Why c Exists

"And Ether Said: Let There Be Light and Relativity"

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Abstract

We show that neither the universal constant c nor the gravitational constant G are fundamental axioms of nature. Both arise from a single physical mechanism: the finite reorganisation speed of a frictionless quarkic ether whose pressure and inertial density are fixed by the displaced volume of the 13–quarkbase electron.

In this framework, c is the unique luminal resonant mode of the Ψ–field—the only dispersionless, self-coherent solution able to propagate without generating a wake in the ether. Its invariance defines causal structure, relativistic kinematics, and the emergent Minkowski metric. The same basal pressure P_0 that sets this propagation speed also determines the strength of gravitational coupling.

By identifying the electron's rest energy with pure compression energy $E_e = P_0 V_{\text{disp}}$ and using the experimentally fixed Compton scale to determine V_{disp}, the basal ether pressure satisfies $P_0 \sim 10^{24}\,\text{Pa}$. Combining this with the observed values of c and G yields a gravitational response coefficient $\xi\kappa \sim 10^{-19}\,\text{m}^{-2}$, expressing gravity as the extremely weak deformation of the etheric index produced by displaced-volume gradients.

Under this interpretation, relativity, electromagnetism, gravity, and cosmic structure become macroscopic manifestations of the same underlying phenomenon: the finite-speed dynamics of a continuous, perfectly coherent pressure medium. The constants c and G are therefore two numerical expressions of one physical entity—the quarkic ether.

Contents

1 The Return of the Ether: When Relativity Emerges from the Quarkic Vacuum

For more than a century, the word *ether* has been banished from physics. Einstein discarded it because it seemed unnecessary: the equations of relativity appeared sufficient. However, the **Quarkbase Cosmology** revives the concept from a different perspective: the ether is neither an archaic gas nor a mystical substance, but a **perfect-pressure plasma** that permeates the entire universe and from which forces, particles, and even spacetime itself emerge.

Most remarkably, when analysing how an object moves within this medium, **relativity reappears spontaneously**.

2 A Velocity Limit in the Ether

The ether possesses a maximum speed at which its pressure waves can propagate, denoted by c_Ψ. No quarkbase —the fundamental particle of the model— can move faster than this. As the velocity approaches this limit, the pressure front becomes compressed and the wake behind it elongates; the medium cannot "refill" the displaced volume in time.

The outcome is that the effort required to keep accelerating grows without bound. It is the same barrier imposed by light in Einstein's relativity, but here it **arises from the intrinsic behaviour of the ether itself**. The limit is not geometric or axiomatic: it is a consequence of the finite rate at which the etheric plasma can redistribute the displaced volume created by a moving quarkbase.

$$\mathcal{L} = \tfrac{1}{2}\,\partial_\mu\Psi\,\partial^\mu\Psi - \tfrac{1}{2}\,\mu^2\Psi^2 - J\Psi, \qquad \frac{1}{c_\Psi^2}\ddot{\Psi} - \nabla^2\Psi + \mu^2\Psi = -J.$$

For a point-like source moving at constant velocity ($v < c_\Psi$):

$$J(t,\mathbf{x}) = \alpha\,\delta^{(3)}\Big(\mathbf{x} - \mathbf{v}t\Big),$$

the pressure field it generates cannot reorganize instantaneously; the ether requires a finite time to "close" the displaced volume.

This delay has three immediate consequences:

1. **Frontal compression:** The region in front of the moving quarkbase accumulates unrecovered pressure. As $v \to c_\Psi$, the gradient grows without bound, forming a sharply compressed front.

2. **Trailing wake:** Behind the quarkbase, the medium lags. The displaced volume remains "open" over a distance proportional to the recovery time of the ether, producing an extended wake.

3. **Energy accumulation:** The energy stored in the field increases because the ether cannot redistribute pressure fast enough to maintain equilibrium. This energy grows according to the same Lorentz-type factor that appears in relativity, but here it reflects the volumetric compression of the medium.

The velocity c_Ψ therefore plays a dual role: it is simultaneously the maximum propagation speed of pressure disturbances and the emergent kinematic limit that prevents any quarkic configuration from exceeding it.

Crucially, this limit is also the speed at which **constructive resonances of the ether** can propagate without losing coherence. Modes that travel slower than c_Ψ remain partially confined to local structures (bound states), while the *luminal mode*—the helicoidal, resonance-stabilised wave of the Ψ field—propagates exactly at this maximal velocity. Thus, what in classical relativity is the "speed of light" becomes, in the quarkic framework, the natural propagation speed of the fundamental resonant mode of the etheric plasma.

This interpretation reveals c_Ψ not as an imposed constant, but as the dynamically inevitable speed of coherent propagation in a frictionless pressure medium. When the quarkbase approaches this value, the field cannot reorganise quickly enough to restore isotropic pressure, causing the energy cost of further acceleration to diverge.

3 The Same Lorentz Factor from a Different Origin

From this **medium delay** arises the relativistic factor of the ether:

$$\gamma_\Psi(v) = \frac{1}{\sqrt{1-(v/c_\Psi)^2}}.$$

This term does not stem from an abstract geometry but from the **physical cost of dragging the ether**. The higher the velocity of the quarkbase, the longer the medium takes to recover and the greater the displaced volume. All relativistic effects emerge from this delayed restoration of pressure, not from a postulated geometry of spacetime.

At the characteristic scale λ (the typical range of the pressure field), the recovery time is:

$$\tau_{\text{rec}} = \frac{\lambda}{c_\Psi - v} = \frac{\lambda/c_\Psi}{1 - v/c_\Psi} \approx \frac{\lambda}{c_\Psi}\gamma_\Psi^2(1+\beta_\Psi), \qquad \beta_\Psi = \frac{v}{c_\Psi}.$$

And the length of the generated wake:

$$L(v) = v\,\tau_{\text{rec}} \propto \gamma_\Psi\,\lambda.$$

Thus, the faster the quarkbase moves, the longer the "trail" of displaced volume left behind it becomes, and the more concentrated the compression in front.

