Foundations of Flow-Resistance Theory (FRT)

Time Structure, Norm Relation, Gravitational Field, and Cosmological Field Equation

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Abstract

This article presents the foundations of Flow-Resistance Theory (FRT), a theoretical framework that interprets gravitation as a manifestation of a varying realized time structure. The presentation begins with the cosmological starting point: isotropic four-dimensional spatial expansion since the Big Bang. From this expansion, the four fundamental postulates of FRT are developed. The central distinction between the locally invariant fundamental speed c_0 and the nonlocal dynamical quantity c is justified by the symmetry of expansion rather than merely postulated. The screening mechanism of mass is traced, by means of Gaussian geometry, to the familiar 1/r dependence of the gravitational potential. Furthermore, an FRT Friedmann equation is derived in which both the matter term and the cosmological term Λ follow from the same screening mechanism. The resulting prediction for the dark-energy parameter, $w_0 \approx -0.7$, agrees remarkably well with the current DESI DR2 measurements ($w_0 \approx -0.8$ [±0.1]). FRT thus formulates a testable departure from ΛCDM: decreasing expansion acceleration without phantom crossing.

1 Cosmological Starting Point: The Big Bang as the Origin of Expansion

Standard cosmology describes the Big Bang as the beginning of space, time, and matter. FRT builds on this framework but reinterprets it structurally: the Big Bang is understood as the origin of an isotropic four-dimensional expansion whose characteristic speed is the fundamental quantity c_0.

In this picture, the universe has expanded since the Big Bang in three spatial dimensions and one temporal dimension. The decisive claim of FRT is that the temporal dimension is not an independent background parameter but rather the radial direction of this expansion itself. In FRT, space and time are not presupposed; they are realized.

Specifically, this means that for each realized meter of spatial expansion there is exactly one light-meter of temporal expansion. A light-meter here denotes the time that light in a vacuum requires to travel one meter. This symmetric relationship is the structural core of local Lorentz invariance in FRT and thus defines c_0.

The totality of all radial expansion directions from the origin of the Big Bang constitutes the set of all time axes. Locally—in the sense of all physically accessible distances in the Solar System and even on galactic scales—these time axes are practically parallel, analogous to the rays of sunlight reaching Earth. Over very large cosmological distances, by contrast, the time axes diverge measurably, allowing specific predictions for the cosmic expansion history (see Section 9).

2 The Four Fundamental Postulates of FRT

All of FRT can be founded on four postulates from which all further consequences are developed. No additional assumptions are made. These four postulates are not isolated from one another but build upon one another.

Postulate 1: Expansion

Space has expanded isotropically in four dimensions since the Big Bang. The rate of expansion is tied to the fundamental speed c_0. This expansion is the physical origin of space and time.

Postulate 2: Time as Expansion

Physical time is the realized temporal (radial) dimension of this expansion. At every location, exactly one light-meter of temporal expansion corresponds to each meter of spatial expansion. Time is primary; three-dimensional space is secondary, as a hypersurface of the expansion sphere and a direct consequence of temporal expansion.

Postulate 3: Time–Light-Speed Equivalence

Motion and the realized light-speed structure obey the norm relation: $c_0^2 = c^2 + v^2$. The universal speed scale c_0 is redistributed geometrically between the realized light/time component c^2 and the kinematic component v^2; it is neither created nor destroyed. There is an equivalence between time and the speed of light.

Postulate 4: Mass as Resistance and Antivalence to Time

Mass is resistance to the local realization of spatial expansion. It locally slows expansion, which appears as a variation of the realized time structure and is observed as gravitation. Mass stands in an antivalent—structurally inverse—relationship to time.

3 Why c_0 Is Locally Invariant: An Explanation from Expansion Symmetry

One of the central propositions of FRT—the local invariance of c_0—is simply postulated in many theories. FRT, by contrast, can account for it through the symmetry of expansion.

Expansion is locally symmetric: spatial and temporal realization are coupled in a ratio of 1:1 (one spatial meter, one temporal light-meter). A pointwise measurement therefore cannot detect any variation in c_0, because space and time are affected by expansion in the same manner. A measurable difference can arise only across finite distances, where differences in expansion dynamics accumulate.

