouTube for his experiment with full results but his work was used by pseudoscience on the internet a lot, the video name is "Extended Michelson-Morley Interferometer experiment. English version" (https://youtu.be/7T0d7o8X2-E), for Professor C. Y. Lo his work was published in Chinese Journal of Physics(https://www.sciencedirect.com/journal/chinese-journal-of-physics) the magazine is now owned by Elsevier Group since 2016, so all previous issues are not available thanks God the professor's work was on his page on researchgate (https://www.researchgate.net/publication/252315461_Space_Contractions_Local_Light_Speeds_and_the_Question_of_Gauge_in_General_Relativity).



We could make an ordinary working horizontal Michelson-Morley experiment, but next to a large mountain-chain so that the mass of the mountain-chain will act like a runaway gravity well and we will still get a positive change in the interference pattern.

However, detecting the spacetime hoofing effect is much harder since it's depending on the movement of a gravity well to solve this I made a setup with a vertical non-rotating interferometer in which it's horizontal arm oriented to the north or south to eliminate the Sagnac effect and this setup should be enough to do it

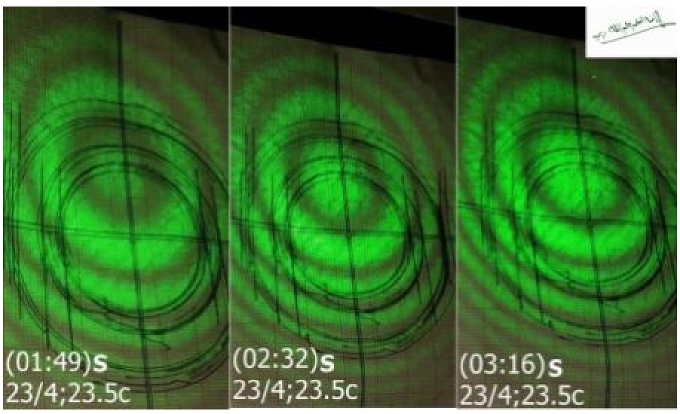
The justification for this is as follow

The earth is a gravity well and since its revolving around the sun then it should gain a relative mass in the direction of movement and according to my work the gravitational potential should be different for a fixed observer but since the earth revolving around itself then the velocity rate of this movement is relative to an observer on the surface of the earth as it's changing with this rotation as follow.

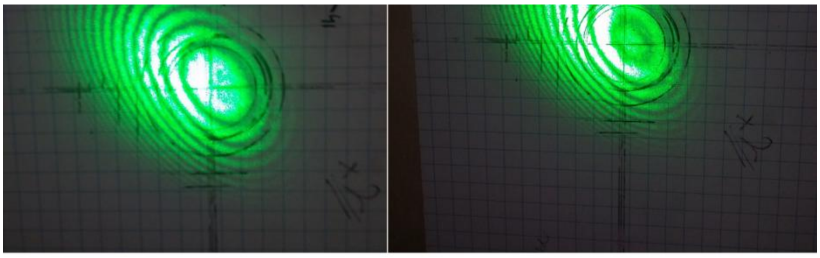
$$g_B = \frac{GM_B}{r^2}\ ; M_B = M(\gamma \cos(b)); M \geq \frac{m_P}{2} \therefore M = \frac{m_P}{2}, n = 1,2,3\cdots; \gamma = \frac{1}{\sqrt{1-v^2/c^2}}; 0 \leq b \leq \pi$$

I got a lot of results considering the same temperature and the minimum time elapsed

The following are some of these results it took place in 23/4/2017 and I put the horizontal arm orientation to the south the three images show a gradual change in interference pattern from minima to maxima in a time period of 87 minute on a steady temperature of 23.5c°



I made a different setup to detect the spacetime hoofing by putting the interferometer in a V orientation such that both arms are fixed and making a 45° the first arm orientation to the north and the second arm to the south i.e., no Sagnac effect and we will detect only the effects of the spacetime hoofing the following images are in 2017/05/19 and I wrote the time and temperature under each image the first image show a maxima interference the second image show a minima interference time period of 40 minute and temperature change of ($0.4c^{\circ}$)



19:05 ; 26.3c° 19:45 ; 25.9c°

6. Conclusions

1. Gravity is not a force, in fact it's the difference in spacetime curvature due to energy density distribution difference through spacetime with masses equal to half Planck mass or bigger and such a mass cannot be produced without quantum entanglement such that half Planck mass is the minimum requirements to create any curvature in spacetime fabric.

i.e. how much the difference in the spacetime curvature between the measurement point and observer point and that's why its appear to us in most cases as a weak interaction due to the difference between Schwarzschild radius and the dimensions of the mass in question so when the difference between Schwarzschild radius and the dimensions of the mass in question become small the gravity effect become bigger and in dramatic way.

