ISSN: 2634 - 8853

Journal of Engineering and Applied Sciences Technology

Research Article Open Access

On the Evolutionary Emergent Gravity Induced by the Interaction Among Energy & Matter

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ABSTRACT

This paper introduces a complete Framework supported by my previous works which showed the bilateral relationship between gravitational potential energy and kinetic energy, the origin of Gravity based on the relationship between matter and electromagnetic energy, the different stages of its Evolution, how General Relativity arises from Special Relativity and finally, a new Einstein's Field Extended Equations entailing a new Cosmological Model (without the need for a cosmological constant or dark energy). Although each one of my works was based on the previous ones, given the density and prolixity of everything introduced, this paper is intended first of all as a structured summary-guide of my work related to Gravity, while refering to my previous papers to delve deeper into each and every one of the analyzed subjects. Some particularly relevant topics (e.g. the analysis of the Warping Boundary, the behavior and properties of the emergent time like a fluid, the non-existence of singularities associated with gravity or an extension of the Bekenstein-Hawking entropy law) are also added giving the whole the form of a complete Framework (which I consider in any case more an extension than a modification of Einstein's Theory of General Relativity).

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Received: November 14, 2025; **Accepted:** November 17, 2025; **Published:** November 26, 2025

Introduction

This work does not pretend in anyway to rectify any point of Einstein's General Relativity Theory. On the contrary, it should be considered an add-on or extension to it.

In fact, although a structural change to the Einstein Field Equations (EFEs) could be proposed based on my new view about the relationship between matter, gravity and time dilation (***Gravity would be a consequence of the time dilation associated with matter, and not the cause***), I've preferred keeping the classic formulation because it's not really affected by such change of perspective [1].

My first work showed ***the bidirectional relationship between gravitational potential energy and kinetic energy***. That is, not only gravitational potential energy is converted to kinetic energy when it's acting over an object in free fall: ***Any object can counteract the gravitational potential energy associated to another one due to its own kinetic energy***.

This conclusion was inferred ***as result of developing the following hypothesis: time dilation associated to gravity over an object (general relativity theory) can be "compensated" or counteracted by the time dilation produced by the object's speed (special relativity theory) (*)***, reaching to the following relation [2]:

$$GM\left(\frac{1}{r}-\frac{1}{r+h}\right)=\frac{v^2}{2} \qquad (1)$$

Where G=Gravitational Constant, M=Body, Mass (e.g. Earth), r=Body Radius (e.g. Earth), h=Altitude and v=Object Speed.

Calling **V'=-(GM (1/r-1/(r+h))** the term at the left (respecting per convention the minus sign) and comparing it with the classic/newtonian formulation of the gravitational potential field **V=GM/(r+h)** we can observe a relevant difference: while the absolute value of V decreases with the altitude h, the absolute value of V' increases with h [3].

In other words, although the time dilation decreases with the gravitational potential field, the speed needed for counteracting it increases with the altitude. Therefore it's very low close to sea level and it increases notably at high altitudes. In fact, for very high altitudes $\mathbf{v^2=2GM/r}$. In other words, the speed v of equilibrium (Zero Gravity) for very high altitudes is the escape velocity.

The sum of both is ΔV=V+V'=-GM/r, the gravitational potential field at the Earth's surface.

V' could be considered the "anti-gravitational" potential field associated to the kinetic energy of an object in relative movement that is capable to compensate the V gravitational potential field.

The root of the difference among V and V' lies in the origin of the time axis. We've considered the Earth's surface like origin of the time axis for objects in relative movement instead the Earth's center. Although the foundation for such criteria has been explained in a previous work, it has been also addressed under a topological view in another work [2,4].

An object can be considered following ***a relative movement*** related to another one when ***it doesn't follow a timelike geodesic***.

Movements along timelike geodesics can't be considered following a relative movement between two bodies because such movement is "linked" through a timelike geodesic path. Other way of viewing it is their circular/elliptical movement could be considered linked to a centripetal acceleration vector which according Special Relativity must be considered always absolute, so their associated linear movement also it is. In fact such restriction was already exposed for spinning objects rotating around one of its symmetry axis [2].

On the other hand, taking the Earth's surface like origin of times is not consistent with the Newtonian view of conversion of gravitational potential energy into kinetic energy, which expressed in shape of energy per mass unit is:

$$\frac{GM}{r+h} = \frac{v^2}{2} \qquad (2)$$

The relativistic reason is ***objects in free fall are following a timelike geodesic so they can't be considered following a relative movement*** while in our generic case expressed in (1), we're supposing the relative movement of an object with relation to the Earth's surface so we apply the Earth's surface like origin of times. Therefore the expression (2) could be considered a simplification of applying (1) to the movement of an object following a timelike geodesic while (1) expresses ***a generic movement that doesn't follow a timelike geodesic***.

In summary, we've reached to ***a bidirectional relation among gravitational potential energy and kinetic energy, valid for any object (in relative movement or not) as result of applying a "double relativistic" (special+general) approach***. (as expressed previously in (*))

It means a new paradigm for Physics, changing forever the perception of the ***relationship among gravitational potential energy and kinetic energy***, with huge implications.

In fact, such bidirectional relationship allows to explain in another way the equilibrium reached among celestial bodies (or between artificial satellites and Earth). Instead thinking that the "inertia" of an object in movement (the fictitious so-called "centrifugal force" in a classic view) is the cause of counteracting the "gravitational force", our extended relativistic view is that the gravitational potential energy over a mass is counteracted by the kinetic energy associated to such mass in movement. When such equilibrium is reached along space-time timelike geodesics, their governing equilibrium equation expresses the equality among gravitational potential energy and kinetic energy: $mGM/(R+h)=mv^2/2$ (3), which can also be expressed like (2).

In the specific case of ***Light, Light follows null geodesics counteracting the Gravity effect (gravitational potential energy) due to its own energy in shape of electromagnetic radiation (which also can be considered ultimately kinetic energy)***.

So we could consider in a generic way that the kinetic energy of an object creates its "own gravitational potential field" in shape of kinetic energy, or, to put it another way, an "antigravitational" field based on its own dilation time as opposition to the produced by the dilation time of the celestial body, "compensating" its gravitational effect.

Analyzing the equilibrium reached for compensating time dilations, we can appreciate a very relevant difference among (1) and (2). While ***in (2)*** we're compensating ***the complete time dilation for an altitude h, in (1)*** we're compensating only ***the difference of time dilations between the surface of the celestial body and the object for an altitude h*** due we're following a relative movement so we must compensate such time dilation difference for reaching a equilibrium state at altitude h.

Time dilation would be the cause of Gravity instead its consequence (we'll analyze this assertion forward when we'll talk about the origin of Gravity). Therefore when the gravitational potential energy is fully compensated by kinetic energy at an altitude h, calling ***ΔU'*** (the ***effective gravitational potential field***) the difference among potential fields, that is, **$\Delta U' = (GM\,(1/r-1/(r+h))-v^2/2$**, when ***ΔU'=0 means there's not an effective gravitational potential field working over the object***. Consequently, the object is in equilibrium, just as it was not affected by Gravity. In other words, although g is obviously > 0, we reach a "***Zero Gravity" effect***.