It is precisely this accumulated difference that the quantity c expresses. The decisive conceptual distinction is therefore:

c_0 is local and invariant: At every point in the structure, the same fundamental speed is realized for reasons of symmetry.

c is nonlocal and dynamic: It describes the accumulated difference in realized expansion dynamics between two separated points in spacetime. The gradient establishes the gravitational field. The mass of every body slows expansion equally in spatial and temporal terms; the gravitational field is therefore not a mysterious action at a distance between masses but rather the respective expansion gradient in space—or, more precisely, in space and time.

This distinction is not a terminological subtlety but the structural core of FRT. Anyone who fails to distinguish c_0 from c will read FRT as a theory of a locally varying speed of light—which is not what is intended. FRT therefore does not belong to the class of “Variable Light Speed” or VLS theories. Nevertheless, FRT can satisfy all five requirements that George Ellis places on such theories without additional assumptions. The Ellis requirements for a “viable” VLS theory [10] will be addressed in a separate article.

Because FRT assumes expansion at the speed of light, light propagation is not regarded as an independent process but rather as passive co-motion with spatial expansion.

The four postulates allow a straightforward approach to explaining phenomena predicted and repeatedly confirmed by special and general relativity. One such prediction is the independence of the speed of light

from the velocity of its source: imagine a light source and a light receiver in free vacuum space. Irrespective of the speed and direction of motion of the source relative to the receiver, the receiver always measures the same speed at which the light reaches it. The explanation given by FRT is simple: because the speed of light depends only on the expansion of the space surrounding the source and receiver, the velocity of the light source has no influence whatsoever on the speed of propagation of light in space—or, more precisely, with space. This thus explains the familiar Lorentz invariance of light.

One postulate of special relativity asserts the constancy of the speed of light. This follows (locally) from the symmetry of spatial expansion.

While Albert Einstein uncovered the connection between space and time, FRT goes a step further: it claims that space is a consequence of the temporal expansion structure. Space is secondary, whereas time—or, more precisely, time structure—is the primary phenomenon. “Time rays” extend from the Big Bang point in all directions—a radius with three angles by which the time rays differ. Together, the present endpoints of these time rays form present-day space. Since this is the boundary surface of expansion, we call it “outer space” (Oberraum), because as a hypersurface or hypersphere it constitutes a kind of surface.

When the third postulate of FRT speaks of time–light-speed equivalence, one may ask how speed, defined as a change in distance per unit time, and time itself can be equivalent. The reason lies precisely in the secondary nature of space: during four-dimensional expansion, “time rays” diverge from one another because they are never parallel. The spatial distance between the current endpoints of any two time rays increases. This increase occurs synchronously with the temporal increase, while space (the hypersurface) and time are orthogonal to each other.

A consequence of these considerations is that every point of three-dimensional space (the outer space or Oberraum) has its own time axis.

Because of the enormous size of the universe, the angles between the time axes are so small that they are practically parallel even across the Solar System. Over very large cosmological distances, however, this angular difference should be taken into account, because it may affect the perception of time and therefore speed for very distant objects.

A further insight of special relativity is the phenomenon known as the twin effect: of two twins, one travels far from Earth in a spaceship, reaching speeds close to that of light (more than 99%), while the other remains on Earth. After the spaceship returns and lands on Earth, they discover that they are no longer the same age: the twin who stayed on Earth is now considerably older than the space traveler.

This too can be readily explained using FRT's own conceptual tools: because, according to the speed-conservation law in the third postulate, greater speed is always accompanied by a reduction in the relative speed of light, the effect of time—or “c”—on the spaceship is correspondingly smaller than for the people remaining on Earth. Figuratively, one could speak of a weaker flow through the space travelers. Spatial expansion is interpreted as a flow; hence the name “Flow-Resistance Theory.” A body more nearly at rest (relative to the surrounding spatial expansion) is permeated by time more strongly, or “faster,” than a rapidly moving body.