2. Elementary particles do not meet (T) condition i.e., half Planck mass so it cannot affect space-time, but a group of quantum entangled elementary particles with a collective mass of bigger than or equal to half Planck mass will curve spacetime i.e., if no quantum entanglement then no gravity that’s mean in principle we could switch off gravity of any mass if we break the entanglement of each particle of that mass until we reach to less than the (T) condition.

In simple words, an electron traveling through a double-slit experiment will not affect spacetime but a cluster of elementary particles with a mass equal to or bigger than half Planck mass all bonded by quantum entanglement will bend spacetime as it's traveling through space and when it passes through the double-slit its wave function will change and its gravity effect will change too due to the change of energy density distribution difference through spacetime.

3. Hoofing effect or controlling spacetime is when a mass with (T) condition moving in a relative speed then the relativistic mass that's gained from this speed will be add a gravitational potential in the direction of the velocity and this will create a controlled artificial gravity and could be used to create gravitational singularities for nuclear fusion and superluminal speed travel as follows:

$$g_B = \frac{GM_B}{r^2}\ ; M_B = M(\gamma \cos(b)); M \geq \frac{m_P}{2} \therefore M = \frac{m_P}{2}, n = 1,2,3\cdots ; \gamma = \frac{1}{\sqrt{1-v^2/_{c^2}}}; 0 \leq b \leq \pi$$

$$v \equiv \text{the velocity of the gravity well}$$

$$\therefore\Rightarrow c` = \left(\frac{GM}{r^2} t \frac{1}{\sqrt{1-v^2/_{c^2}}} + c\right);\ t \equiv \text{ time}$$

We will have a different rate of gravitational time dilation that’s vary with angle and this will create a gravity around the accelerated mass i.e., artificial antigravity.

Hoofing effect is not a warp drive since warp drive depends on exotic matter distributed in uneven distribution through spacetime while the hoofing effect depends on adding relativistic mass to the total mass through using the (T) condition i.e., half Planck mass and it’s multiplies and since the relativistic mass depends on the direction of movement then we will create artificial gravity could be used in superluminal travel and in creating artificial gravitational singularities that we could use in nuclear fusion.

4. Quantum interaction is limited to one of two ways either with causal speed limit i.e., speed of light or any theoretical exotic causal connection such as tachyonic field[182],[183], or it could happen through quantum entanglement and this causally unbound to spacetime because its disobey and break the light cones and could even transfer information from future to the past

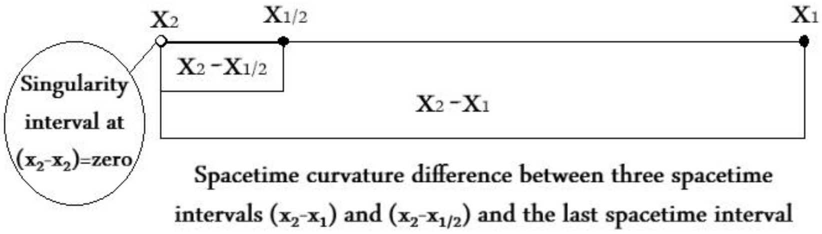
This is not the case for the gravitational effects at all, in fact for any gravitational effects we have spacetime expanding on the universal scale faster than light on specific gradually increase ratio[184],[185].

On event horizon of black holes spacetime will collapse in the speed of light[186] and as a consequence for that spacetime will collapse below event horizon faster than light[187] with gradually increase ratio we have images for event horizon for some of these black holes[188],[S]we have to accept that quantum gravity and strings theories are disproved by the superluminal experimental observation we have to accept that spacetime is a real entity and not just a mathematical perspective it’s a physical continuous non-discrete non-quantized fabric of four dimensions.