The following Figure 1 shows how changes, for objects in relative movement (i.e. don't following timelike geodesics) the Gravitational Potential Field and the "Virtual AntiGravitational Field" with the altitude. We call it virtual because it's not an static field but a theoretical field that must be compensated by the kinetic energy of an object in a relative movement at different altitudes to reach a "Zero Gravity" effect. For objects following geodesics paths the gravitational and anti-gravitational fields match.

There's a point where the values of both functions match, at an altitude for Earth of **H0=6371 Km**. (i.e. for an altitude equals to Earth's radius).

For values of h < H0, V' < V (in absolute values) so the kinetic energy needed for compensating the gravity effect is lower than the energy of the gravitational field. But for values of h > H0, V' > V (in absolute values) so the kinetic energy needed for compensating the gravity is higher than the energy of the gravitational field.

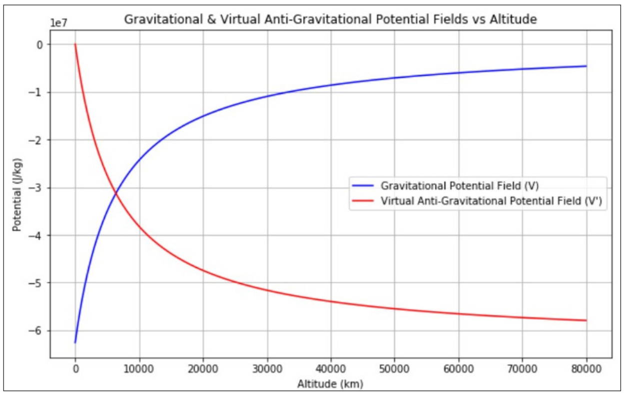

Figure 1

In other words, the most energy-efficient way to counteract a gravitational field is ***moving along a non-geodesic line up to the equilibrium altitude H0 and along a geodesic path for altitudes above H0***.

Finally, the fact that we had found a consistent formulation supported by both Relativity theories (General and Special) encloses a clue about what is the real origin/nature of the Gravity which we'll develop later.

Methodology

We'll use the following methods to show the need of a modified Einstein's Field Equations (EFEs). We'll call them Einstein's Field Extended Equations (EFEEs):

- Analyze the bidirectional relationship among kinetic energy and gravitational potential energy (we've already done it in the previous chapter).
- Analyze the origin of the Gravity and its relationship with Special Relativity Theory.
- Analyze under what conditions kinetic energy can be transformed into gravitational potential energy and when the process is irreversible.
- Analyze how Gravity has evolved (increased) over a cosmological time through different stages.
- Analyze the relativistic metric for objects in movement.
- Analyze the influence of kinetic energy over objects in relative movement at critical speeds (higher than escape velocity).

Based on the previous methods, we should be able to:

- Build a new EFEEs (Einstein's Field Extended Equations) based on all exposed above.
- Build a new cosmological model with no need for a cosmological constant / no need for dark energy.

What actually is Gravity?... Gravity Origin

We summarized before, in the Introduction chapter, the real bidirectional relationship among kinetic energy and Gravity and how kinetic energy can counteract Gravity, with different scenarios for objects following or not timelike geodesics.

In other work, starting from this new expression of the relationship among kinetic energy and Gravity, I took a relevant step forward concluding that ***Gravity emerges as time dilation from the interaction among electromagnetic energy and matter via the photoelectric effect*** [5].

It's a consequence of the kinetic cloud around the atoms composed by the expelled electrons that are trapped due the high scattering cloud&matter density. ***It arises directly related to Special Relativity due to the speed difference***.

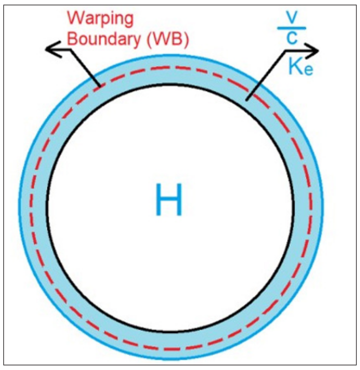

Figure 2

While the cloud average speed (v/c) defines the degree of the time dilation (and therefore the gravity), the kinetic energy density defines the time needed (t0) to be conserved over cosmological time.

The own gravity emerging as consequence of the time dilation, will work as inertia to continue the dilation of the emerged time. In other words: emergent time is associated to an intrinsic property ("elasticity" or "rigidity" depending from our view). (4) It means that if we apply a kinetic speed v

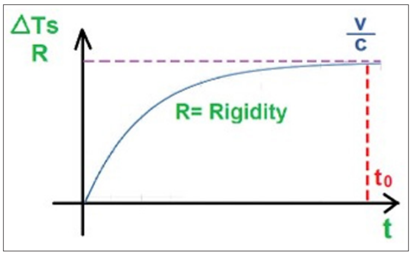

Figure 3

(or under a relativistic view v/c) to an object, the time dilation does not emerge instantly. It takes some time to reach it.

The rigidity of the emergent time is proportional to the kinetic energy, to be more exact also to the kinetic velocity (v/c), the dilation time (ΔTs) and the exposure time (t).

The more the time dilation is getting closer to v/c, the higher the rigidity. Time dilation for a speed v presents an asymptote (v/c) that can't be reached, but when $\partial R/\partial t \rightarrow 0$, the more difficult is reverting the emerging time. It means that if the object is suddenly stopped or simply $v \rightarrow 0$, then the time dilation is reverted faster the further it's from the asymptote.

There's a point (t0) where the rigidity is not reversible, that is, elasticity → 0. Crossing such theoretical point, the emerged time is conserved on time as gravitational energy or using another conventional expression, as gravity. More kinetic energy will not imply more dilation, or the dilation will be meaningless. That is, kinetic energy will be converted into gravitational energy, being irreversible once such t0 point of "no return" (elasticity → 0) has been crossed. Therefore ***the value of the emergent time is closer to the average speed of the electrons than to the kinetic energy density while the value of t0 is directly influenced by the kinetic energy density. The more the kinetic energy density, the lesser the value of t0***. That is, the point of irreversible conversion of kinetic energy in gravitational energy is reached sooner the greater the kinetic energy density.

The Rigidity would follow a function $R=f(t)=1-e^{-kt}$

Where t=exposure time, k a parameter which value must to be defined. The t0 value must be also defined.

Summary: As the kinetic energy density increases, it's gradually converted into gravitational potential energy according to the following assumption: Emergent Time (time dilation) has a property ("Rigidity"), which follows a function f(t)= 1−e−kt (where t=exposure time) and it's also directly proportional to the square root of the kinetic energy density and the own time dilation. Rigidity (R) is very close to the asymptote R=1 when the exposure time of the kinetic energy surpases a value (t0). We'll suppose that t0 is reached when 1-R= ε. The lower the value of ε, the more appropiate the value of t0.

t0 is also inversely proportional to the kinetic energy density, that is, as the kinetic energy density increases, t0 is reached before. The Rigidity is also proportional to the kinetic speed, or, in relativistic terms, to v/c. But what defines the time t0 for getting Rigidity --> 1 is the kinetic energy density. The relation v/c has an inertia to be reached that is the own time dilation, or, in one word, the gravity. But what defines the time needed for getting that the emerged time is preserved on time, that is, that Rigidity is very close to one, is the time t0. When exposure time < t0, then gravitational potential energy (time dilation) decreases according to R (see Figure 3) "deconverting" again in kinetic energy. But when exposure time >= t0, then gravitational potential energy (time dilation) remains forever [5].