This brings us to an important difference between the premises of FRT and those of relativity theory: while Einstein started from the relativity of motion between bodies, FRT extends relativity to include a body's (even a single body's) relation to the dynamics of spatial expansion. In Einstein's original conception, a body existing alone was in fact not possible (since no reference quantity existed). He consequently considered cosmological processes as a whole, rather than starting with the individual body. FRT, by contrast, proceeds in precisely the opposite direction and considers the individual body in its interaction with its surroundings.

4 Formal Quantities and Notation

On the basis of the four postulates, the following quantities are introduced. The concept of “height” is important to FRT because, unlike general relativity, FRT does not start from spacetime as a whole with individual masses as “disturbances” within it. Rather, it starts from concrete bodies and examines their fields and the causes of those fields. Height above a body's surface is therefore the relevant reference scale.

In FRT, height h above a body's surface consists of a spatial component (h) and a temporal component (Θ), where $\Theta = h/c_0$. FRT regards space and time not as a static background but as dynamically generated by expansion.

Definition: Temporal Height Θ

$\Theta := h/c_0$ is the time required for light traveling at the fundamental speed c_0 to traverse a spatial height h. It is the temporal counterpart of spatial height in the absolute FRT reference structure. Its unit is the light-meter (Lm).

Definition: Proper Time τ

$d\tau = (c/c_0)\, d\Theta = \cos\theta\, d\Theta$. Proper time is the projection of temporal height by the realized light-speed factor. It is the time actually realized by matter within the local structure.

Definition: Norm Angle θ

$\cos\theta = c/c_0$, $\sin\theta = v/c_0$. The norm angle parameterizes the redistribution of the fundamental norm between the realized light/time component and the kinematic component.

5 The Norm Relation and Its Consequences

FRT yields the norm relation

$$c_0^2 = c^2 + v^2 \tag{1}$$

directly from the assumption of isotropic four-dimensional spatial expansion.

Starting Point: 4D-Isotropic Expansion

FRT assumes that space expands in four dimensions with the norm speed c_0.

“Isotropic” here means that initially there is no preferred direction of expansion. The total expansion speed has the same norm everywhere in the four-dimensional structure:

$$|\vec{C}| = c_0 \tag{2}$$

Here $\vec{C}$ is the four-dimensional expansion vector. Since all these vectors are assumed to have a common origin, the use of Hamiltonian quaternions is meaningful. The set of all quaternions representing spacetime will be described as a fiber bundle in a later article. The scalar component of the quaternions corresponds to the respective local time axes arising from radial expansion; the three vector components, as imaginary parts, describe space and rotations within it. Time corresponds to the real part.

It can be decomposed into three spatial components and one timelike component:

$$\vec{C} = (c_x, c_y, c_z, c_\Theta) \tag{3}$$

The norm is then:

$$c_0^2 = c_x^2 + c_y^2 + c_z^2 + c_\Theta^2 \tag{4}$$

Spatial Motion as a Component of Expansion

The three spatial components are combined into observable spatial motion:

$$v^2 = c_x^2 + c_y^2 + c_z^2 \quad (5)$$

Thus v is not something “additional” to expansion, but rather the spatially directed component of four-dimensional expansion.

Timelike Expansion as the Relative Speed of Light

The fourth component is the timelike realization of expansion. In FRT, this is identified with the relative, nonlocal speed of light c:

$$c_\Theta = c \quad (6)$$

It is important that, in the general case,

$$c \neq c_0 \quad (7)$$

c_0 is the local, field-independent norm. Locally, c_0 is always operative.

By contrast, c describes the realized timelike component of expansion, that is, the relative speed of light, which can be determined only over distances, through motion, or across potential differences.

Substitution into the 4D Norm

Starting from

$$c_0^2 = c_x^2 + c_y^2 + c_z^2 + c_\Theta^2 \quad (8)$$

and using

$$v^2 = c_x^2 + c_y^2 + c_z^2 \quad (9)$$

and

$$c_\Theta = c \quad (10)$$

we immediately obtain:

$$c_0^2 = v^2 + c^2 \quad (11)$$

or:

$$c_0^2 = c^2 + v^2 \quad (12)$$

This is the norm relation of FRT.