The Lorentz factor γ_Ψ encapsulates this behaviour: as $v \to c_\Psi$, the medium requires an increasingly large time to reorganize behind the moving source. The quarkbase drags a growing region of unrecovered pressure, and the ether must rearrange itself over progressively larger distances.

In energetic terms, the increase in γ_Ψ means that **the field accumulates energy due to the unrecovered displacement of the ether**, in the same way that a relativistic object accumulates kinetic energy through its motion. But here, the source of the effect is concrete: the compressed front and delayed wake imply that the total displaced volume grows with γ_Ψ, and the energy stored in the pressure gradients grows accordingly.

This also reveals why **coherent resonances of the ether** propagate at c_Ψ. A wavepacket that travels at a velocity lower than c_Ψ is continually interacting with the lagging region behind the source and cannot maintain perfect phase alignment. Only at the limit $v = c_\Psi$ can a self-sustained, non-dispersive mode propagate without accumulating a wake. Thus, γ_Ψ not only governs the dynamics of moving quarkbases, but also determines the conditions under which the **luminal resonant mode** of the ether—the physical counterpart of light—can exist and preserve coherence over arbitrary distances.

In this sense, the Lorentz factor emerges as a quantitative measure of the ether's inability to reorganize faster than c_Ψ: a purely physical origin for the fundamental invariance of the limiting velocity.

4 Compression Energy, Not Mass

The rest energy of a quarkbase does not arise from mass, but from the **minimum pressure required to keep it stable within the ether**. That fundamental energy is:

$$E_0 = P_0\,V_q\,c_\Psi^2,$$

where P_0 represents the **internal compression coefficient** and V_q the effective volume of the quarkbase. The product P_0V_q defines a **quarkic compression constant**, analogous to the parameter m_0 in relativity, but of a purely volumetric nature.

The associated pressure field has an energy density given by the energy–momentum tensor:

$$T^{\mu\nu} = \partial^\mu \Psi \, \partial^\nu \Psi - \eta^{\mu\nu} \mathcal{L},$$

so that the total energy of the system is

$$E = \int d^3x \, T^{00} = \int d^3x \left[\tfrac{1}{2c_\Psi^2} (\partial_t \Psi)^2 + \tfrac{1}{2} \Big((\nabla \Psi)^2 + \mu^2 \Psi^2 \Big) \right].$$

For the stationary state, the energy remains at E_0. When the quarkbase moves, the volume of compressed ether increases in proportion to γ_Ψ, and the field acquires additional energy due to the frontal compression and the delayed wake:

$$E = \gamma_\Psi \, E_0 = \gamma_\Psi \, P_0 \, V_q \, c_\Psi^2.$$

The observed inertia is not an intrinsic property of the quarkbase, but rather **the reaction of the displaced ether resisting a faster deformation**. Accelerating it implies modifying the coherent pressure field of the surrounding medium, which raises the required energy by the same factor γ_Ψ.

5 Time Dilates Because the Medium Lags

When a quarkbase moves, the ether requires a finite time to return to its equilibrium state behind it. This **delayed recovery of the medium** not only creates a physical wake but also slows down all internal processes associated with the vibration of the pressure field.

If the quarkbase is at rest, the field oscillations are symmetric in both time and space. However, when it moves, the rear part of the field remains in a recovery phase while the front is already being compressed. The result is that the **internal rate becomes dilated** in the same proportion as the medium's delay.

Mathematically, the motion is described by a coordinate transformation of the form:

$$t' = \gamma_\Psi \left(t - \frac{v}{c_\Psi^2} x \right), \qquad x' = \gamma_\Psi (x - vt),$$

with

$$\gamma_\Psi = \frac{1}{\sqrt{1 - (v/c_\Psi)^2}}.$$

From these relations, one obtains the correspondence between proper time and the observer's time:

$$d\tau^2 = dt^2 \left(1 - \frac{v^2}{c_\Psi^2} \right), \quad \Rightarrow \quad d\tau = \frac{dt}{\gamma_\Psi}.$$

This means that the physical processes associated with the quarkbase—such as the oscillations of the Ψ field in its immediate surroundings—evolve more slowly for an external observer. Here, **time dilation** is not a geometric consequence but a **phase effect**: the ether cannot transmit the recovery of pressure faster than c_Ψ, so each internal oscillation becomes "spaced out" in time.

Likewise, **length contraction** is interpreted as a compression of the pressure front:

$$L_{\parallel} = \frac{L_0}{\gamma_\Psi(v)}.$$

The compressed front and elongated wake are not optical illusions but direct manifestations of the real delay of the ether.

In summary, the relativity of time and length does not emerge from an abstract geometry but from the **same dynamic behaviour of the quarkic medium** that imposes a natural limit on the propagation speed of any perturbation.

6 Velocity Addition and the Absolute Barrier

In the dynamics of the quarkic ether, velocities do not add linearly. When a quarkbase moves within an ether flow that already possesses its own velocity, the effective combination is governed by the same rule as in classical relativity, but with c_Ψ as the structural limit of the medium:

$$w = \frac{u + v}{1 + \frac{uv}{c_\Psi^2}}.$$

This result is not arbitrary. It arises from the composition of two successive deformations of the pressure field Ψ: one generated by the quarkbase's own motion and another by the flow of the surrounding ether. They do not add directly because the **longitudinal compression of the medium** changes the temporal and spatial scale of each perturbation.

The limit appears naturally. When the velocity of the quarkbase approaches the propagation speed of the field:

$$\lim_{v \to c_\Psi^-} \gamma_\Psi(v) = \infty,$$

the volume of ether displaced at the front tends to infinity:

$$\Delta V(v) = \Delta V_0 \, \gamma_\Psi(v).$$

Physically, this means that **there is no medium left to compress**. The pressure front accumulates without being able to propagate, and any attempt to increase the velocity requires an enormous amount of energy. There is no friction to stop it (the ether satisfies $\mu = 0$), but the very geometry of the displacement makes further acceleration impossible.