The exact values of the parameters of the functions that define the previous conditions could be found through experimentation. Only very specialized labs have the specialized equipment for driving such empirical research so I did a first tuning based on the environment conditions expected in the two relevant stages that have shaped the gravity in Universe [5].

Where Gravity Begins?.. (Warping Boundary)

The geometric beginning of the Gravity effect is strictly linked to the location where emergent Time arises. The kinetic energy coming from electromagnetic radiation works at atomic scale, not at quantum scale, not at Planck scale. That is, the kinetic energy cloud should be trapped in some point close to the atomic scale. Such point must be also directly related to the geometric end of the Quantum world. That is, superposition effect should find a boundary clearly related to this point.

I called such point "***Warping Boundary***" (***WB***), as it's showed in the Figure 2 [6].

It's expected a transition environment among Quantum (no Gravity) and the Warping Boundary (WB) where time dilation (and consequently Gravity) is expressed.

Therefore it's expected that contradictory phenomens could be detected in this narrow strip. i.e. There wouldn't be a clearly defined boundary for superposition effects.

In summary, my work shows that all "Quantum Gravity" based theories are wrong. On the other hand, claming that Gravity is entropic ("Entropic Gravity" theories) is equivalent to claiming that Gravity is not fundamental (but without showing at all how it emerges), although it had been a first step on the right path.

As shown above, Gravity emerges as consequence of the interaction between electromagnetic energy and matter so Gravity can't be considered either simply a holography.

The geometric beginning of the Gravity effect is strictly linked to the location where emergent Time arises.

We'll analyze next the Warping Boundary and its associated Transition Zone, studying the contribution of a simple Hydrogen atom over its closest environment to time dilation&gravity in order to understand a bit more how works the transition among quantum and gravity worlds.

Some experiments have got (with some relevant restrictions to get isolation) around 2000 atoms in superposition, with masses greater than 25,000 atomic mass units, i.e. far superior to those of Hydrogen. It would set the farthest known "***Warping Boundary***" in the mesoscopic scale close to the microscopic scale.

The effective location of the kinetic cloud around the Hydrogen atoms and consequently ***the Warping Boundary changes depending especially of the plasma density where their associated emergent time was shaped***. For very high plasma densities, the Hydrogen molecules are so close each other that the effective value of the Warping Bondary will be closer to the angstrom scale but it will be higher for lower plasma densities, influencing in turn over the Warping Boundary for heavier elements built from these elementary bricks.

The environment between the angstrom scale and the effective Warping Boundary makes up the ***Transition Zone***.

We'll suppose a critical scenario where the contribution of one atom to the Warping Boundary of the kinetic cloud was located just in the limit with the microscopic scale, that is, at one micrometer (10^{-6} meters).

For studying how the contribution due to such atom influences over the geometry of its ***transition zone***, we'll analyze the according values of the time dilation (in shape of gravitational potential) & gravity.

Taking into account that time dilation and gravitational potential are directly related ($\Delta Ts=2V/c^2$), the atom mass is 1.67×10^{-27} Kg. and calling d_0=1 Amstrong (10^{-10} meters), the values of the gravitational potential **V** in function of the distance d/d_0 are the following ones:

Scale	Distance (m)	Distance (d/d0)	V (m^2/s^2)	ΔTs
10^{-6}	10^{-10}	1	1.11461×10^{-27}	2.48030×10^{-44}
10^{-7}	10^{-9}	10	1.11461×10^{-28}	$4.97900x10^{-45}$
10^{-8}	10^{-8}	10^2	1.11461×10^{-29}	$1.57400x10^{-46}$
10^{-9}	10^{-7}	10^3	1.11461×10^{-30}	$4.98000x10^{-47}$
10^{-10}	10^{-6}	10^4	1.11461×10^{-31}	$1.57500x10^{-48}$

And the values of the associated **Gravity** g in function of the distance d/d0 are the following ones:

Scale	Distance (m)	Distance (d/d0)	g (m/s2)
10^{-6}	10^{-10}	1	1.11461×10^{-17}
10^{-7}	10^{-9}	10	1.11461×10^{-19}
10^{-8}	10^{-8}	10^2	1.11461×10^{-29}
10^{-9}	10^{-7}	10^3	1.11461×10^{-23}
10^{-10}	10^{-6}	10^4	1.11461×10^{-25}

These values belong to the theoric contribution of a single atom over an atom. But depending on the location of the Warping Boundary and the according size of the transition zone, the total contribution over an atom should be increased taking on account the total number of atoms surrounded by the Warping Boundary. In any case, they give us an idea about the order of magnitude we are referring to.

Conclusions

- The value of the gravitational potential V close to atomic (angstrom) scale is very low (0.0001 the value of the gravitational potential close to the Warping Boundary), decreasing in the same proportion the value of the dilation of time ΔTs close to atomic (angstrom) scale with relation to the dilation of time ΔTs close to the Warping Boundary.
- The value of Gravity g close to atomic (angstrom) scale is extremely low (10^{-8} of the gravity close to the Warping Boundary) due it decreases in powers of 10^2.

- ***The influence of the geometry related to Time over the quantum world (i.e., the warping of space-time) is negligible at Angstrom scale*** but increases along the transition environment till reach the Warping Boundary (that we set in this example in the limit iwh the microscopic scale).

If we assume now that the Warping Boundary is closer to the angstrom scale, the value of the contribution for each atom will obviously increase, but the number of atoms in the transition zone will decrease, so the order of magnitude will not change significatly.

- ***The wave function will collapse in the Warping Boundary, but it also could collapse over any point of the transition zone.*** The closer we are to the Warping Boundary, the greater the chance of collapse. The collapse of the wave function related to gravity would also demonstrate the validity of this framework. I encourage to research at different scales for finding the Warping Boundary for different materials and conditions to understanding better the effects that could take place in the transition zone (7).

The collapse of the wave function really marks the boundary among our world governed by the Gravity and the Quantum world. So it seems obvious it's related one way or another way to Gravity. What would have no sense is relating the wave function collapse to any hypothesis about the origin of Gravity directly related to Quantum. If Gravity was intrinsically related to Quantum (graviton, string theory, quantum gravity …) the collapse of the wave function should not be associated to Gravity, beyond of any mathematical artifact that could be used trying to show it.

Behavior of The Emergent Time as a Fluid

We analyzed previously how the emergent Time had an intrinsec property that we called "**Rigidity**" or "Elasticity" linked to the induced Gravity (4).

Now we'll do a relevant step forward ***to analyze in detail the essence of the emergent Time (Te) trying to explain its behavior once it's consolidated***.