This norm relation is a conservation law: a body's velocity v and the relative speed of light c always combine to give the local total speed of light c_0. This balancing mechanism explains relativistic kinematic effects as well as gravitational effects.

Physical Meaning

The relation states:

timelike component + spatial component = constant expansion norm

When the spatial component of motion v increases, the timelike component c must decrease:

$$v \uparrow \Rightarrow c \downarrow \quad (13)$$

It follows that:

$$c = \sqrt{(c_0^2 - v^2)} \quad (14)$$

or

$$c = c_0 \cdot \sqrt{(1 - v^2/c_0^2)} \quad (15)$$

This directly gives the Lorentz factor:

$$\gamma = c_0/c \tag{16}$$

and hence:

$$\gamma = 1 / \sqrt{(1 - v^2/c_0^2)} \tag{17}$$

FRT Interpretation

In FRT, the norm relation means:

Motion is a redistribution of four-dimensional expansion.

It is not c_0 that changes, but rather the division of the constant expansion norm:

$$c_0^2 = c^2 + v^2 \tag{18}$$

in other words:

constant expansion norm = timelike expansion + spatial expansion

Time dilation is thus not merely a kinematic effect, but an expression of the fact that as spatial motion increases, a smaller proportion of expansion remains available for timelike realization.

The fundamental norm relation is:

$$c_0^2 = c^2 + v^2 \tag{19}$$

Dividing by c_0^2 yields the unit-circle form:

$$c^2/c_0^2 + v^2/c_0^2 = 1 \tag{20}$$

This has the natural parameterization:

$$c/c_0 = \cos\theta,\ v/c_0 = \sin\theta \tag{21}$$

5.1 Kinematic Time Dilation and the Lorentz Factor

In the purely kinematic case (without gravitation), the norm relation gives:

$$c = \sqrt{(c_0^2 - v^2)} \tag{22}$$

Substitution into the proper-time projection yields:

$$d\tau = \sqrt{(1 - v^2/c_0^2)}\, d\Theta \tag{23}$$

This is the familiar kinematic time-dilation structure of special relativity—here as a direct consequence of the norm relation and the proper-time projection.

The Lorentz factor follows directly:

$$\gamma = d\Theta/d\tau = c_0/c = 1/\cos\theta = 1/\sqrt{(1 - v^2/c_0^2)} \tag{24}$$

FRT thus provides a geometric interpretation: γ measures the factor by which the realized light/time component is reduced relative to the full fundamental norm c_0. Relativistic time dilation arises because the realized time component is the cosine projection of the fundamental norm.

5.2 Definition of the Gravitational Field

In FRT, gravitation is defined as a variation of the realized time structure. The field strengths are:

$$\partial c/\partial\Theta \text{ (temporal field aspect)},\ \partial c^2/\partial h \text{ (spatial field aspect)} \tag{25}$$

These derivatives describe how the realized light-speed structure changes across time and space. They do not represent independent forces but together encode the variation of the underlying expansion structure.

6 The Screening Mechanism: Gaussian Geometry and the Gravitational Potential

Postulate 4 states that mass slows local spatial expansion. This braking effect must be radiated isotropically from the mass into the surrounding space. The question of the spatial dependence of the potential can be answered through Gaussian geometry.

6.1 Why Screening Is Isotropic

Locally, all time axes are practically parallel (see Section 1). The expansion structure is therefore locally isotropic. A mass screens this isotropic expansion equally in all spatial directions—analogous to the isotropy of an electric charge in its field.

6.2 Derivation of the 1/r Falloff

The screening effect of a mass is distributed over the surface of a sphere of radius r. Since this surface grows as r^2:

$$\text{screening density} \propto 1/r^2 \tag{26}$$

The integrated potential is obtained by integrating over r:

$$\Delta(c^2) = G \cdot m/r \tag{27}$$

Thus the 1/r dependence of the gravitational potential is not postulated but geometrically enforced—just as Coulomb's law follows from Gaussian geometry in three-dimensional space.

