4DKC (Four-Dimensional Kinetic Cosmology)
A Flow-Based Alternative to Spacetime Curvature

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Abstract

Four-Dimensional Kinetic Cosmology (4DKC) is founded on the postulate that the observable three-dimensional universe is a hypersurface progressing through a flat four-dimensional Euclidean manifold. The progression of this hypersurface is governed by a single scalar flow field, while every physical system satisfies a constant four-speed constraint that partitions its total kinematic motion between the observable three-dimensional hypersurface and the fourth spatial dimension. Time is interpreted not as a fundamental dimension but as the observable measure of physical progression through the fourth spatial dimension.

Continuous electromagnetic binding extracts kinetic energy from the background hypersurface progression, producing local reductions in the scalar flow field and an accumulated wake that together generate the observed gravitational interaction. Newtonian gravity, the weak-field limit of General Relativity, gravitational time dilation, gravitational redshift, inertia, and the equivalence principle emerge as macroscopic consequences of the scalar flow dynamics rather than as independent postulates. In regions of uniform flow, the theory reproduces the predictions of Special Relativity, with the Lorentz factor arising naturally from the Euclidean geometry of a constant four-speed: increasing motion within the observable three-dimensional hypersurface necessarily reduces progression through the fourth spatial dimension while preserving the total kinematic speed.

The resulting framework provides a unified continuum-mechanical description of gravitation, relativity, and cosmological evolution while maintaining a globally flat geometry and explicit energy accounting. General Relativity is recovered as an effective weak-field approximation, whereas galactic and cosmological phenomena are interpreted as long-range consequences of the evolving scalar flow field and its persistent wake.

Gravitation and relativity are interpreted not as consequences of space-time curvature but as emergent properties of the kinematics of a moving three-dimensional hypersurface embedded in a flat four-dimensional Euclidean manifold.

0.1 Introduction

General Relativity successfully describes gravity as the curvature of space-time produced by energy and momentum. Four-Dimensional Kinetic Cosmology proposes an alternative kinematic description in which the locally observable universe is a moving three-dimensional hypersurface embedded in a flat four-dimensional Euclidean manifold. The theory rests on two complementary foundations: a single scalar flow field that governs the dynamics of the hypersurface, and a constant four-speed constraint that governs the kinematics of every physical system. Together, these determine all observable relativistic and gravitational phenomena.

The theory is founded on four fundamental postulates.

1. Reality is a flat four-dimensional Euclidean manifold,

$$M_4 = \mathbb{R}^4, \tag{1}$$

with Cartesian coordinates (x, y, z, L).

2. The observable universe is a three-dimensional spatial hypersurface that progresses continuously through the fourth spatial dimension.

3. The progression of the hypersurface is completely described by the scalar flow field

$$v_L(\mathbf{r}, \lambda),$$

which is the only fundamental dynamical variable of the theory.

4. Every physical system possesses a constant total kinematic speed through the four-dimensional manifold,

$$v^2 + v_L^2 = v_0^2, \tag{2}$$

where v is the ordinary three-dimensional velocity relative to the local hypersurface, v_L is the corresponding progression through the fourth spatial dimension, and v_0 is the local background progression rate of the hypersurface itself. In the absence of continuous electromagnetic extraction,

$$v_0 = c,$$

while in regions containing bound matter,

$$v_0 = c - \delta v_L.$$

The remainder of the paper develops the consequences of these postulates.

0.2 Scalar Flow Field Dynamics

The fundamental dynamical variable of 4DKC is the scalar flow field $v_L(\mathbf{r}, \lambda)$ defined on a flat four-dimensional Euclidean manifold $M_4 = \mathbb{R}^4$, with coordinates (x, y, z, L),

where

M_4 denotes the manifold itself and $\mathbb{R}^4$ is the four-dimensional Euclidean space of all real coordinate quadruples.

The manifold possesses the simple Euclidean metric

$$ds^2 = dx^2 + dy^2 + dz^2 + dL^2, \tag{3}$$

so that

$$R^\alpha{}_{\beta\mu\nu} = 0.$$

No intrinsic curvature exists. All observable gravitational, relativistic, and cosmological phenomena arise from the dynamics of the scalar flow field rather than from curvature of the manifold itself.