We know that Te should fulfill the following requirements:

- It's directly related to the gravitational potential. According Schwardschild metric, the g00 component of the metric tensor is $g00=1-2GM/rc^2$, that can be expressed like $g00=1-2V/c^2$, where the term $2V/c^2$ is the time dilation or emergent time rate, that is, $\Delta Ts=2V/c^2$
- Gravity and gravitational potential (therefore time dilation) are linked by the factor 1/r. In other words, time dilation decreases by 1/r and gravity by $1/r^2$
- Te must follow simple addition rules: Additions of small contributions of Te lead to an arithmetic larger time.
- Te associated to a container must fullfil it, that is, the aggregated time consequence of the micro contributions must emerge on its surface.

There's a known substance in the Nature that could fulfill the previous requirements. I'm talking about ***fluids***.

For analyzing the most adequate way to relate the time behavior with a specific kind of fluid, we must resort to the Navier-Stokes equations and its derivations. My view is ***the most adequate fluid to model the emergent time is a theoric laminar fluid with a low Reynolds number whose viscosity and permeability change in inverse way to the distance***. The fluid should be ***linked to only one variable (dimension), the radial distance***, so it should be expressed in spherical coordinates.

In summary, the emergent time (fluid) would not need any additional dimension to be expressed. It had two associated properties, viscosity and permeability, flowing from its source (mass) and expanding from it in a radial way.

We could start from the original differential Navier-Stokes equations, then impose the previous conditions on them and integrating them to reach some kind of "original" expression that we could attribute to ourselves [8]. But spending a lot of paper and useless effort is not my goal when there has been so qualified physicists along History who have provided solutions that serve perfectly for building our own customization starting from them.

In fact I think ***a customizacion from Darcy's Law*** could fulfill our requirements, so we'll use it as an starting point [9].

At first time, we must start from Darcy's formulation disregarding the gravitational component.

Darcy's Law in Porous Media (Gravity-Free Case)

Darcy's Law describes the laminar flow of a Newtonian fluid through a porous medium under a pressure gradient. In the absence of gravity ($g = 0$), it simplifies to a direct proportionality between the Darcy velocity q (volume flux per unit area) and the pressure gradient ∇p:

$$q = -\frac{k}{\mu}\nabla p$$

Where: $\boldsymbol{k}$ is the intrinsic permeability of the porous medium (units: m^2), μ is the dynamic viscosity of the fluid (units: Pa·s) and the negative sign indicates a flow from high to low pressure. This is the general vector form, valid in any coordinate system.

Adaptation for Spherical Flow in Spherical Coordinates

For spherical (radial) flow, we assume azimuthal symmetry (no dependence on angular coordinates θ or ϕ) and purely radial flow from a point source. In spherical coordinates (r,θ,ϕ), the velocity has only a radial component qr, with $q\theta = q\phi = 0$.

Then the pressure gradient simplifies to: $\nabla p = \frac{\partial p}{\partial r}\vec{r}$

Thus, the radial Darcy velocity (m/s) is: $q_r = -\frac{k}{\mu}\frac{\partial p}{\partial r}$

In component form (full vector in spherical coordinates), taking into account that in spherical coordinates the gradient operator is

$$\nabla p = \left(\frac{\partial p}{\partial r}, \frac{1}{r}\frac{\partial p}{\partial \theta}, \frac{1}{r\sin\theta}\frac{\partial p}{\partial \phi}\right)$$

For spherical symmetry (p=p(r) only), the angular derivatives vanish: $\partial p/\partial\theta = \partial p/\partial\phi = 0$. This leaves only the radial term:

$$q = q_r\vec{r} + q_\theta\vec{\theta} + q_\phi\vec{\phi} = -\frac{k}{\mu}\frac{\partial p}{\partial r}\vec{r} + 0\cdot\vec{\theta} + 0\cdot\vec{\phi}$$

That can be expressed as $\frac{\partial p}{\partial r} = -\frac{\mu}{k}q$

From now on, we will use the terms radius and (radial) distance interchangeably.

Darcy's Law for Spherical Flow governed by the Viscosity and Permeability params.

We're talking about an "unidimensional fluid" in the sense that's a fluid only influenced by a variable: the radius (distance) r. So we're going to consider that the viscosity decreases with the radius (but in such way that a laminar flow with a low Reynolds number must be always guaranteed) while the permeability also decreases with the radius.

Permeability and viscosity are linked because higher viscosity means more resistance to flow making it harder for the fluid to pass through the medium and viceversa. Therefore if the viscosity decreases with the radius, although permeability also does it, it must do it in a slower way.

i.e. We'll suppose that permeability ***k*** is not constant and inversely proportional to the square root of the radius ($k(r)= \alpha/r^{1/2}$) and the viscosity **μ** is inversely proportional to the radius, μ (r)= β/r). So

$$\frac{\mu}{k} = \frac{\beta/r}{\alpha/r^{1/2}} = \frac{\beta}{\alpha}r^{-1/2} \quad (5)$$

Thus $$dp = -\frac{\beta q}{\alpha}r^{-1/2}dr$$

Integrating both sides, with limits (p) from pw to pe (corresponding to (r) from rw to re):

$$\int_{p_w}^{p_e} dp = -\frac{\beta q}{\alpha}\int_{r_w}^{r_e} r^{-1/2}dr \quad \rightarrow \quad p_w - p_e = \frac{2\beta q}{\alpha}(\sqrt{r_e} - \sqrt{r_w})$$

Time like a radial laminar fluid following Darcy's Law for spherical flow with variable permeability and viscosity

With pe = 0 and rw = 0, the integrated equation simplifies to

$$p_w = \frac{2\beta q}{\alpha}\sqrt{r_e}$$ Expressed in another way: $$q = \frac{p_w \alpha}{2\beta\sqrt{r_e}}$$

Units: Flow rate (m/s), Pressures (N/m^2) and the parameters: the Permeability scale factor α ($m^{5/2}$, coming from k (m^2)) and the Viscosity scaling factor β (N.s/m coming from μ = N s/m²)

The square of the flow rate is: $\mathbf{q^2=p_w^2 (\alpha^2/4\beta^2) / r_e}$ (6)

The gravitational potential is $V = \frac{GM}{r}$ (7)

And now comes the most exciting part. The time component of the Schwardschild metric is $(1-2GM/c^2r) c^2dt^2=$ $\mathbf{c^2dt^2 - 2GM/r\ dt^2}$ [10]. Therefore the term related to **the square of the time dilation is 2GM/r=2V** (8), being V the gravitational potential field according to (7). So (6) is fully consistent with (8). In other words, we've demonstrated the validity of our hypothesis about considering the behaviour of the emergent time like a fluid reaching to the conclusion that the square of the flow rate of the emergent time is the (double of the) gravitational potential field. That is, $\mathbf{q^2=p_w^2 (\alpha^2/4\beta^2) / r_e = 2V = 2\ GM/ r_e}$ (9)

Analyzing this expression:

- The role of the mass **M** is carried out by the term related to the pressure $\mathbf{p_w}$. M is intrinsecally linked to the time dilation which would work like a fluid flowing from a maximum pressure directly associated to M till zero pressure at the infinite.
- The role of **G** seems to be linked in some way with the parameters related to permeability and viscosity (**α/β**).