The factor m/r is the individual braking value of a body: the more mass is concentrated within a smaller radius, the stronger the local screening effect. FRT thus introduces a special quantity: gravitational resistance, R_G, with SI units [kg]/[m], defined as a body's mass divided by its radius, m/r. The gravitational constant G specifies exactly how large the braking effect of mass on spatial expansion is per kilogram. The product of G and R_G has the units m^3/s^2 and represents the braking effect of a given mass on spatial expansion. This provides a natural explanation of the units of the gravitational constant. It should be noted that the product of G and R_G always refers to the interior of the mass itself; for the screening effect of a body reduces the external braking effect (that is, braking acceleration) according to the body's extent, its radius. The field strength is therefore concentrated essentially around one radius and then, over a knee-shaped curve, falls relatively rapidly into a flat progression.

The bipolarity of gravitation assumed in FRT appears functionally in the braking function, which describes the progression of volume development as a function of a body's spatial height: this function B(h) is the spatial integral of the gravitational potential. It has a zero at which the braking effect of mass exactly cancels spatial expansion. In the universe, the opposing poles are the large concentrations of mass, such as galaxies, on the one hand, and the large, practically mass-free regions, so-called voids, on the other. Gravitation therefore involves opposite poles: expansion and contraction.

This bipolarity makes it possible to explain the rotational-velocity anomaly of spiral galaxies in a very natural way without requiring ad hoc assumptions such as dark-matter halos around galaxies. Indeed, studies by the author [11] found a clear correlation between the strength of the anomaly and the surrounding voids, or a galaxy's proximity to voids. By contrast, spiral galaxies more densely surrounded by other galaxies exhibit a considerably weaker manifestation of this anomaly.

6.3 The Complete Gravitational Potential

At a height h above a body of radius r and mass m:

$$\Delta(c^2) = G \cdot m/(r + h) \quad (28)$$

The first derivative with respect to h gives the field strength:

$$\partial\Delta(c^2)/\partial h = -G \cdot m/(r + h)^2 \quad (29)$$

This is the Newtonian gravitational field—derived here from the screening mechanism rather than postulated.

6.4 Numerical Example: Earth's Gravitational Acceleration from the Time-Dilation Gradient

The measured gravitational time-dilation gradient near Earth is:

$$(1/c) \cdot \partial c/\partial h \approx 1.0941 \times 10^{-16}\ m^{-1} \quad (30)$$

The field definition gives:

$$\partial c^2/\partial h \approx 2c_0^2 \cdot 1.0941 \times 10^{-16}\ m^{-1} \approx 19.7\ m/s^2 \quad (31)$$

Earth's gravitational acceleration follows immediately:

$$g \approx (1/2) \cdot \partial c^2/\partial h \approx 9.8\ m/s^2 \quad (32)$$

Terrestrial gravitational acceleration thus follows directly from the measured time-dilation gradient—without a free parameter.

The major difference from general relativity here is that no indirect calculation of field strength from the curvature of space is required; instead, field strength is derived directly from the postulates. Curvature is secondary in this approach.

7 Why Gravitation Is Not a Force in FRT

In Newtonian mechanics, gravitation is a force acting at a distance between masses. In general relativity, it is a geometric effect of curved spacetime. FRT offers a third interpretation: gravitation is the consequence of a gradient in the realized expansion structure. The curvature of space in spacetime is therefore dynamically enforced rather than static. The expanding hypersphere is called the “outer space” (Oberraum).

A freely falling body does not follow a downward pull but rather the spatial realization of expansion: toward increasing mass, the expansion rate decreases and the realized spatial structure changes. The body follows this changing structure—it remains locally force-free because no direct pull acts on it. This explains the equivalence of gravitation and inertia at a structural level.

The interpretive difference from general relativity is important: general relativity describes “how” spacetime is curved by energy and momentum (Einstein's equations). FRT explains “why”: mass, acting as resistance to expansion, slows the local rate of realization, producing curvature. In this sense, general relativity is the geometric description of the same mechanism without identifying its cause.

8 The FRT Friedmann Equation

A central result of FRT is the derivation of a cosmological field equation from the screening mechanism. It reproduces the familiar Friedmann equation but explains both terms—matter and the cosmological constant—through the same principle.