From this it follows that c_Ψ is the **absolute kinematic limit of the etheric universe**: the maximum velocity at which information or deformations of the Ψ field can propagate.

7 Radiation, Doppler, and Etheric Light

A source that vibrates or moves within the ether generates waves of the Ψ field. When at rest, these waves expand symmetrically; but if the source moves, the compression of the front and the delay in the wake produce **a directional deformation of the radiation**.

Mathematically, the frequency observed by a detector at rest with respect to the medium is obtained through the etheric Doppler relation:

$$\omega' = \gamma_\Psi \, \omega \, (1 - \beta_\Psi \cos\theta), \qquad \beta_\Psi = \frac{v}{c_\Psi}.$$

Here ω is the proper frequency of the pressure vibration, and θ the angle between the direction of motion and the line of observation.

This frequency shift does not arise from a change in absolute time, but from the **delayed phase of the Ψ field**: the compressed front emits waves that are closer together, while the wake emits them farther apart. The result is identical to the relativistic prediction of the optical Doppler effect but has a distinct physical foundation: **the delay of the ether**.

The same principle produces the **angular aberration** of radiation. The waves in the front become concentrated into an increasingly narrow cone as the velocity rises:

$$\cos\theta' = \frac{\cos\theta - \beta_\Psi}{1 - \beta_\Psi \cos\theta}.$$

When v approaches c_Ψ, the emission angle tends to align with the direction of motion, concentrating the field energy into an increasingly smaller region.

This angular compression represents a genuine "etheric light": the pressure waves of the Ψ field exhibit **all the properties of electromagnetic radiation** (frequency, wavelength, Doppler effect, aberration), but their origin does not lie in electrical oscillations — it resides in **pressure vibrations of the quarkic plasma**.

In this formulation, light and any form of radiation are phenomena of the same nature as a perfect acoustic wave in a frictionless medium. The difference is that their limiting velocity c_Ψ is the highest possible and defines the metric structure of the universe.

8 Luminal Resonant Mode (Etheric Light)

A source that vibrates or moves within the ether generates waves of the Ψ field. When the source is at rest, these waves expand symmetrically; but if it moves, the compression of the front and the delayed recovery in the wake produce a **directionally deformed radiation pattern**. The observed frequency for a detector at rest with respect to the medium follows the etheric Doppler relation:

$$\omega' = \gamma_\Psi \, \omega \, (1 - \beta_\Psi \cos\theta), \qquad \beta_\Psi = \frac{v}{c_\Psi}.$$

This shift arises from the **delayed phase** of the Ψ field: the compressed front emits waves that are closer together, the wake emits them farther apart. This is physically distinct from Einstein's interpretation, but mathematically identical.

The same delay produces the **angular aberration**:

$$\cos\theta' = \frac{\cos\theta - \beta_\Psi}{1 - \beta_\Psi \cos\theta}.$$

As $v \to c_\Psi$, radiation becomes squeezed into a narrow cone aligned with the direction of motion.

At this stage of the theory one identifies the essential fact: the Ψ-field's pressure waves behave exactly like electromagnetic radiation—frequency, wavelength, Doppler, aberration—yet their origin lies not in electrical oscillations but in **pressure vibrations of a quarkic plasma**. This defines the phenomenon traditionally called "etheric light".

8.1 Emergence of the Luminal Resonant Mode

Among all solutions of the Ψ field, there exists a special class: **the luminal resonant modes**, defined by:

$$\Psi(\mathbf{x}, t) = A\cos(\mathbf{k}\cdot\mathbf{x} - \omega t + \phi)\,, \qquad \omega = c_\Psi\,|\mathbf{k}|.$$

A wave obeying $\omega/k = c_\Psi$ propagates with **zero wake**: the ether does not need to "close" behind the disturbance, because the phase pattern moves exactly at the maximal speed at which pressure can be redistributed.

Any mode travelling slower than c_Ψ:

- interacts with its own trailing wake,
- experiences phase degradation,
- and cannot maintain coherence.

Only the luminal resonant mode remains:

- non-dispersive,
- self-sustained,
- perfectly phase-coherent,
- and immune to destructive interference with its own displacement trail.

This identifies the physical nature of light:

Light = Luminal Resonant Mode of the Ether.

8.2 Why the Luminal Mode Defines the Metric of the Universe

Because the ether can reorganise itself only up to c_Ψ, the luminal resonant mode:

- travels at the maximal allowed propagation speed,
- sets the universal causal structure,
- defines simultaneity,
- and determines the effective Minkowski metric of the medium.

Thus, the constancy of c is not a postulate: it is a **constraint of coherent resonance**. No physical signal can outrun the medium's ability to reorganise pressure.

This is why:

- time dilation,

- length contraction,
- velocity addition,
- and energetic divergence as $v \to c_\Psi$

are *not* geometric axioms, but consequences of the finite-speed reorganisation of the quarkic plasma.

8.3 Integration with Gravity and Cosmic Structure

The luminal mode also couples naturally with:

- the pressure-index formalism of gravity,
- the curvature of rays in a region with varying $n_\Psi(x)$,
- the Shapiro-like delay,
- the cosmological redshift relation $1 + z = n_\Psi(t_{\text{obs}})/n_\Psi(t_{\text{em}})$.

At cosmic scales:

- the resonances of extremely low k (long wavelengths),
- responsible for cluster and supercluster distribution,
- are simply the large-scale analogues of the same Ψ-resonant dynamics.

This produces a unified physical picture:

- **atomic resonances** (frequencies such as ν_p),
- **free electromagnetic radiation** (luminal resonant mode),
- **gravitational propagation** (index variation),
- **cosmic web patterns** (ultra-low-frequency modes),

all emerging from the **same field**, the same physics, the same limit c_Ψ.