In any case, it's obvious that p_w^2 units don't match M units and $\alpha^2/4\beta^2$ units don't match G units so it we want to find the relationships among G, α/β, p_w^2 and M we must deep one step forward.

Both Mass and Pressure contribute to the stress-energy tensor in Einstein's EFE so expressing the gravitational potential in terms of pressure instead of mass is fully consistent under a relativistic view. In fact density ρ (Kg/m^3) can be expressed in terms of $\mathbf{p_w/c^2}$ ($N/(m^2c^2)$)

So calling Ψ= **α/β** and **R**=Earth Radius, (9) becomes

$\mathbf{q^2= \rho^2c^4\Psi^2 / (4r_e) = 2\ GM/ r_e \rightarrow \Psi = (8GM / \rho^2c^4)^{1/2} = (8\ GM)^{1/2} / \rho c^2}$ $\approx 1.13960\times10^{-13}\ m^{5/2}\ kg^{-1}s$ (10)

So:

- **Ψ** not only depends of **G**. ***It also depends of the density ρ and the mass M which is the same as saying that it depends on the density and the geometry (R)***. So it will not be constant but different for any mass.

  Ψ is inversely proportional to density. There's not a direct relationship between dynamic viscosity and density in fluids but there's an inverse relationship between permeability and density. So a higher density implies a lower permeability.

- The value of **Ψ** is extremely small. Although we can't deduce independently the values of **α** and **β**, their relationship shows that the permeability must be very low and the viscosity very high specially for small values of distance r. Therefore the behavior of the emergent time in its origin (for very low values of the distance r) shows a very high "rigidity" that can only be overcome with high values of kinetic energy density, how we analyzed previously (4).

Expressing (10) in function of the mass M and its radius R instead density:

$\mathbf{q^2= \rho^2c^4\Psi^2 / (4\ r_e) = M^2c^4\Psi^2/4\ (4/3\Pi R^3)^2\ r_e= 2\ GM/ r_e}$

Thus $\mathbf{9Mc^4\Psi^2/16x4x2\Pi^2R^6 = G \rightarrow \Psi = (64x2x\Pi^2R^6G\ /9Mc^4)^{1/2}=2^{1/2}\ 8\Pi R^3/(3c^2)\ (G/M)^{1/2}}$ (11)

So $\mathbf{\Psi} \approx 1.14 \times 10^{-13}\ m^{5/2}\ s^{-1}$

(11) is just another way of showing that **Ψ** not only depends of G but of the geometry (R) and mass (M).

The Figure 4 shows the values of **Ψ** for Solar System Bodies in ascending order:

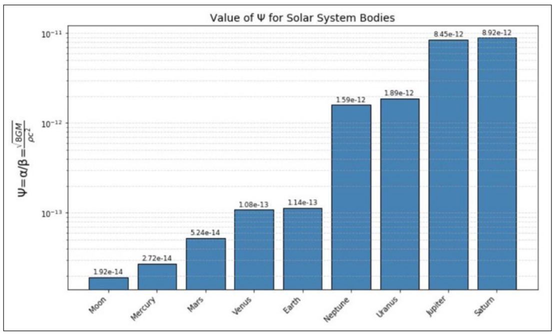

Figure 4

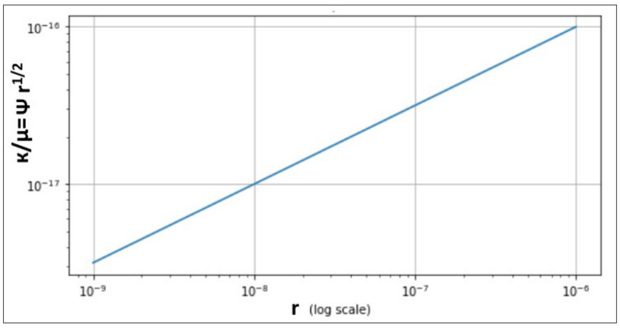

Figure 5

Gravity is inmediately derived from the gravitational potential field (g=-dV/dr respecting signs).

So **$g=- 1/2\ p_w^2\ (\alpha^2/4\beta^2)\ /\ r_e^2=-1/8\ \rho^2c^4\Psi^2/\ r_e^2$ (12)**

So ***Gravity emerges as consequence of the evolution of the gravitational potential field (i.e., the flow of the emergent time) with the radius expressed as derivative of the square of the flow of the emergent time related to the distance (radius)***. Or, expressed like a vector, it's the ***gradient*** of the radial vector representing the square of the flow of the emergent time pointing to the source of such emergent time. So ***it's closely related to the viscosity (which is higher close to the surface of the mass implying a higher resistance to the flow) and the permeability (which also decreases with the radius implying a decrease in the time flow)***. It's directly related to the parameter $\mathbf{\Psi}^2$.

The expression (12) is equivalent to the 3D Newtonian classical $g=GM/r^2$. In fact, if we calculate the value of g for different altitudes, ***we find the same results*** (with a minimum difference as consequence of the precision used for calculating **Ψ**).

We analyzed previously in (4) a property associated to the emergent time that we called "***Rigidity***" or "Elasticity" linked to the kinetic energy density in the origin of the emergent time.

Now we've concluded that the ***behavior of the emergent time once consolidated corresponds to a fluid with two associated properties: viscosity and permeability***.

So the latest question that arises is what is the relationship among "Rigidity/Elasticity" and the parameters vicosity and permeability?... My view is the rigidity that arises in the emergent time origin is simply the expression of the permeability and viscosity params evolution at microscopic scale and below. The initial viscosity and permeability would tend to grow quickly till reach their values but ***previously it's necessary to overcome their initial resistance/inertia ("Rigidity") for getting that the fluid (time) can flow. The kinetic energy density would play the role of "accelerator of the flow" by overcoming the rigidity as soon as possible***, accelerating the process of the fluid creation and flowing. ***The more kinetic energy density, the lower time for the emergent time is consolidated and flows***.

From (5): **$\kappa/\mu= \alpha/\beta\ r^{1/2}= \Psi\ r^{1/2}$**

The Figure 5 shows that for values in the range from angstrom scale to microscopic scale, i.e. where the emergent time arises, the relation between κ/μ has a value a lot lower than the Ψ value, showing the rigidity (lower permeability and higher viscosity) preceding to the consolidation of the emergent time.

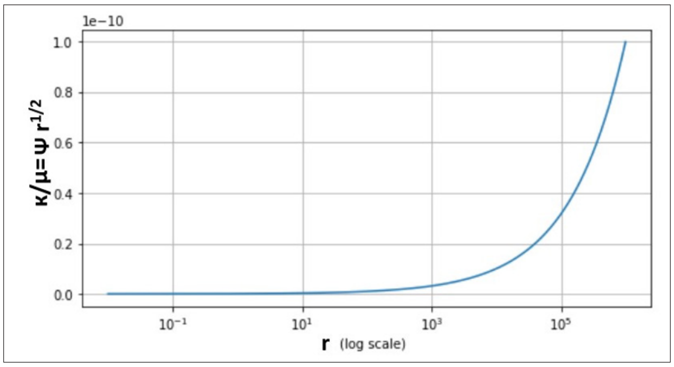

Figure 6

The Figure 6 in turn shows how evolves the relation κ/μ at the macroscopic scale.