8.1 Global Braking Effect of All Mass

The mean mass density of the universe at time t is:

$$\rho(t) = M_{total} / [(4/3)\pi R_U^3] \quad (33)$$

The global braking effect on expansion is obtained by integrating the potential $\Delta(c^2) = Gm/r$ over the entire mass distribution:

$$\Delta(c^2)_{global} = G \cdot M_{total}/R_U = (4\pi G/3)\, \rho\, R_U^2 \quad (34)$$

This corresponds to the matter term in the Friedmann equation.

8.2 The Cosmological Term from c_0

The unbraked expansion energy of the structure itself is characterized by c_0^2. Globally, the norm relation gives:

$$c_0^2 = c_{cosm}^2 + v_{expansion}^2 \quad (35)$$

The term c_0^2/R_U^2 assumes the role of the cosmological constant Λ—it is the intrinsic expansion energy of the structure. Unlike in general relativity, Λ is not introduced here as a free parameter but follows naturally from c_0.

8.3 The FRT Friedmann Equation

The complete cosmological field equation of FRT is:

$$H^2 = (8\pi G/3)\rho - c^2/R_U^2 + c_0^2/R_U^2 \quad (36)$$

In the limit $c \to c_0$ (the mass-free void state), this reduces to the standard Friedmann equation with $\Lambda = c_0^2/R_U^2$. FRT thus treats both terms—gravitational braking and cosmic expansion—as consequences of the same screening mechanism. This is interpreted as the bipolarity of gravitation.

9 Predictions of FRT and Comparison with DESI Data

9.1 Dark-Energy Equation of State

In FRT, dark energy is not an independent substance but the net expansion force minus the global braking effect of mass. The effective pressure follows from the ratio of matter density to critical density:

$$w(z) = -1 + \Omega_m(z) \quad (37)$$

Here $\Omega_m(z) = \Omega_{m,0}\,(1+z)^3 / [\Omega_{m,0}\,(1+z)^3 + \Omega_{\Lambda,0}]$ is the matter-dominated fraction. This relation follows from the FRT Friedmann equation without free parameters.

Taking $\Omega_{m,0} \approx 0.3$ gives, for the present epoch ($z = 0$):

$$w_0 = -1 + \Omega_{m,0} \approx -1 + 0.3 = -0.7 \quad (38)$$

9.2 Comparison with DESI DR2 (2025)

In its second data release (DR2, 2025), the Dark Energy Spectroscopic Instrument (DESI), combined with CMB and supernova data, measured a remarkable departure from the ΛCDM standard model. An overview of the FRT predictions and DESI measurements is given below:

Quantity	FRT prediction / DESI measurement
w_0 (FRT)	−0.7 (without free parameters)
w_0 (DESI DR2)	-0.8 ± 0.1
w_a (FRT)	< 0 (decreasing acceleration)
w_a (DESI DR2)	≈ 0.6, preference 2.8–4.2σ

Quantity	FRT prediction / DESI measurement
Phantom crossing (FRT)	Not predicted
Free parameters	None (only empirical G)

The agreement in direction and order of magnitude is remarkable, since $w_0 = -0.7$ follows without fitting to the data. The difference of 0.1 relative to the DESI central value lies within the measurement accuracy and could be explained by higher-order corrections to the field dynamics.

9.3 Decreasing Expansion Acceleration

One of the clearest predictions of FRT is that the expansion acceleration of the universe decreases with time. This follows directly from Postulate 4: the more the universe expands, the more dilute the matter density becomes, the weaker the overall braking effect, and the stronger the net expansion—but the force behind it, the expansion dynamics itself, diminishes.

This is exactly the behavior shown by the DESI data: cosmic acceleration has passed its peak and is in a phase of decline, as indicated by the negative value of w_a.

9.4 No Phantom Crossing

FRT predicts $w(z) > -1$ at all epochs. So-called phantom crossing—a transition from $w > -1$ to $w < -1$ in the past at $z \approx 0.5$, as it appears in the w_0w_a fit of the DESI data—is structurally excluded in FRT. This constitutes a testable departure from ΛCDM: if future precision cosmology confirms phantom crossing, it would be a serious problem for FRT; if it is identified as an artifact of parameterization, that would speak in favor of FRT.