8.4 Synthesis

The luminal resonant mode is:

- the **fundamental** free-wave solution of the Ψ field,
- the carrier of causal structure,
- the origin of relativistic invariance,
- the physical identity of light,
- the boundary between confined and free quarkic excitations.

Where relativity speaks of "the speed of light", the quarkic framework speaks of:

the unique non-dispersive resonance supported by a frictionless etheric plasma.

9 Gravity as a Pressure Gradient

Within the quarkic framework, what we call "gravity" is the spatial variation of the ether's **pressure index**. This variation rescales the local propagation speed of the field and defines an **effective metric** for both trajectories and waves.

9.1 Local Velocity, Index, and Eikonal

Let the local velocity of the medium be

$$c_\Psi(\mathbf{x}) = c_\Psi^{(\infty)}\Big(1 - \xi\,\Phi_\Psi(\mathbf{x})\Big), \qquad |\xi\,\Phi_\Psi| \ll 1,$$

and the etheric index

$$n_\Psi(\mathbf{x}) \equiv \frac{c_\Psi^{(\infty)}}{c_\Psi(\mathbf{x})} \simeq 1 + \xi\,\Phi_\Psi(\mathbf{x}).$$

Here, Φ_Ψ is the **pressure potential** induced by sources and deformations of the Ψ field.

In the eikonal approximation, the waves obey the principle of stationary phase:

$$\delta \int n_\Psi(\mathbf{x})\, dl = 0,$$

which gives rise to ray curvature, delay, and etheric lensing.

9.2 Effective Metric (Weak and Isotropic Regime)

The dynamics of particles and waves can be rewritten in an effective metric:

$$ds^2 = g^{\text{eff}}_{\mu\nu} dx^\mu dx^\nu, \qquad g^{\text{eff}}_{00} \simeq 1 + 2\,\phi_\Psi, \quad g^{\text{eff}}_{ij} \simeq -(1 - 2\,\phi_\Psi)\,\delta_{ij},$$

with

$$\phi_\Psi(\mathbf{x}) \equiv \tfrac{1}{2}\Big(n_\Psi^2 - 1\Big) \simeq \xi\,\Phi_\Psi(\mathbf{x}).$$

In this metric, the conservation law $\nabla_\mu T^{\mu\nu} = 0$ determines the trajectories (geodesics) of quarkbases and wave fronts.

9.3 Pressure Potential Equation

The potential that deforms the index arises from the Ψ field. In the quasistatic and linear regime:

$$(\nabla^2 - \lambda^{-2})\,\Phi_\Psi(\mathbf{x}) = -\kappa\,\rho_{\text{src}}(\mathbf{x}),$$

where λ is the range (of Yukawa type), and ρ_{src} represents the **ether displacement density** generated by the sources/localizers of the Ψ field. For point-like distributions:

$$\rho_{\text{src}}(\mathbf{x}) = \sum_a \alpha_a\,\delta^{(3)}(\mathbf{x} - \mathbf{x}_a).$$

9.4 Nonrelativistic Limit: "Gravitational" Acceleration

For small velocities compared with c_Ψ, the geodesic equation yields

$$\frac{d^2\mathbf{x}}{dt^2} \;\simeq\; -\nabla\phi_\Psi(\mathbf{x}),$$

that is, the acceleration is the **gradient of the effective pressure potential**. There is no "mass" involved, only the response of the medium.

9.5 Observable Signals

a) Delay (Etheric Shapiro Effect). A ray passing through a region with $n_\Psi > 1$ accumulates a delay:

$$\Delta t \simeq \frac{1}{c_\Psi^{(\infty)}} \int \big(n_\Psi(\mathbf{x}) - 1\big)\, dl \simeq \frac{\xi}{c_\Psi^{(\infty)}} \int \Phi_\Psi(\mathbf{x})\, dl.$$

b) Angular Deflection (Etheric Lens). For an approximately cylindrical profile:

$$\hat{\alpha} \simeq \int \nabla_\perp n_\Psi(\mathbf{x})\, \frac{dl}{n_\Psi(\infty)} \simeq \xi \int \nabla_\perp \Phi_\Psi(\mathbf{x})\, dl.$$

c) Gravitational Frequency Shift. For two levels at different heights of ϕ_Ψ:

$$\frac{\Delta\omega}{\omega} \simeq \phi_\Psi(\mathbf{x}_{\rm em}) - \phi_\Psi(\mathbf{x}_{\rm obs}) \simeq \xi\Big[\Phi_\Psi(\mathbf{x}_{\rm em}) - \Phi_\Psi(\mathbf{x}_{\rm obs})\Big].$$

d) Temporal Redshift (Cosmological Scenario). If the index varies with time on a large scale:

$$1 + z = \frac{n_\Psi(t_{\rm obs})}{n_\Psi(t_{\rm em})} \simeq 1 + \xi\Big[\Phi_\Psi(t_{\rm obs}) - \Phi_\Psi(t_{\rm em})\Big].$$

9.6 Compatibility with the Relativistic Limit of the Ether

Local clocks satisfy

$$d\tau^2 = g_{00}^{\rm eff}\, dt^2 - g_{ij}^{\rm eff}\, dx^i dx^j / c_\Psi^{(\infty)2}, \qquad d\tau \simeq (1 + \phi_\Psi)\, dt \quad \text{(local rest frame)}.$$

The same mathematical forms of relativity emerge here because the **propagation limited by** c_Ψ and the **spatial variation of** $c_\Psi(\mathbf{x})$ generate an effective metric that governs both particles and waves.

10 Two Theories, One Same Form

After the entire development, the correspondence between classical relativity and the etheric relativity of the Ψ field turns out to be exact in form, although completely different in physical meaning. The equations are preserved, but the symbols change their physical nature.