Consequences of considering the essence of the emergent time like an special fluid in this Framework.

The consequences of considering emergent time like a fluid goes even beyond of our initial goal. It's not only fully consistent with our framework but implies very relevant consequences when it's applied in conjunction with it:

- ***Time (like fluid) always adapt to its container.*** So ***the reference origin of times should be always located in the surface of the mass***. It has no sense to take the center of the mass as reference of times anymore. First consequence: ***There's no singularity related to time dilation and therefore to gravity***. On the other hand, according to (4), the unit value of emergent time dilation ΔTs is asymptotic to v/c. Therefore time dilation always had a limit (ΔTs→1 when v → c) that would prevent that ΔTs=1 and consequently the creation of an infinite dilation.

  Newton Law is a 3D simplification using the center of the mass implicitly as reference. Although we've used it previously to understand the relationship among time dilation, gravitational potential field and gravity, the most adequate way is working with the relativistic view and gravitational potential field (ΔV) instead with absolute values.
- Considering the ***entropy related to the surface and not to the volume of the mass*** is just another consequence of the

previous sentence. It had not to do only with black holes but could be applied to any mass.

It would be an **universalization of the *Bekenstein-Hawking entropy law*** according to which a black hole's entropy is related to its surface area, not its volume, because its information content seems to be encoded on the 2D surface of its event horizon, rather than throughout its 3D volume [11].

Gravity Evolution. Gravitational Potential Energy vs G

Showing that Gravity is part of the evolution of the Universe was already included in one of my first works, an article based on a 2023 book, but it was fully developed in detail in a later article, showing how the gravitational constant can no longer be considered constant because Gravity evolves (increases) over Time [4,5,12].

We analyzed how ***G is not constant along the Universe***, because it depends of the shaping of the time dilation associated to matter due its relationship with electromagnetic energy through different stages being the stellars the most relevant ones [5].

We'll also analyze in this paper an add-on which was not discussed in my previous papers. I'm talking about the relationship among gravitational potential energy and G. We'll take the Earth like reference because it's our most objetive way of analyzing such relationship. Any mass should follow the same pattern so it should be extrapolable to any scale.

Gravity is associated to the dilation time that emerges as consequence of the interaction among electromagnetic energy (kinetic energy) and matter. Being such dilation directly related to the gravitational potential field, our next question is what is the shape of the curve of the gravitational potential field taking on account that it's a function inverse to the distance and direct to the gravitational "constant" G whose dependence on the value of the emergent time was previoulsy analyzed [4].

The following Figure 7 helps us to illustrate it. In this graph, we show a imaginary gravitational potential field (gravitational potential energy per mass unit) for different values of a parameter called "ro". ro is directly related to G. G is the current gravitational constant, so the product ro*G=G', representing G' different values of G. When ro=1, then G'=G.

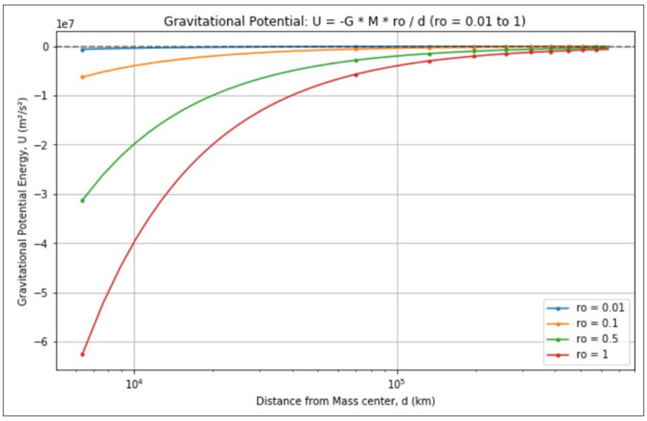

Figure 7

The interpretation is that for a very low value of G, there's very little influence of the gravitational potential field even for distances very close to the mass. It also decreases very fast over the distance. But the curve is bending more and more as G increases till reach the "classic" aspect for G'=G. (13)

Relativistic Metric for Objects in Movement

Our research shows the close relationship among special relativity and general relativity. The dilation of time due to the speed can't be considered independent of the dilation of time related to "conventional" gravity anymore. They're really two faces of the same coin.

Objects in movement counteract gravitational fields due to its own kinetic energy. The reason, as we've seen before, is kinetic energy is the key (the root) of the gravity origin, being part of its very essence. Such "temporal gravitational field" only can be converted to a "consolidated gravitational field" under very specific and demanding circumstances, being kinetic energy density and time the involved parameters.

But the "temporal gravitational field" created by an object in movement seems to be limited to the object itself as long as the circumstances related to time and kinetic energy density for converting it in a "consolidated gravitational field" do not arise. It's not extended apparently to its environment (just as it happens with the gravity associated to a mass whose gravitational potential field extends a function of the distance). Time dilation associated to an object in movement seems to be limited to the object itself while time dilation associated to a mass decreases as a function of the distance.

Then the relativistic generic metric for an object in movement in vacuum or along a geodesic is [2]:

$$ds^2=-(1-v^2/c^2)\, c^2dt^2 \quad (14)$$

where v=object speed and c=Light speed.

This expression can be derivated directly from Minkowsky metric but following with our view about the relationship among Special and General Gravity, it can also be inferred from (2): $GM/(R+h)=v^2/2 \rightarrow 2GM/(R+h)= v^2$. Therefore, the time component according Schwarzschild metric would become $-(1-2GM/((R+h)c^2))=-(1- v^2/c^2)$.

For the particular case of Light (v=c), the time component is reduced to 0, or, in other words, time dilation becomes infinite. Under the view of a photon, time doesn't exist.

For extending the metric (14) to objects in relative movement each other, i.e. to objects with "free" movement (i.e. not limited to a geodesic), we should resort to formulation (1) instead (2) : $GM/R-GM/(R+h)=v^2/2 \rightarrow 2GM/(R+h)=2GM/R-v^2$ Therefore, the time component according Schwarzschild metric would become $-(1-2GM/((R+h)c^2))=-(1- (v^2/c^2-2GM/(Rc^2)))$.

Influence of Kinetic Energy Over Objects in Relative Movement at Critical Speeds

Now we'll go another step forward, showing how objects in relative movement not only can counteract Gravity but converting kinetic energy in a "temporal gravitational potential energy" with some relevant implications at critical speeds. Only when some very demanding conditions are fulfiled (a relevant kinetic energy density applied during a time related with such value) the "temporal gravitational potential energy" is finally consolidated as gravitational potential energy.

We could say in a simplified way that a "gravitational newtonian force" is the reduced expression over a "3D world" (i.e. without taking into account the time axis) of the effects of a "4D relativistic world" (taking into account the time axis).

