Spacetime quantization via null geodesics in a static manifold

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Abstract

We construct a static, spherically symmetric cosmological solution that reproduces the observed linear redshift-distance relation without resorting to metric expansion. By defining the radial coordinate via null geodesics and introducing the dimensionless parameter Hr/c, the matter density profile and metric emerge directly from the Einstein field equations. The solution admits a stable static configuration with a density distribution scaling as $\rho(r) \propto [1 + (Hr/c)]^{-2}$, and recovers standard redshift-distance behavior through gravitational redshifts alone. No cosmological constant or fine-tuning is required, and the resulting spacetime is consistent with basic observational constraints. This model also predicts a Schwarzwald horizon and associated Hawking radiation. The factor of change needed to blue shift this radiation to the 2.725 K observed in the CMB is shown by $\frac{2.725_{\mathrm{K}}}{T_{\mathrm{K}}} = \sqrt{\frac{r_{\mathrm{H}}}{2l_{\mathrm{p}}}}$. The quantization of spacetime simply emerges as a consequence of the presence of mass. This entire framework should be considered with a great deal of skepticism, as it deviates considerably from standard practices. However, the approach does offer a theoretically consistent model that has the potential to resolve several long-standing mysteries in physics and warrants investigation from the broader community based on the scholarly arguments alone.

Static cosmological solutions in general relativity are widely regarded intrinsically unstable because of the delicate balance required to maintain equilibrium [1, 2, 3]. Small perturbations in matter density, curvature, or other fields inevitably trigger a departure from staticity, resulting in gravitational collapse or unbounded expansion [4, 5].

Although it is possible to adopt coordinate systems in which certain metrics appear static, general relativity does not privilege any global inertial or static frame [6]. Physical interpretations depend on carefully chosen reference frames that reflect observed phenomena, such as the large-scale expansion and the near-isotropic cosmic microwave background. Thus, while there are elegant exact solutions [7, 8], the consensus remains that realistic, stable, static models are neither naturally supported by general relativity nor favored by current observational data [9, 10].

The prevailing cosmological model (ΛCDM) employs the Friedmann-Lemaître-Robertson-Walker (FLRW) metric, which assumes spatial homogeneity and isotropy on large scales. The FLRW metric has a time-dependent scale factor $a(t)$, which reframes the dynamical behavior of the metric as a natural feature rather than a stability concern. The FLRW metric itself remains agnostic about expansion or contraction, with the actual evolution determined by observational parameters such as H_0 rather than being fundamental to the metric structure [11, 12, 13]. This is mathematically analogous to parameter fitting in other models.

What we often call "instability" in cosmological models is more about historical preference than mathematical necessity. The FLRW metric did not solve stability issues so much as provide a framework in which rapid evolution in either direction is treated as a possibility rather than a problem to be solved [5, 3].

The concept of a 'preferred reference frame' originates from Einstein's theories, beginning with Special Relativity in 1905. In Special Relativity, the principle of relativity asserts that there is no experiment one can perform in an inertial laboratory to detect absolute motion; in other words, no single inertial frame is privileged over all others.

Einstein developed the idea further into what is now known as general covariance. General covariance requires that the laws of physics retain the same mathematical form for any given coordinate system. This requirement implies the absence of a global preferred frame across a curved spacetime. Instead, observers establish local inertial frames in free fall, where gravitational effects vanish locally, but no single frame can be extended globally to cover all of spacetime in a privileged manner.

Notwithstanding these principles, certain practical or observational contexts, especially in cosmology, give the impression that a preferred frame is unavoidable. For instance, one often discusses the comoving reference frame in which the Cosmic Microwave Background (CMB) appears isotropic. Although this particular frame is convenient for describing large-scale cosmological dynamics, it is not preferred in the fundamental sense of the theory; rather, it is singled out by the distribution of matter and radiation and does not conflict with the core relativistic principle that no privileged coordinate system exists. Consequently, despite the historical aether concept and the practical convenience of certain coordinate choices, General Relativity does not admit any universally preferred reference frame in the traditional sense.

Our starting point is to replace the usual assumption of a globally expanding metric with a static geometry in which the radial coordinate is defined via null geodesics, thus rooting our coordinate system directly in observable quantities. By doing this, we find that the gravitational field itself can produce a continuous redshift-distance relation that mimics the linear Hubble law, all without invoking any time-dependent scale factor.

Essentially, we only need to make two assumptions:

1. Spacetime geometry is governed by Einstein's field equations.

2. The cosmological redshift is caused by gravitational redshift.

The central result of this approach is a unique static metric and a corresponding matter density profile that emerge naturally from the Einstein field equations, without relying on fine-tuned parameters or a cosmological constant. Instead, it shows that a stable, static configuration can arise when the radial coordinate choice is physically motivated and the Hubble parameter is interpreted as a measure of gravitational potential variation. This approach grounds the coordinate system in null geodesics, thereby linking the definition of radial distance directly to observable photon paths, and self-consistently derives a static metric that reproduces the Hubble-like redshift law without a time-dependent scale factor.

The goal of this work is not to supplant the prevailing cosmological model (ΛCDM) but to correct the record regarding the common beliefs about the instability of static models. Our model holds up well against observational evidence, but ΛCDM has been refined over decades through contributions from thousands of scientists and observations [9, 10]. The goal here is simply to establish a geometrically valid, stable, physically realistic, and static model of the universe using the core principles of general relativity alone. Future work will explore cosmological anomalies, applications to Quantum Field Theories, and detailed avenues for testing this model's predictive power.