Physical Concept	**Classical Relativity**	**Quarkic Ether Relativity**
Limiting velocity	c (speed of light)	c_Ψ (propagation speed of pressure)
Relativity factor	$\gamma = \dfrac{1}{\sqrt{1-(v/c)^2}}$	$\gamma_\Psi = \dfrac{1}{\sqrt{1-(v/c_\Psi)^2}}$
Rest energy	$E_0 = mc^2$	$E_0 = P_0 V_q c_\Psi^2$ (minimum compression energy)
Energy in motion	$E = \gamma\, mc^2$	$E = \gamma_\Psi\, P_0 V_q c_\Psi^2$
Energy–momentum relation	$E^2 = p^2c^2 + m^2c^4$	$E^2 = p^2c_\Psi^2 + (P_0V_q)^2 c_\Psi^4$
Proper time	$d\tau = \dfrac{dt}{\gamma}$	$d\tau = \dfrac{dt}{\gamma_\Psi}$
Longitudinal contraction	$L_\parallel = L_0/\gamma$	$L_\parallel = L_0/\gamma_\Psi$
Gravity	curvature of spacetime	gradient of the pressure index $n_\Psi(\mathbf{x})$
Radiation	electromagnetic waves	pressure waves of the Ψ field
Inertia	intrinsic property of mass	volumetric reaction of the compressed ether

11 Conceptual Synthesis

Einstein's relativity and the quarkic-ether relativity **use the same formal equations**, but rest on fundamentally different foundations:

1. **Einstein**: spacetime is a geometry without material support; its curvature dictates motion.
2. **QuarkBase**: the universe is a continuum of perfect pressure; its redistribution dictates motion.

At the limiting velocity c_Ψ, the ether behaves as a non-deformable medium; the effective metric of the Ψ field becomes identical to the Minkowski metric. The transformations, relativistic effects, and gravitation are **mathematical emergences of a single physical phenomenon: the finite propagation of pressures in a frictionless medium**.

12 A Unified Physical Interpretation

Because the ether can only reorganise itself at a finite speed, all the familiar relativistic structures arise automatically from the dynamics of the Ψ field:

- **Time dilation** corresponds to the delayed closure of displaced volume around moving quarkbases.

- **Length contraction** reflects the compressed front of the pressure field.
- **Mass–energy relations** arise from the energy stored in unrecovered pressure gradients.
- **Relativistic momentum** is the cumulative cost of dragging the ether.
- **Gravitation** is the spatial variation of the effective propagation speed $c_\Psi(\mathbf{x})$, interpreted as an index of refraction for the field.

None of these require modifying the geometry of spacetime; all follow from the mechanics of a frictionless continuum of pressure.

13 Global Unification

The same principle — finite reorganisation of pressure — unifies:

- local dynamics of particles,
- propagation of radiation,
- relativistic phenomena,
- the optical behaviour of gravity,
- and even the largest-scale structure of the cosmos.

The pressure field that governs atomic resonances (e.g., ν_p), the resonant modes that constitute light, and the long-wavelength modes that generate the cosmic web are all manifestations of the same underlying continuum.

The formal equivalence between Einstein's theory and the quarkic framework is therefore not accidental: both describe the behaviour of the Ψ field at different scales and in different regimes of phase coherence.

Relativity emerges as the **macroscopic limit** of a deeper, strictly physical mechanism: the dynamics of pressure in a medium of perfect, frictionless continuity.

14 Numerical Implications of the Measured Value of c

The experimentally established value

$$c = 299{,}792{,}458 \text{ m/s}$$

is not arbitrary. Within the quarkic-ether framework, this constant emerges from the microphysical architecture of the electron and from the elastic–inertial structure of the Ψ-field.

Three empirical facts connect directly to the value of c:

1. the electron consists of **13 quarkbases** arranged in a fixed geometric configuration,

2. the electron's rest energy is **pure etheric compression**,

3. light is the **luminal resonant mode** of the Ψ-field.

As a consequence, the numerical value of c arises from the geometry, energy distribution, and pressure–inertia balance of the quarkic plasma.

14.1 Fundamental Relations

Using only experimentally known constants and the 13-quarkbase geometry, the following relations hold.

Let:

- m_e = electron mass,
- r_q = quarkbase radius,
- $V_q = (4\pi/3)\, r_q^3$,
- $\phi_e = 13/27$ (internal volume fraction in the electron),
- $\kappa \approx 1.35$ (packing factor),
- $\chi_{\text{geom}} \approx 1$ (dimensionless elastic–inertial factor).

Because the electron's rest energy is:

$$E_e = m_e c^2 = 13\, P_0\, V_q,$$

the basal ether pressure is:

$$P_0 = \frac{3 m_e c^2}{52 \pi r_q^3}.$$

From $c^2 = K_{\text{eff}}/\rho_{\text{eff}}$ and $K_{\text{eff}} = \chi_{\text{geom}} P_0$, we obtain:

$$\rho_{\Psi,0} = \frac{3 m_e \chi_{\text{geom}}}{52 \pi r_q^3}.$$

Both P_0 and $\rho_{\Psi,0}$ scale as $1/r_q^3$.

The speed of light fixes only their ratio:

$$\frac{P_0}{\rho_{\Psi,0}} = \frac{c^2}{\chi_{\text{geom}}}.$$

This is the universal constraint imposed by the luminal resonance of the Ψ-field.

14.2 Interpretation

The formulas above imply three key results.

1. c **is not an independent constant.** It is determined by the ratio between the ether's basal pressure P_0 and its inertial density $\rho_{\Psi,0}$.
2. **The geometry of the electron fixes the numerical factors.** The arrangement of 13 quarkbases produces ϕ_e and κ, which determine the structure of ρ_{eff} and K_{eff}.
3. **The radius r_q sets the absolute scales**, but not the value of c itself: shrinking or enlarging r_q changes P_0 and $\rho_{\Psi,0}$ proportionally, leaving c unchanged.

This means that the constant c is a direct numerical consequence of:

- the 13-sphere geometry of the electron,
- the compression energy stored in the quarkbases,
- and the elastic–inertial structure of the Ψ-field.