The general relationship between the time dilations (**) due to the gravitational potential energy and the speed of an object in relative movement at an altitude h is [1]:

$$\frac{1}{Xt} * \left[GM\left(\frac{1}{r} - \frac{1}{r+h}\right)\right] = \frac{v^2}{2} \qquad (15)$$

(**) Strictly speaking we should divide by c^2 for considerating the real time dilation values.

where Xt is the time differential factor, or, in other words, the percentage of time dilation to be "compensated" by the speed v. So Xt=1,2, …. 10 implies $\Delta Ts^2=1/1*\Delta Ts_0^2$, $1/2*\Delta Ts_0^2$,… $1/10*\Delta Ts_{02}$

where $\Delta Ts_0^2= GM\left(\frac{1}{r} - \frac{1}{r+h}\right)$

ΔTs_0 is the time dilation corresponding to a "zero gravity point", the point where ΔU (and therefore ΔG) is fully compensated by the speed v. If we call $\Delta Tsv^2=v^2/2$ and ***ΔU'=ΔTs₀- ΔTsv*** (where ΔU' is the ***effective gravitational potential field***), the "***zero gravity" effect*** is reached when ***ΔU'=0*** because ***no effective potential is applied over the object so the object is in equilibrium at an altitude h***.

Due to the linear relationship among ΔG and ΔTs^2 (for a specific altitude), any change in ΔTs^2 affects in the same way to ΔG.

For high values of h and xt=1, (15) becomes the expression of the calculation of the escape velocity.

We'll get different values of ***ΔU' > 0*** for different values of Xt > 0. But, what happens if Xt < 1?... In such case, taking Xt=1/2 like example, ΔTs_0^2 (time dilation due to conventional Gravity) = $\Delta T's_V^2 = 2\ \Delta Ts_V^2$, where $\Delta Ts_V^2=v^2/2$ being v the speed needed for compensating the time dilation at an altitude h. Therefore the time dilation difference due to the speed is the double of the time dilation difference due to the gravity and ***ΔU' < 0 so the object must move in opposite direction, to a higher altitude***. Calling Δ'g0 the effective gravity difference at an altitude h, the consequence is the object will be expelled with an antigravitational effect Δ'g0.

In other words, the object creates its own gravitational effect in shape of time dilation due to its relative movement, with the capability not only of counteracting the gravitational effect exerted over it but creating an "anti-gravity" effect whose value is a function of its speed and the altitude.

In short, ***it's the relation among the time dilations of the objects what causes the relative behavior among them***. So an object in a relative movement related another one can cause an "anti-gravity" effect if its relativistic movement has a speed higher than the equilibrium speed.

The object will be expelled till a new equilibrium state is reached, I mean, ***till the time dilations are compensated each other (ΔU' = 0)***. As the object reaches higher altitudes, ΔTs0 increases, so the anti-gravity effect decreases quickly if the speed is not increased.

The new equilibrium altitude can be calculated from (1). If we call v_{h1} the object relative speed at an altitude h1 and its speed at h1 is $v_r > v_{h1}$, then the object will be expelled till an altitude h2 > h1 such that its equilibrium speed $v_{h2} = v_r$.

Some graphs showing the equilibrium (zero gravity effect) speed for different altitudes and diameters of spinning objects as well as the results for a set of experiments are available [2].

Potential Energy for Objects in Relative Movement

If we extrapolate the previous analysis in (13) about the gravitational potential field to an object in movement, we can infer that the "incipient" gravitational field associated to its speed will be limited to the environment closest to the object itself for v << c.

In the particular case of objects moving at "usual" speeds in the Earth environment, their kinetic energy will always be too low to create potential fields that extend beyond the object itself. In fact the escape velocity is only 0.0037% of the light speed.

A good sample of the existence of a small gravitational potential field associated to an object in movement is the International Space Station. The compensation of time dilations (in this case through a timelike geodesic) creates a "Zero Gravity" effect. This effect not only affects to the object itself but to its closest environment (a radius of some meters away). Therefore, if an astronaut is working outside the station but very close to it, she/he will be immersed in this inertial reference system and will therefore barely be affected by the Earth's gravity.

The shape of the gravitational potential field induced by objects in movement could be inferred from the "conventional gravitational field". In this case the role of a mass M is taken by the object speed and consequently G is not applied.

We could express the analogy for a temporal gravitational potential field of an object in movement as $\mathbf{U=-(v^2/c^2)*Gs/d}$ (16) where r0 is the radius of the object (supposed for simplification a spherical object), d >= 1 is the relation of distances d=d0/r0, being d0 the distance from the center of the body to an external point and Gs=1, equivalent to the Gravitational constant playing the role of units coherence.

Therefore the time component of the equation (14) $\mathbf{(1-v^2/c^2)}$ could be expressed as (1-U*d/Gs)

Figure 8

The Figure 8 shows how the potential U is very low and decreases over the distance relation d0/r0 for different speeds, where Ve is the escape velocity.

For speeds lower than Ve, the potential U decreases very fast so its radius of influence is only of a few meters. For speeds pretty higher than Ve, the influence of the potential U is extended for some tens of meters and its value begins to be very significative when v >= 10Ve.

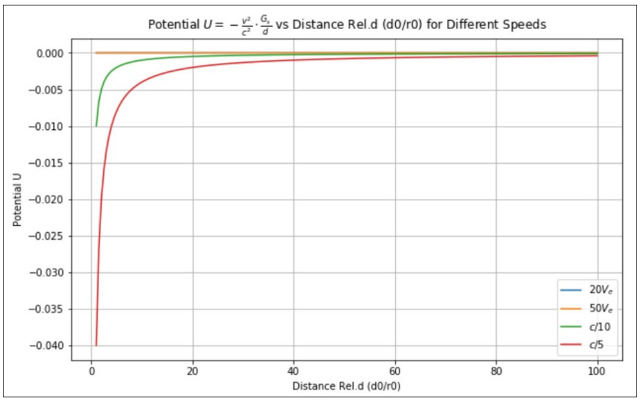

Figure 9

The Figure 9 shows the evolution of potential U over distance for very high speed values from 20Ve till light speed(c) /5. (*)

(*) **Note:** For speeds close to the order of speed light, the equation (2) should be reformulated for taking on account the relativistic kinetic energy instead the conventional one.

Light and Gravity

One of the consequences of this Theory is a new approach about the relationship between Light and Gravity:

Light counteracts the Gravity effect (gravitational potential energy) due to its own energy in shape of electromagnetic radiation (which also can be considered ultimately kinetic energy). The light loses energy as it travels through intense gravitational fields, but it does not loose speed. As light loses energy along its way due to the gravitational fields, its tendency towards the red spectrum increases (redshift).

Therefore the redshift reached by Light is not only due to the Light gets stretched because of the expansion of the Universe (Hubble) but of its loss of energy for compensating the gravitational fields it passes through.

So we should not trust exactly in redshift to know how far a galaxy is. We could find Light coming from the same cosmological time with slightly different redshifts.

Results

New Einstein Field Extended Equations (EFEE)

We propose a new Einstein Field Equations (EFE) which reflect the new proposed relationship among kinetic energy and gravitational potential energy just as we discussed previously. We'll call them Einstein Field Extended Equations (EFEE).

The new EFEE equations must reflect:

- How the kinetic energy of an object creates its own "gravitational field" as result of the time dilation (emergent time) produced by a relativistic speed difference. Therefore although it's related to Special Relativity Theory, it should be also supported by a specific metric related to General Relativity Theory.
- Under what conditions the previous emergent time is conserved on cosmological time as gravitational potential energy [5].
- How Gravity has evolved (increased) over Time. In a first stage it's the result of the interaction among the primitive electromagnetic energy and matter. In a second stage it's the result of the interaction among electromagnetic energy and matter from the fusion processes in the stars.