5. The (T) condition i.e., effects of half Planck mass and its multiples will effects only for the difference in spacetime curvature between two intervals but since physical constants are measured only under symmetric condition to be considered as constants in the first place then physical constants by definitions would not affected by (T) condition i.e., effects of half Planck mass and its multiples since these constants are measured from local perspective i.e., there is no spacetime curvature difference between the observer and the point of measurements i.e., both points are in flat spacetime in relative to each other and this is the meaning of local observer or local perspective and the non-local perspective or non-local observer.

[S] In fact the touching outside of event horizon but still this is an undeniable experimental observations

$$(x_2) - (x_1) > (x_2) - \left(x_{1/2}\right) > [(x_2) - (x_2) = 0] \Rightarrow r_s` = \sqrt{\frac{2MG}{c^2}\left(1 - \frac{r_s}{r}\right)} \dots \boxed{1.3}$$



Spacetime curvature difference between three spacetime intervals $(x_2\text{-}x_1)$ and $(x_2\text{-}x_{1/2})$ and the last spacetime interval the gravitational singularity interval $[(x_2\text{-}x_2)\text{=zero}]$ this difference between these intervals is the source of the illusion of superluminal speed in general relativity [189],[190],[191],[192],[193],[194],[195]

$$\because c` = c\left(1 - \frac{r_s}{r}\right)^{-1/2}$$

When both the observer and the event are in flat spacetime in relative to each other

$$\text{i.e.}, r_s = \text{zero} \therefore\Rightarrow c` = c\left(1 - \frac{\text{zero}}{r}\right)^{-1/2}$$

$$\therefore\Rightarrow c` = c$$

All physical constants are consistent as long as the symmetry is unbroken in fact the (T) condition is an excellent example for Noether's theorem of “Invariant Variations problem”[196],[197],[198] since the effect of (T) condition will lead to a broken symmetry as long measured or observed from a point with a different spacetime curvature.[199],[200],[201],[202],[203],[204]

Key features

- equation numbering is as follows $\boxed{a.b}$; $\boxed{a}$ is chapter number & $\boxed{b}$ is equation number
- $\varepsilon_\circ \equiv$ the electric permittivity of the free space
- $\mu_\circ \equiv$ magnetic permeability of the free space
- $\Phi_E \equiv$ electric flux
- $q \equiv$ electric charge
- $E \equiv$ electric field
- $M \equiv$ mass of the gravity well
- $G \equiv$ Gravitational constant
- $r \equiv$ gravity well radius

- $c`$ ≡ updated speed of light due to gravity as measured by an observer at infinity
- v ≡ photon frequency in free space
- v_g ≡ photon frequency near a gravity well, i.e., blue shifted
- t_g ≡ the proper time at the surface of the gravity source
- t_{ob} ≡ the proper time at the observer point
- λ ≡ wavelength
- λ_g ≡ wavelength near gravity well blue − shifted as measured by an observer at infinity
- $R`$ = shrinking length of spacetime due to gravitational effects
- R = ordinary length of spacetime free of any effect of gravity
- $\varepsilon`$ ≡ updated electric permittivity of the free − space due to gravity
- ds^2 ≡ spacetime interval
- r_s ≡ Schwarzschild radius
- $r_s`$ ≡ updated Schwarzschild radius due to gravity as measured by an observer at infinity
- dr_s ≡ line element in Schwarzschild metric
- dt_s ≡ time element in Schwarzschild metric
- l_P ≡ Planck length
- m_P ≡ Planck mass
- M ≡ gravity well mass
- $T = \frac{2M}{m_p} = n\frac{m_p}{2}$; T ≡ half Planck mass and its multiples
- c_T ≡ speed of light at singularity as calculated by an observer at infinity
- $\left(r_T = i\frac{\sqrt{\pi}}{4}\right)$ ≡ black hole ratio radius
- r_B ≡ Schwarzschild radius due to relativistic mass effect
- $\hbar$ ≡ Planck reduced constant = $(h/2\pi)$
- γ ≡ Lorentz factor
- g ≡ surface gravity

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