14.3 Fundamental Consequence

The speed of light emerges as:

$$c = \sqrt{\frac{K_{\text{eff}}}{\rho_{\text{eff}}}},$$

where:

$$K_{\text{eff}} = \chi_{\text{geom}} P_0, \qquad \rho_{\text{eff}} = \rho_{\Psi,0} + \left(\frac{P_0}{c^2}\right)\left(\frac{\phi_e}{\kappa}\right).$$

and the relations above ensure that the value of c matches the experimentally measured value precisely.

Thus:

the existence and numerical value of c follow from the microgeometry of quarkbases and the physical p

Light propagates at c because:

- the ether has a specific pressure–inertia balance,
- the quarkbase configuration fixes the relevant geometric factors,
- and the luminal resonant mode is the only self-coherent, dispersion-free pattern that the Ψ-field can support.

14.4 Photon Integration

The constant c is not a postulate, not a geometric axiom, not a property of empty spacetime.

It is the **numerical shadow** of the quarkbase architecture of matter and of the elastic–inertial structure of the ether.

The 13-sphere geometry of the electron, together with the pressure and inertia of the Ψ-field, fixes the only possible value for the luminal resonant mode:

$$c = 299{,}792{,}458 \text{ m/s}.$$

In this framework, electromagnetic radiation is simply the **luminal resonant mode** of the Ψ-field, and the **photon** is the minimum transferable energy packet of that mode —the quantised pulse emitted or absorbed when the 13-quarkbase electron changes its internal compression state.

Thus, the same microgeometry that fixes c also determines the allowed emission and absorption frequencies, making the photon the discrete expression of the ether's unique luminal resonance.

This is why c exists.

15 Dependence between c and G

In Quarkbase Cosmology, gravity, inertia, and the speed of light arise from a single physical mechanism: **the behaviour of the quarkic ether when its volume is displaced by rigid quarkbases.**

In this framework:

- the electron has no "mass"; it consists of **13 undeformable quarkbases** that displace a specific volume of ether;
- the electron's rest energy is **pure compression energy** of the ether;
- inertial response is the **delayed re-closure of displaced volume** when the configuration moves;
- gravity is the **curvature of the etheric index** produced by gradients of displaced ether;
- the speed of light (c) is the result of the **pressure-to-inertia ratio** of the Ψ-field;
- the gravitational constant (G) is the **extremely weak coupling** between displaced-volume density and spatial curvature of the etheric index.

The purpose of this derivation is to show that c **and** G **are not independent constants**, but obey:

$$\boxed{G = \frac{\xi\,\kappa}{4\pi}\,\frac{c^4}{P_0}}$$

where:

- P_0 is the basal pressure of the ether,
- ξ and κ encode how displaced volume modifies the etheric index n_Ψ.

The crucial point is that P_0 **itself is fixed by the geometry of the electron**—specifically by the **volume displaced by 13 quarkbases inside a single imaginary sphere**.

The numerical value of G emerges from the same microgeometry that fixes c.

16 Electron Geometry and Displaced Volume

The electron is defined geometrically as follows:

- an imaginary sphere of radius $R_e = 3r_q$;
- containing **13 perfectly rigid quarkbases** of radius r_q:
  - 1 at the centre,
  - 12 arranged tangentially on the inner surface.

Inside this imaginary sphere exist:

1. Regions occupied by quarkbases (rigid volumes),
2. Regions with no matter (ether), which were **expelled** to accommodate the rigid configuration.

This expelled ether forms the **displaced volume**, the fundamental source of:

- electron energy,
- inertial behaviour,
- and gravitational influence.

16.1 Volumes involved

1. Volume of the imaginary sphere

$$V_{\text{sphere}} = \frac{4\pi}{3}(3r_q)^3 = 36\pi r_q^3.$$

2. Total volume of the 13 quarkbases

$$V_{\text{qb}} = 13\left(\frac{4\pi}{3}r_q^3\right) = \frac{52\pi}{3}r_q^3.$$

3. Void/empty regions inside (ether displaced)

$$V_{\text{void}} = V_{\text{sphere}} - V_{\text{qb}} = 36\pi r_q^3 - \frac{52\pi}{3} r_q^3 = \frac{56\pi}{3} r_q^3.$$

Thus the **displaced volume** of the electron is:

$$\boxed{V_{\text{disp}} = \frac{56\pi}{3}\, r_q^3.}$$

This is the only physically relevant quantity at the microscopic level— the one that determines electron energy, inertial response, and its gravitational role.

17 Energy, Inertia, and the Speed of Light (Massless Formulation)

In the Quarkbase framework, there is no intrinsic "mass." Everything that in standard physics is interpreted as mass arises from one quantity only:

displaced ether volume V_{disp}.

Every quarkbase contributes a rigid, undeformable volume that the ether must expel. This expulsion stores **compression energy** inside the field and produces **inertia** when the configuration moves.

17.1 Electron rest energy from displaced volume

The rest energy of an electron is not an intrinsic attribute: it is the compression energy required to accommodate the displaced volume V_{disp} inside the ether, given its basal pressure P_0:

$$\boxed{E_e = P_0\, V_{\text{disp}}.}$$

Substituting the displaced volume of the 13-quarkbase geometry:

$$E_e = P_0 \left(\frac{56\pi}{3} r_q^3 \right).$$

This relation is exact and fundamental. No masses appear anywhere—only pressure and volume.

17.2 Inertia as delayed re-closure of displaced volume

When the electron moves, the ether cannot instantaneously refill the displaced region behind it nor fully compress the region in front of it. This produces:

- a compressed frontal zone,
- an elongated wake of unrecovered displacement,
- and a delayed pressure response that resists acceleration.

This behaviour automatically generates relativistic inertia. The familiar kinetic energy term emerges from the increase of unrecovered displaced volume as velocity approaches the luminal limit, governed by the Lorentz-type factor:

$$\gamma_\Psi(v) = \frac{1}{\sqrt{1-(v/c_\Psi)^2}}.$$

Thus, inertia is not a property of matter; it is a **dynamic effect of the finite reorganisation speed** of the ether.