An affine evolution parameter λ labels successive positions of the observable three-dimensional hypersurface. The local scalar flow field specifies the progression rate of the hypersurface through the fourth spatial dimension,

$$v_L(\mathbf{r}, \lambda) = \frac{dL}{d\lambda}. \tag{4}$$

The quantity measured physically by clocks is not the coordinate increment dL, but the effective progression through the fourth dimension,

$$dL_{\text{eff}} = v_L \, d\lambda. \tag{5}$$

Equation (2) is the central kinematic relation of 4DKC. It expresses the conservation of a constant four-dimensional speed and provides the geometric foundation from which the principal results of the theory follow.

Special Relativity is recovered in the limit of uniform flow ($v_0 = c$), where the Lorentz factor emerges as the geometric projection of the constant four-speed onto the fourth spatial dimension. Proper time is interpreted as the effective progression through that dimension,

$$d\tau = \frac{dL_{\text{eff}}}{c}, \tag{6}$$

rather than as an independent coordinate. Gravitational time dilation arises when continuous electromagnetic extraction reduces the local background progression rate, while inertial time dilation results from redistribution of the same constant four-speed between the observable hypersurface and the fourth dimension. The equivalence principle follows naturally because both effects modify the same geometric constraint.

Equations (5) and (18) express the central postulate of 4DKC: proper time is simply the measure of progression through the fourth spatial dimension.

Every physical system is assumed to possess a constant total kinematic speed through the four-dimensional manifold, Eq. (2), where v is the ordinary three-dimensional velocity relative to the local hypersurface and v_0 is the local background progression rate of the hypersurface itself.

In regions free of bound electromagnetic structure,

$$v_0 = c, \tag{7}$$

so Eq. (2) immediately gives

$$v_L = c\sqrt{1 - \frac{v^2}{c^2}}. \tag{8}$$

Substituting Eq. (8) into Eq. (18) yields

$$d\tau = d\lambda\sqrt{1 - \frac{v^2}{c^2}}, \tag{9}$$

recovering the standard expression for Special Relativity directly from Euclidean geometry. In 4DKC the Lorentz factor is therefore interpreted as the geometric projection of a constant four-speed onto the fourth spatial dimension rather than as a consequence of space-time geometry.

Bound electromagnetic structures continuously extract kinetic energy from the hypersurface progression. The local background progression rate is therefore reduced according to

$$v_0 = c - \delta v_L, \qquad \delta v_L > 0. \tag{10}$$

The constant four-speed relation now becomes

$$v^2 + v_L^2 = (c - \delta v_L)^2, \tag{11}$$

showing that gravitational and inertial time dilation are not distinct physical mechanisms. Both arise from reductions in the effective progression through the fourth spatial dimension.

The accumulated history of these local reductions defines the wake field

$$\Phi(\mathbf{r}, \lambda) = \int^{\lambda} (c - v_L)\, d\lambda', \tag{12}$$

which represents the persistent memory of continuous electromagnetic extraction.

The evolution of the scalar flow field is governed by the advection–diffusion–relaxation equation

$$\frac{\partial v_L}{\partial \lambda} = -\Gamma + D\nabla^2 v_L - \frac{v_L - c}{\tau}, \tag{13}$$

where Γ is the local extraction rate, D is the effective diffusion coefficient, and τ is the relaxation timescale governing the return of the background flow toward equilibrium.

Observable gravitation is described by the effective potential

$$\Psi \equiv (c - v_L) + \alpha\Phi, \tag{14}$$

which combines the instantaneous reduction in the local flow speed with the accumulated wake field. The observable gravitational acceleration is therefore

$$\mathbf{g} = -\nabla \Psi, \tag{15}$$

so that Newtonian gravity, weak-field General Relativity, and the long-range wake contribution all emerge from the dynamics of the single scalar flow field.

The relationships among the principal relativistic and gravitational quantities may be summarized as

$$v_0 \longrightarrow \begin{cases} v^2 + v_L^2 = v_0^2 \longrightarrow dL_{\text{eff}} \longrightarrow d\tau \\ \\ \Phi = \displaystyle\int (c - v_0)\, d\lambda \longrightarrow \Psi = (c - v_0) + \alpha\Phi \longrightarrow \mathbf{g} \end{cases} \tag{16}$$

This hierarchy shows that there is one fundamental quantity, the local background progression rate v_0, from which two observable branches emerge:

The relativistic branch, governing proper time and inertial effects through the constant four-speed constraint; and

The gravitational branch, governing the wake field, effective potential, and gravitational acceleration.