Therefore the gravitational constant G will not be constant anymore. So it must be expressed as G(t). It will depend of the degree of conversion of kinetic energy into gravitational energy (always for exposure times t>= t0), which increases over some stages linked to cosmological Time. We'll take the current cosmological constant (G0) like reference [5].

The relationship among kinetic energy density and warping of space-time is already included in the conventional EFEs. In fact it's implicit into the T_{00} component of the stress-energy tensor which represents the local energy density, or the energy per volume unit of a system. But it does not express any difference among the roles of mass density and kinetic energy density.

Einstein did not include gravitational potential energy in the stress-energy tensor due it's implicitly reflected in it as mass density. But ***there's a direct relation among mass density and gravitational potential energy density, so we introduce a gravitational potential energy density in the T_{00} tensor instead the mass density component***. Then a conversion among kinetic energy density and gravitational potential energy density applies. ***G will not be constant anymore. As kinetic energy is converted into gravitational potential energy over time, G will gradually increase***.

We could conclude that kinetic energy could be considered like the way that objects in movement have to create its "own temporal gravity" for counteracting the gravitational field in which they're inmersed. Such kinetic energy can be produced by different ways, but under a cosmological view, the electromagnetic energy is the one in charge of creating it when interacting with matter.

If the kinetic energy is not applied at least over a minimum time (t0) related to its kinetic energy density, it can't be considered strictly that is converted to gravitational energy (or simply we could consider that is temporally converted but if the kinetic energy stops then the "temporal gravitational energy" is "reverted" as kinetic energy again).

The principle of conservation of energy is fully respected in the new EFEEs, so it's not necessary to check it.

In summary, the new EFEEs reflect all the specifications detailed previously in the chapter about Gravity Origin.

Our extended EFEs (EFEEs) are calculated in detail according to such specifications and expressed in [5]:

$$R_{\mu\nu} - \frac{1}{2}Rg_{\mu\nu} = \frac{8\pi G(t)}{c^4}T_{\mu\nu}$$

- **No cosmological constant:** $\Lambda = 0$, and dark energy is replaced by the conversion of kinetic energy density ρ_k to gravitational potential energy density ρ_g.
- **Stress-energy tensor:** $T_{\mu\nu} = (\rho_k(t) + \rho_g(t) + p)u_\mu u_\nu + pg_{\mu\nu}$, where $\rho_k(t) + \rho_g(t) = \rho_{k0}$ (conservation of total energy density).
- **Rigidity function:** $R(t) = 1 - e^{-kt}$, with $t_0 = \frac{\alpha}{\rho_k}$, and $k = \frac{-\ln(\epsilon)}{t_0} = \frac{-\ln(\epsilon)\rho_k}{\alpha}$.
- **Conversion mechanism:**
  - For $t < t_0$: $\rho_g(t) = R(t)\rho_{k0}$, $\rho_k(t) = (1 - R(t))\rho_{k0}$.
  - For $t \geq t_0$: $\rho_g(t) = \rho_{k0}$, $\rho_k(t) = 0$.
- **Rigidity proportionality:** $R(t) \propto \sqrt{\rho_k} \cdot \tau$, where $\tau \approx \sqrt{g_{00}} \approx 1 - \frac{\Phi}{c^2}$, and $\Phi \propto G(t)\rho_g$.

EFEEs Parameter Definitions. Summary.

The previous EFEEs are supported by four parameters:
ϵ: Defined by $1-R(t0) = \epsilon$, so $e-kt0 = \epsilon$.

k: The rate constant in $R(t) = 1-e-kt$, given by $k = \frac{-\ln(\epsilon)}{t_0} = \frac{-\ln(\epsilon)\rho_k}{\alpha}$

α: Proportionality constant in $t_0 = \frac{\alpha}{\rho_k}$

with units [energy density × time] (e.g., J·s/m3).

β: Proportionality constant in, $R(t) = \beta\sqrt{\rho_k} \cdot \tau$

with units to make R(t) dimensionless.

The exact values of these four parameters **α, β, k** and **ϵ** should be calculated based on empirical research.

A New Cosmological Model
The shape of the new EFEEs when applied to a cosmological model are consequence of the electromagnetic origin of Gravity. In the work "Topology of Emergent Time" we analyzed in detail how Time dilation emerges from the relationship among kinetic energy and matter being the electromagnetic energy the source of the released kinetic energy [4].

The previous EFEEs has four parameters α, β, k and ϵ . Just as we told before, their exact values should be calculated based on empirical research.

In any case, doing a first tunning of this model to be fully consistent with latest JWST and DESI data (with no need for a cosmological constant, not need for dark energy at all) leads us to the following results according [5]:

Stage Early Universe, $z \sim$ 8:
$\alpha 1 \approx 9.47\times10^6$ J·s/m^3

$\beta 1 \approx 5714$m$^{3/2}$/J$^{1/2}$

$\epsilon \approx 0.01$

$k1 \approx 1.46\times10^{-14}$s^{-1}
t0 ≈ 10 Myr

Stage Stellar Context, Present:
$\alpha 2 \approx 9.47\times10^6$ J·s/m^3
$\beta 2 \approx 10^{-3}$m$^{3/2}$/J$^{1/2}$
$\epsilon \approx 0.01$ $k2 \approx 0.486$s^{-1} t0 ≈ 9.47 s

Consistency with Observations
JWST: Our model is fully consistent with JWST data. It enhances rapid conversion ($t0 \approx$ 10Myr) and very early galaxies.

DESI: The late-time $\rho g \approx 5.4\times10^{-10}$J/m^3 and $G(t) \approx G0$ produce acceleration consistent with BAO data, mimicking $w \approx -1$ without dark energy.

Pantheon+ Observational Constraints+Hubble Diagram: The model is absolutely consistent.

Conservation: $\rho k + \rho g = \rho k0$ ensures energy conservation. The divergence-free $T\mu\nu$ is maintained by internal conversion.

Conclusion: These parameters eliminate the need for a cosmological constant or dark energy by using G(t) and ρg to drive early galaxy formation and late-time acceleration. G(t) will continue its evolution in the future.

Conclusion
We've reached to a new EFEEs equations which reflect:
- The bidirectional relationship among kinetic energy and gravitational potential energy.
- The relevance of a specific relativistic metric related to objects in relativistic movement.
- The origin of the Gravity and its direct relation with the Special Relativity Theory.
- The new role of the kinetic energy density in the stress-

energy Tensor showing the conversion of kinetic energy in gravitational potential energy.
- How G varies over time at cosmological level as consequence of the conversion of kinetic energy into gravitational potential energy.

Discussion

The fine-tunning of the parameters of the functions that relate the conversion of kinetic energy in gravitational potential energy relating rigidity of emergent time, kinetic energy density and exposition time for conversion irreversibility should be driven in two ways:
- Experimentation.
- Update conversion parameters based on new observations from the JWST and other telescopes.

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