17.3 The speed of light from pressure–inertia ratio

The propagation speed of small-amplitude pressure waves in the quarkic ether obeys:

$$c_\Psi^2 = \frac{P_0}{\rho_{\Psi,0}}\,\chi_{\text{geom}},$$

where:

- P_0 is the basal pressure,
- $\rho_{\Psi,0}$ is the inertial density of the Ψ-field,
- χ_{geom} is a dimensionless factor of order unity determined by the spherical 13-quarkbase geometry.

In the luminal regime, this propagation speed is identified with the physical speed of light:

$$\boxed{c = c_\Psi.}$$

Thus the value of c is not an empirical constant to be imposed; it is the direct consequence of the **ratio between the ether's stiffness and its inertial density**, both ultimately fixed by the microgeometry of the electron through its displaced volume.

17.4 Key result of this section

The speed of light appears because:

- the ether has a finite stiffness P_0,
- a finite inertial density $\rho_{\Psi,0}$,
- and a rigid geometric constraint set by 13 quarkbases.

Together they fix:

$$\boxed{c^2 = \frac{P_0}{\rho_{\Psi,0}},}$$

within the geometric factor χ_{geom}.

Everything that standard physics attributes to "mass" is here an effect of **compression energy** and **finite-speed reorganisation of displaced volume**.

18 The Gravitational Field Equation and Its Newtonian Mapping

In Quarkbase Cosmology, gravity is not a force between masses but the **response of the etheric index** $n_\Psi(\mathbf{x})$ to spatial variations in **displaced-volume density**.

The Ψ-field obeys, in the quasistatic and weak-field regime, the differential equation:

$$(\nabla^2 - \lambda^{-2})\,\Phi_\Psi(\mathbf{x}) = -\kappa\,\rho_{\rm src}(\mathbf{x}),$$

where:

- Φ_Ψ is the pressure potential,
- $\rho_{\rm src}$ is the **density of displaced ether volume** (fundamental source),
- κ is a coupling constant,
- λ is the characteristic Yukawa-range of the Ψ-field.

At distances small compared with λ, the equation reduces to the Poisson form:

$$\nabla^2\Phi_\Psi = -\kappa\,\rho_{\rm src}.$$

18.1 The etheric index and the effective gravitational potential

The local propagation speed of the etheric medium is:

$$c_\Psi(\mathbf{x}) = c_\Psi^{(\infty)}\Big(1 - \xi\,\Phi_\Psi(\mathbf{x})\Big),$$

where ξ measures how strongly the potential Φ_Ψ modifies the index. The etheric index is therefore:

$$n_\Psi(\mathbf{x}) = \frac{c_\Psi^{(\infty)}}{c_\Psi(\mathbf{x})} \simeq 1 + \xi\,\Phi_\Psi.$$

The effective gravitational potential used in ray optics and geodesic motion is:

$$\phi_\Psi(\mathbf{x}) = \tfrac{1}{2}\Big(n_\Psi^2 - 1\Big) \simeq \xi\,\Phi_\Psi.$$

Thus:

$$\nabla^2\phi_\Psi \simeq \xi\,\nabla^2\Phi_\Psi = -\xi\,\kappa\,\rho_{\rm src}.$$

18.2 The Newtonian limit and the definition of $\rho_{\rm equiv}$

The Newtonian gravitational potential Φ_N satisfies:

$$\nabla^2\Phi_N = 4\pi G\,\rho_{\rm equiv},$$

where $\rho_{\rm equiv}$ is the standard mass-density used by classical gravitation.

To map both descriptions, we identify:

$$\Phi_N = c^2\,\phi_\Psi = c^2\,\xi\,\Phi_\Psi.$$

Taking Laplacians:

$$\nabla^2\Phi_N = c^2\,\xi\,\nabla^2\Phi_\Psi = -\,c^2\,\xi\,\kappa\,\rho_{\rm src}.$$

Equating with the Newtonian form:

$$4\pi G\,\rho_{\rm equiv} = -\,c^2\,\xi\,\kappa\,\rho_{\rm src}.$$

Dropping the sign (Newtonian convention-dependent), we obtain:

$$4\pi G\,\rho_{\rm equiv} = c^2\,\xi\,\kappa\,\rho_{\rm src}.$$

18.3 Eliminating "mass": the correct identification

In the Quarkbase formulation:

- $\rho_{\rm src}$ is the **density of displaced ether per unit physical volume**,
- $\rho_{\rm equiv}$ is **not** a physical quantity: it is the mass-density needed to match Newtonian notation.

The physically correct relation is:

$$\rho_{\rm equiv} = \frac{\varepsilon_{\rm comp}}{c^2} = \frac{P_0\,\rho_{\rm src}}{c^2},$$

because the compression energy per unit volume is:

$$\varepsilon_{\rm comp} = P_0\,\rho_{\rm src}.$$

Thus:

$$\rho_{\rm equiv} = \frac{P_0}{c^2}\,\rho_{\rm src}.$$

Insert into the Newton–ether matching equation:

$$4\pi G\left(\frac{P_0}{c^2}\,\rho_{\rm src}\right) = c^2\,\xi\,\kappa\,\rho_{\rm src}.$$

The factor $\rho_{\rm src}$ cancels:

$$4\pi G\,\frac{P_0}{c^2} = c^2\,\xi\,\kappa.$$

Solving for G:

$$\boxed{G = \frac{\xi\,\kappa}{4\pi}\,\frac{c^4}{P_0}.}$$

This expression contains only fundamental Quarkbase quantities:

- c: speed of the luminal resonant mode,

- P_0: basal ether pressure fixed by the electron's displaced volume,
- $\xi\kappa$: gravitational response coefficients of the ether.

There is no "mass." Only displaced volume and etheric response.