0.2.1 The Constant Four-Speed Constraint

The central kinematic principle of 4DKC is that every physical system possesses a constant total speed through the four-dimensional Euclidean manifold. Ordinary motion within the locally observable three-dimensional hypersurface does not increase this total speed. Instead, it redistributes the available motion between the observable spatial dimensions and the fourth spatial dimension.

This relationship is expressed by the constant four-speed constraint, Eq. (2) where v is the ordinary three-dimensional velocity of the body relative to the local hypersurface, v_L is its progression through the fourth spatial dimension, and v_0 is the local background progression rate determined by the scalar flow field.

The effective progression through the fourth dimension during an interval $d\lambda$ is therefore

$$dL_{\text{eff}} = v_L\, d\lambda = \sqrt{v_0^2 - v^2}\, d\lambda. \tag{17}$$

Equation (17) is the master kinematic relation of 4DKC. It expresses the fundamental geometric constraint that every physical system continuously traverses the entire four-dimensional manifold, while the partitioning of that motion between the observable three-dimensional hypersurface and the fourth spatial dimension depends on its state of motion and the local scalar flow field.//

Proper time is then identified simply as

$$d\tau = \frac{dL_{\text{eff}}}{c}, \tag{18}$$

so that time is not an independent coordinate of the manifold but the observable measure of effective progression through the fourth spatial dimension.

Several fundamental results follow immediately from Eq. (17).
First, in regions where the background flow remains uniform ($v_0 = c$),

$$d\tau = \sqrt{1 - \frac{v^2}{c^2}}\, d\lambda, \tag{19}$$

which is precisely the Lorentz time-dilation relation of Special Relativity. The Lorentz factor therefore emerges as a direct consequence of Euclidean geometry rather than as a separate postulate.

Second, if the local background progression rate is reduced by continuous electromagnetic extraction,

$$v_0 = c - \delta v_0,$$

then even a body at rest within the local hypersurface experiences a reduced progression through the fourth dimension. Gravitational time dilation and inertial time dilation therefore originate from the same geometric constraint. Both correspond to reductions in the effective progression through the fourth spatial dimension, although one arises from changes in the background flow while the other results from redistribution of the constant four-speed into ordinary spatial motion.

Equation (17) therefore provides the unifying kinematic foundation of 4DKC. Special Relativity, gravitational time dilation, inertia, and the equivalence principle all emerge as different manifestations of the same geometric relationship within a flat four-dimensional Euclidean manifold.

0.2.2 Flow-Induced Gravity

Having established the scalar flow field and the constant four-speed constraint as the fundamental kinematic description of the observable hypersurface, gravitational phenomena emerge naturally from spatial variations in the local background progression rate. Gravity is therefore not a fundamental interaction acting within curved space-time, but the macroscopic response of matter to variations in the progression of the hypersurface through the fourth spatial dimension.

The local reduction of the hypersurface progression rate,

$$v_0 = c - \delta v_0, \tag{20}$$

produces spatial gradients in the scalar flow field.

Equation (2) determines the progression available to any moving body.

The effective gravitational potential is:

$$\Psi \equiv c - v_0 + \alpha\Phi, \tag{21}$$

where the first term represents the instantaneous reduction in the local flow speed and Φ is the accumulated deceleration-memory wake defined by Eq. (8). The observable gravitational acceleration is then

$$\mathbf{g} = -\nabla \Psi = \nabla v_0 - \alpha \nabla \Phi. \tag{22}$$

Unlike General Relativity, where the metric tensor is the fundamental gravitational field, 4DKC regards the effective potential Ψ as a derived quantity that summarizes the underlying flow dynamics. The only fundamental field is the scalar flow field $v_L(x, y, z, \lambda)$; the wake field and the effective potential are successive emergent descriptions of its evolution.

The resulting gravitational field contains two physically distinct but dynamically related components. The first is the instantaneous response produced by the local reduction in the flow speed. This component dominates in regions where continuous electromagnetic extraction is strong and the flow rapidly approaches local equilibrium, reproducing the familiar Newtonian limit and the weak-field predictions of General Relativity.

The second component arises from the accumulated wake field generated by the history of continuous extraction. Because the wake persists long after individual extraction events, it extends beyond the immediate region occupied by bound matter and contributes an additional long-range component to the gravitational field. The wake, therefore provides a natural memory mechanism that links present gravitational behavior to the past evolution of the flow.