See also the proposed explanation of the rotation anomaly of spiral galaxies, which FRT can account for naturally without assuming dark matter [10].

10 Relationship to Established Frameworks and Outlook

At its present stage, FRT reproduces the time-dilation structure of special relativity in its kinematic sector, and Newtonian dynamics together with the weak-field approximation of general relativity in its gravitational sector. The FRT Friedmann equation reproduces the standard cosmological structure but explains the Λ term through the same mechanism as gravitation.

Compared with general relativity, FRT achieves the following: local Lorentz invariance is explained by expansion symmetry; the mass dependence of gravitation follows from the screening mechanism; and the cosmological constant arises naturally from c_0 rather than being freely postulated. In this sense, FRT offers a causal mechanism for effects that general relativity merely describes geometrically.

Open questions and necessary next steps include: derivation of a complete second cosmological field equation (analogous to the acceleration equation of general relativity); a precise mathematical definition of antivalence between mass and time; connection to quantum mechanics; and experimental tests using optical resonators in different gravitational environments capable of distinguishing c_0 from c.

The present formulation of FRT is intended as a foundational framework. It does not yet claim a complete field-theoretical unification, but prepares the formal basis for one. In FRT, relativistic kinematics and gravitational dynamics are governed by the same underlying norm relation $c_0^2 = c^2 + v^2$—this is its structurally unifying core.

Key Statements of FRT at a Glance

1. Space and time are realized aspects of a 4D expansion since the Big Bang with c_0.

2. c_0 is locally invariant (expansion symmetry); c is dynamically nonlocal (difference between points).

3. The norm relation $c_0^2 = c^2 + v^2$ geometrically produces the Lorentz factor and time dilation.

4. Mass screens expansion isotropically; Gaussian geometry enforces $\Delta(c^2) = Gm/r$.

5. The FRT Friedmann equation explains Λ naturally from c_0 without a free parameter.

6. Prediction: $w_0 \approx -0.7$, decreasing acceleration, no phantom crossing—consistent with DESI DR2.

References

[1] Lemaître, G. (1927): Un Univers homogène de masse constante et de rayon croissant rendant compte de la vitesse radiale des nébuleuses extra-galactiques. Annales de la Société Scientifique de Bruxelles, 47, 49–59.

[2] Hubble, E. (1929): A Relation between Distance and Radial Velocity among Extra-Galactic Nebulae. Proceedings of the National Academy of Sciences, 15(3), 168–173.

[3] Einstein, A. (1915): Die Feldgleichungen der Gravitation. Sitzungsberichte der Preußischen Akademie der Wissenschaften, 844–847.

[4] Einstein, A. (1916): Die Grundlage der allgemeinen Relativitätstheorie. Annalen der Physik, 49, 769–822.

[5] Friedmann, A. (1922): Über die Krümmung des Raumes. Zeitschrift für Physik, 10, 377–386.

[6] Friedmann, A. (1924): Über die Möglichkeit einer Welt mit konstanter negativer Krümmung des Raumes. Zeitschrift für Physik, 21, 326–332.

[7] DESI Collaboration (2025): DESI 2025: Dark Energy Spectroscopic Instrument Data Release 2 – Cosmological Constraints from Baryon Acoustic Oscillations. (Combined analysis with CMB and supernovae; $w_0 \approx -0.8 \pm 0.1$, preference for w_a > 0.)

[8] Weinberg, S. (2008): Cosmology. Oxford University Press.

[9] Misner, C. W., Thorne, K. S. & Wheeler, J. A. (1973): Gravitation. W. H. Freeman and Company.

[10] Ellis, G. F. R. & Uzan, J.-P. (2005): c is the speed of light, isn’t it?. American Journal of Physics, 73(3), 240–247.

[11] Feuerbach, H. (2026): Flow-Resistance Theory (FRT) – Foundations, Relativity, and Gravitation. Also a series of four articles on the FRT approach to explaining the rotation anomaly of spiral galaxies; see link below.

Further articles and the interactive FRT GPT chat are available at:

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