19 Numerical Determination of G from c, P_0, and Displaced Volume

The relation obtained in the previous section,

$$G = \frac{\xi\,\kappa}{4\pi}\,\frac{c^4}{P_0},$$

shows that the gravitational constant G is not fundamental: it is the result of how strongly the etheric index responds ($\xi\kappa$) to a given **compression background** P_0 and to the luminal propagation speed c.

To turn this into a numerical statement, we now fix P_0 using only:

- the 13–quarkbase geometry of the electron,
- the displaced volume $V_{\rm disp}$,
- and the experimentally measured electron rest energy.

19.1 Fixing P_0 from the electron's displaced volume

From Part 2, the displaced volume of a single electron is:

$$V_{\rm disp} = \frac{56\pi}{3}\,r_q^3.$$

We introduce a natural microscopic scale by identifying the electron's imaginary radius with its reduced Compton wavelength $\bar{\lambda}_C$:

$$R_e \equiv 3r_q \simeq \bar{\lambda}_C, \qquad r_q = \frac{\bar{\lambda}_C}{3}.$$

Using the experimental value:

$$\bar{\lambda}_C \simeq 3.86 \times 10^{-13}\,\mathrm{m},$$

we obtain:

$$r_q \simeq 1.29 \times 10^{-13}\,\mathrm{m}, \qquad V_{\rm disp} \simeq 1.3 \times 10^{-37}\,\mathrm{m}^3.$$

In the Quarkbase picture, the electron rest energy is the compression energy:

$$E_e = P_0\,V_{\rm disp}.$$

Identifying this with the experimentally known 0.511 MeV ($E_e \approx 8.19 \times 10^{-14}\,\mathrm{J}$), we obtain:

$$P_0 = \frac{E_e}{V_{\text{disp}}} \approx 6.5 \times 10^{23}\,\text{Pa}.$$

Thus the ether supporting the luminal mode must have a basal pressure of order:

$$\boxed{P_0 \sim 10^{24}\,\text{Pa}.}$$

19.2 Consistency with the speed of light

From the luminal propagation law:

$$c^2 = \frac{P_0}{\rho_{\Psi,0}},$$

we can infer the inertial density of the ether:

$$\rho_{\Psi,0} = \frac{P_0}{c^2} \approx \frac{6.5 \times 10^{23}}{(2.998 \times 10^8)^2} \approx 7 \times 10^6\,\text{kg/m}^3.$$

This corresponds to a very stiff but frictionless medium:

- enormous pressure,
- high inertial density,
- and no dissipation ($\mu = 0$),

exactly what is needed to sustain a perfectly coherent luminal resonant mode at c.

19.3 Determining $\xi\kappa$ from the observed value of G

Inserting the numerical values of c, P_0 and the experimentally measured G into:

$$G = \frac{\xi\,\kappa}{4\pi}\,\frac{c^4}{P_0},$$

we solve for the product $\xi\kappa$:

$$\xi\kappa = \frac{4\pi G P_0}{c^4}.$$

Using:

- $G = 6.67430 \times 10^{-11}\,\text{m}^3\,\text{kg}^{-1}\,\text{s}^{-2}$,
- $c = 2.99792458 \times 10^8\,\text{m/s}$,
- $P_0 \approx 6.5 \times 10^{23}\,\text{Pa}$,

we obtain numerically:

$$\xi\kappa \approx 6.8 \times 10^{-20}\,\mathrm{m}^{-2}.$$

Thus, for the same ether that yields the observed value of c via $P_0/\rho_{\Psi,0}$, the product of gravitational response coefficients must be:

$$\boxed{\xi\kappa \sim 10^{-19} - 10^{-20}\,\mathrm{m}^{-2}.}$$

This is an **extremely weak coupling** between displaced-volume density and curvature of the etheric index, fully consistent with the empirical fact that gravity is the weakest of the known interactions.

19.4 Final synthesis

Combining all results:

1. The electron's geometry (13 quarkbases inside an imaginary sphere) fixes a **unique displaced volume** V_{disp}.
2. The basal pressure P_0 is determined by the condition:

   $$E_e = P_0 V_{\mathrm{disp}},$$

   matching the observed rest energy of the electron.
3. The luminal speed c is fixed by:

   $$c^2 = \frac{P_0}{\rho_{\Psi,0}},$$

   with $\rho_{\Psi,0}$ the inertial density of the ether.
4. The gravitational constant G is fixed by:

   $$G = \frac{\xi\,\kappa}{4\pi}\,\frac{c^4}{P_0},$$

   where $\xi\kappa$ quantifies how a given displaced-volume density curves the etheric index.

Therefore, G **and** c **are not independent**:

- both emerge from the **same basal pressure** P_0,
- the **same displaced volume** V_{disp} of the 13-quarkbase electron,
- and the **same etheric response** encoded in $\xi\kappa$.

The numerical value of G is thus the macroscopic shadow of a much deeper statement:

> a single quarkic ether, with fixed displaced volume per electron and a unique luminal resonant mode, determines simultaneously the speed of light and the strength of gravity.

20 Final Conclusion

In the Quarkbase framework, the existence of the universal constant c and the value of the gravitational constant G are not arbitrary features of nature, nor independent axioms. They arise from a single physical structure: a frictionless quarkic ether whose pressure, inertia, and finite reorganisation speed govern all forms of motion, radiation, and gravitational behaviour.

The luminal resonant mode of this medium determines the causal structure of the universe, while the displaced volume of the 13-quarkbase electron fixes the basal pressure that sets both the value of c and the scaling of G.

Relativity, electromagnetism, gravity, and cosmic structure are therefore unified as macroscopic manifestations of one underlying mechanism: the finite-speed dynamics of a continuous, perfectly coherent pressure field.

In this sense, c exists because the ether can reorganise itself only up to a single, maximally coherent propagation mode — and G exists because displaced-volume gradients slightly deform that coherence. The two constants are different numerical expressions of the same physical entity: the quarkic ether.

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