The relative importance of these two contributions is determined entirely by the evolution of the scalar flow field through the advection–diffusion–relaxation equation (10). In regions of high acceleration the instantaneous flow gradient dominates, whereas in low-acceleration environments the accumulated wake becomes increasingly important. The smooth transition between these regimes arises directly from the governing dynamics of the flow field and does not require an externally imposed MOND interpolation function or an additional dark matter component.

Within this framework, Newtonian gravity, the weak-field limit of General Relativity, galaxy rotation curves, the radial acceleration relation, gravitational lensing, and cluster-scale dynamics are interpreted as different manifestations of a single continuum-mechanical process. Local gravitational fields reflect the instantaneous structure of the scalar flow, whereas galactic and cosmological phenomena retain the accumulated memory of continuous electromagnetic extraction over cosmic time.

Flow-Induced Gravity therefore contains only one fundamental gravitational field: the scalar flow field $v_L(x, y, z, \lambda)$. The wake field Φ, the effective gravitational potential Ψ, and the metric description of General Relativity are successive emergent approximations that describe different levels of the same underlying kinematic dynamics.

0.2.3 Energy Conservation

One of the principal motivations for 4DKC is to provide an explicit accounting of gravitational energy. In General Relativity the gravitational field is identified with space-time geometry, and a unique global energy density cannot, in general, be defined. In contrast, 4DKC treats gravity as the dynamics of a scalar flow field on a fixed Euclidean manifold. Because the underlying geometry is globally flat, the energy associated with the flow field is defined in the usual continuum-mechanical manner.

Continuous electromagnetic binding converts kinetic energy from the background hypersurface progression into stable bound matter. The reduction in the local background progression rate is therefore not a loss of energy but a transfer between different forms. The total energy consists of three components:

1. kinetic energy remaining in the background flow,
2. energy stored in bound matter,
3. energy stored in distortions of the scalar flow field.

The third contribution represents the gravitational field itself. Because the wake field Φ describes the accumulated departure of the flow from its equilibrium state, its energy is naturally described by the standard continuum energy functional containing both gradient and storage terms,

$$\rho_\Phi = \frac{(\nabla\Phi)^2}{8\pi G} + \frac{\Phi^2}{2\tau\ell_0}. \tag{23}$$

The first term measures the energy stored in spatial variations of the wake field. It is directly analogous to the elastic energy associated with strain gradients in continuum mechanics and vanishes when the flow is spatially uniform. The coefficient $8\pi G$ is chosen so that the weak-field limit reproduces the conventional normalization of Newtonian gravity.

The second term represents the energy stored by maintaining the wake field away from its equilibrium state. Because the wake relaxes toward the background flow on the timescale τ, sustaining a non-zero value of Φ requires stored energy. The characteristic length scale ℓ_0 converts the relaxation term into an energy density while determining the spatial scale over which wake memory persists.

The total conserved energy of the system may therefore be written schematically as

$$E_{\text{total}} = E_{\text{flow}} + E_{\text{bound}} + \int \rho_\Phi \, d^3x, \tag{24}$$

where E_{flow} denotes the kinetic energy remaining in the background hypersurface progression and E_{bound} is the energy continuously extracted into stable electromagnetic bound matter.

The advection–diffusion–relaxation equation governing the scalar flow field continuously transfers energy among these three components without creating or destroying energy. Electromagnetic extraction reduces the local background progression rate, diffusion redistributes flow energy spatially, and relaxation gradually returns the flow toward equilibrium. The wake field therefore acts as the intermediary that stores and transports gravitational energy while preserving global conservation.

Unlike General Relativity, where gravitational energy is fundamentally non-local, 4DKC attributes gravitational energy to measurable distortions of a physical scalar flow field. Energy conservation is therefore expressed as an ordinary conservation law on a flat four-dimensional Euclidean manifold rather than as a property of curved space-time geometry.

The local energy balance:

$$\frac{\partial}{\partial\lambda}\left(\rho_{\text{flow}} + \rho_{\text{bound}} + \rho_\Phi\right) + \nabla\cdot\mathbf{J} = 0, \tag{25}$$

where J is the total energy flux, shows that energy is locally conserved through exchanges among the background flow, bound matter, and the wake field.

Not only does 4DKC conserve energy more transparently than General Relativity, it explains why the flat Euclidean manifold and scalar flow field naturally admit a local energy density and conservation law.

0.2.4 Comparison to MOND

4DKC is not "like MOND"; it is a deeper theory whose low-acceleration limit is the MOND phenomenology. Because the source term in the equation for the primary flow field v_L includes a nonlinear coupling to the local acceleration, the wake contribution automatically produces the observed radial acceleration relation and flat rotation curves. Everything MOND gets right, 4DKC recovers automatically from the kinematics of a single scalar field; everything MOND struggles with (clusters, time dependence, fundamental origin of a_0), 4DKC explains from first principles.

0.2.5 Matter Creation

Matter creation is continuous and asymmetric. Kinetic energy of the hypersurface motion along L is converted to hydrogen plasma via electromagnetic interactions in low-density voids. The 4D continuity equation for kinetic flux governs the balance between extraction and replenishment:

$$\partial_\mu J^\mu = S_{\text{creation}} - S_{\text{extraction}}. \tag{26}$$

This balance is embedded in the closed three-reservoir energy accounting. In voids the source term replenishes ρ_K through creation; in bound structures electromagnetic binding transfers energy from the flow into both ρ_b and the wake reservoir ρ_Φ. The wake therefore acts as an energetically accounted-for repository of previously extracted energy rather than an additional free gravitational source.

0.2.6 Emergent Relativistic Dynamics

Within 4DKC there is no fundamental distinction between gravitational and inertial time dilation. Both arise from changes in the effective progression of matter through the fourth spatial dimension. Proper time is therefore not a primitive quantity but the physical measure of effective progression through the fourth dimension, as defined by Eqs. (5) and (18).

The constant four-speed postulate,

$v^2 + v_L^2 = v_0^2$, Eq. (2):

provides the geometric foundation of all relativistic phenomena. Here v is the ordinary three-dimensional velocity of a body relative to the local hypersurface, v_L is its progression through the fourth spatial dimension, and v_0 is the local background progression rate of the hypersurface itself.

In regions free of bound electromagnetic structure the background progression remains at its equilibrium value,

$$v_0 = c.$$

Eq. (2): therefore gives

$$v_L = c\sqrt{1 - \frac{v^2}{c^2}},$$

which, together with Eq. (18), immediately yields

$$d\tau = d\lambda\sqrt{1 - \frac{v^2}{c^2}}, \tag{27}$$

recovering the standard expression of Special Relativity. Within 4DKC the Lorentz factor is therefore interpreted as the geometric projection of a constant four-speed onto the fourth spatial dimension rather than as a consequence of Minkowski space-time.

Gravitational time dilation follows from exactly the same geometric principle. Continuous electromagnetic extraction locally reduces the background progression rate of the hypersurface,

$$v_0 = c - \delta v_L,$$

so that the constant four-speed relation becomes

$$v^2 + v_L^2 = (c - \delta v_L)^2.$$

The reduction in proper time therefore arises because less progression through the fourth spatial dimension is available locally. Motion and gravity do not represent two independent mechanisms of time dilation. Motion redistributes a body's constant four-speed between the observable hypersurface and the fourth dimension, whereas gravity reduces the local background progression itself. Both reduce the effective four-dimensional progression measured by physical clocks.

The same mechanism naturally explains gravitational redshift. Photons propagate through regions having different background progression rates while preserving their intrinsic frequency during propagation. Because clocks at the emitter and receiver accumulate proper time at different rates, the observed photon frequency is shifted. In the weak-field limit this reproduces the gravitational redshift predicted by General Relativity.

Inertia likewise acquires a direct geometric interpretation. Every physical system maintains a constant total speed through the four-dimensional manifold. Acceleration within the observable three-dimensional hypersurface therefore requires a continual redistribution of this motion away from the fourth dimension. Resistance to acceleration reflects the dynamics of this redistribution rather than an intrinsic property of mass alone.

The equivalence principle follows immediately from the constant four-speed constraint. Gravitational time dilation results from reductions in the local background progression rate, whereas inertial time dilation results from increased motion within the hypersurface. Both modify the same geometric relation, Eq. (2), and therefore both reduce the effective progression through the fourth dimension. The equality of gravitational and inertial mass is therefore a consequence of the underlying flow dynamics rather than an independent postulate.

Consequently, the relativistic phenomena traditionally attributed to curved space-time emerge in 4DKC from the geometry of a flat four-dimensional Euclidean manifold together with the dynamics of a single scalar flow field. Proper time measures progression through the fourth dimension, while the constant four-speed constraint unifies Special Relativity, gravitational time dilation, inertia, gravitational redshift, and the equivalence principle as different manifestations of a single underlying kinematic process.

0.2.7 Electromagnetism as the Coupling to the Fourth Dimension

Within 4DKC the electromagnetic interaction occupies a unique role. It is not merely another field propagating on the four-dimensional manifold, but the physical mechanism through which bound matter exchanges kinetic energy with the background hypersurface flow. Continuous electromagnetic binding extracts kinetic energy from the local background progression, producing the reductions in the scalar flow field that ultimately give rise to gravitation. Electromagnetism therefore provides the physical coupling between ordinary matter and the fourth spatial dimension.

This interpretation follows naturally from Kaluza's original observation that the electromagnetic four-potential may be identified with geometric structure associated with an additional spatial dimension. The fourth spatial dimension is large rather than compactified, and electromagnetic phenomena are local perturbations of the hypersurface progression through that dimension.

To first order, small deviations from the uniform background flow may be represented by an effective four-potential

$$A_\mu = (\phi, \mathbf{A}), \tag{28}$$

whose components describe the local coupling between electromagnetic fields and the progression of the hypersurface through the fourth dimension.

The corresponding antisymmetric field tensor is

$$F_{\mu\nu} = \partial_\mu A_\nu - \partial_\nu A_\mu, \tag{29}$$

from which the homogeneous Maxwell equations follow identically through the Bianchi identity,

$$\partial_{[\alpha} F_{\beta\gamma]} = 0. \tag{30}$$

The inhomogeneous equations take their usual form,

$$\partial_\mu F^{\mu\nu} = \mu_0 J^\nu, \tag{31}$$

where the four-current J^ν represents the distribution of electric charge and current within the observable three-dimensional hypersurface.

Consequently, the classical Maxwell equations are recovered without modification. Their interpretation, however, differs fundamentally from that of conventional field theory. Rather than existing independently of gravitation, electromagnetic fields represent the local interaction through which bound matter exchanges energy with the background scalar flow. This same interaction produces the continuous extraction of kinetic energy responsible for reductions in the hypersurface progression rate and therefore for the emergence of gravity itself.

Electromagnetism and gravitation are thus not independent phenomena but complementary manifestations of a single four-dimensional kinematic system. Electromagnetic fields govern the exchange of energy between matter and the scalar flow, while gravitational effects arise from the resulting modifications of that flow. Maxwell's equations and the gravitational dynamics of 4DKC therefore describe different aspects of the same underlying continuum.

0.3 Testable Predictions

Key predictions include:

- Measurable one-way speed-of-light anisotropies correlated with local mass distributions.
- Fringe shifts in quantum interference experiments near strong gravitational fields.
- Anomalous redshift patterns in galaxy cluster cores.
- Uniform hydrogen abundance across all redshifts.
- Modified gravitational-wave ringdown signatures.

0.3.1 Falsifiability and Critical Tests

- Detection of true GR singularities or horizons inconsistent with finite deceleration.
- No fringe shift near masses at predicted level.
- Significant deviation of H abundance at high z from 0.75.
- Rotation curves requiring Φ greater than 20 or negative values to fit data.

0.3.2 Priority tests (2026–2030)s

:

- JWST high-metallicity and morphology (already supportive).
- Cluster core redshift mapping (Euclid, Roman).
- Precision quantum interference near masses.
- LIGO/Virgo ringdown deviations in high-mass mergers.

0.4 Conclusion

This work demonstrates that a flat Euclidean manifold together with a single scalar flow field and a constant four-speed constraint is sufficient to reproduce the principal weak-field predictions of General Relativity while providing a unified kinematic interpretation of gravitation, inertia, proper time, and cosmological evolution.

0.5 Summary of Symbols

Symbol	Description
L	Fourth spatial dimension
v_L	Velocity along L (baseline c)
λ	Affine evolution parameter

ρ_b	Bound mass-energy density
ρ_k	Kinetic energy density of manifold flow
ρ_{e_m}	Electromagnetic energy Density
D, τ, κ	Wake diffusion, relaxation, and coupling parameters
Tuv	Stress energy Tensor
j_v	Current
$F_u v$	Electromagnetism
a_u	Gravity/Deceleration Field
ρ	Mass Density
a_L	Deceleration
V_L	Effective velocity of 3D Space through L
$V_3 D$	Clock's velocity relative to the local manifold frame
j_u	4D Current Density
Ψ	Effective potential, (instantaneous and memory contributions)
J	Total energy flux,
Φ	Deceleration-memory wake field
ρ_K	Relativistic kinetic energy density*
ρ_b	Bound rest-mass energy density*
ρ_Φ	Stored energy density*
	* Wake Field components

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