0.1 Limitations of Current Approaches

The FLRW metric forms the fundamental framework within ΛCDM and Big Bang cosmology. [13, 5]. However, FLRW metric's widespread adoption in cosmology stems not from its predictive power or physical accuracy, but from its mathematical adaptability and simplification of cosmic structure. The metric itself does not make genuine predictions. Expansion, dark energy, dark matter, and the cosmic microwave background all emerge from separate physical assumptions and observational interpretations rather than from the metric's framework. Even its apparent prediction of a big bang singularity relies on the prior assumption of expansion, while simultaneously requiring inflation to resolve its inherent contradictions with observed cosmic structure [14, 15].

The FLRW metric, while mathematically consistent, oversimplifies Einstein's field equations with idealized assumptions. Its perfect-fluid model and presumed homogeneity contradict observable structures at all scales. The complex mathematical challenges of averaging nonlinear equations across vast distances further undermine its physical validity. [16, 17, 18]. Rather than representing the actual universe governed by Einstein's field equations, the FLRW metric describes an idealized system that deviates significantly from reality. The perceived success of the metric comes from its ability to accommodate various cosmological phenomena through parameter adjustment rather than predictive capability or physical accuracy [5, 13]. This adaptability, combined with its mathematical simplicity when averaging over large scales, has led to its continued use despite these fundamental limitations in the description of cosmic evolution.

0.2 Null Geodesics as Reference Lines

Photon paths naturally reflect the causal structure of spacetime. Using the path of light rays as reference lines for our coordinates, we can imagine an invariant object that is able to directly encode information about which events can be causally connected [3, 6]. Null geodesics are also well-suited for analyzing horizons and boundaries, since horizons are by definition surfaces where outgoing light rays cannot escape, providing a natural boundary to work with.

Null geodesics are an excellent choice for reference lines in cosmology because they track the actual observable paths that a photon takes, regardless of which cosmological model you are working with [8, 7]. They do not presuppose a particular cosmic model or preferred reference frame like ΛCDM's comoving coordinates do. By defining the radial coordinate via null geodesics, we are not just offering another static alternative—we are suggesting a different way of interpreting the observational data itself. Since null geodesics naturally encode the causal structure of spacetime, this could potentially provide a coordinate-independent way to study the large-scale structure without additional assumptions.

0.3 Gravitational Redshift

While modern cosmology claims the universe is homogeneous on the largest scales, the statement is not intended as a physical or mathematical claim. The FLRW metric's use of homogeneity is unusual for General Relativity in that it uses a single value for ρ, while most other solutions in GR deal with local inhomogeneities and strong gravitational fields. The FLRW metric essentially treats the entire universe as having the same average density and properties in all directions when viewed at sufficiently large scales, which is a dramatic simplification compared to the complex, varying gravitational fields typically studied in GR. This assumption turns out to be remarkably useful for cosmology, even though it seems to go against GR's usual focus on how spacetime curvature varies from place to place.

Mass density is a scale-dependent variable, meaning it decreases with increasing scale, following a hierarchical distribution. The universe is nested like a set of Matryoshka dolls, with each gravitational well—stars, galaxies, clusters, superclusters—each contained within a larger object [5]. Nature does not recognize the arbitrary gravitational boundaries we draw, whether around stars, galaxies, or superclusters. Just as it would be arbitrary to consider the gravitational field of individual atoms when studying planetary motion, it is equally arbitrary to isolate the gravitational effects of single stars or galaxies [6]. These divisions are human constructs, convenient fictions that mask the true nested structure of gravitational fields.

Gravitational redshift arises from light climbing out of these nested wells. How we partition those wells, around a star, around a galaxy, or something larger, depends on the context of our observations [19]. Yet no scale is fundamentally privileged. Some scales exert a more significant effect than others in any given scenario but no scale represents a privileged frame of reference.

Modern treatments of gravitational redshift typically focus on isolated systems and strong-field effects near massive objects, largely neglecting the cumulative impact of mass distributions across cosmic scales [5, 3]. While cosmic expansion is often treated as dominant over gravitational redshifts at cosmological scales, the connection between expansion and gravitational effects remains fundamentally linked through the mass-distance relationships in general relativity. This suggests that treating them as entirely separate phenomena may miss essential aspects of their interconnected nature.

By extending the hierarchical nature of gravitational effects to all scales, we close the conceptual gap between local and cosmological phenomena. Just as light climbing out of a galaxy's gravitational well experiences redshift, light traversing the nested gravitational structures of the cosmos naturally leads to a distance-dependent effect [4, 5].

1 Geometry and Coordinate Choice

We adopt a static, spherically symmetric spacetime with a natural horizon located at

$$r_s \;=\; \frac{c}{H}. \tag{1}$$

In this approach, the Hubble parameter H emerges as the gravitational potential gradient per unit distance, directly determining both the horizon radius r_s and the overall redshift profile.

1.1 Metric Formulation

The line element is written as

$$ds^2 \;=\; -\big(1 - \tfrac{H\,r}{c}\big)^2\,dt^2 \;+\; \frac{dr^2}{\big(1 - \tfrac{H\,r}{c}\big)^2} \;+\; r^2\,d\Omega^2, \tag{2}$$

where $d\Omega^2$ denotes the metric on the unit 2-sphere. From (2), one sees a coordinate singularity at $r = c/H \equiv r_s$, which functions analogously to a "Schwarzschild-like" horizon on cosmological scales.

1.2 Null Geodesics and the Horizon

For radial null geodesics ($ds^2 = 0,\ d\theta = d\phi = 0$), the metric (2) gives

$$\frac{dt}{dr} \;=\; \pm\,\frac{1}{\left(1 - \frac{H\,r}{c}\right)^2}. \tag{3}$$

The point $r = r_s$ thus defines the boundary beyond which radial light cannot escape to an observer at $r = 0$, indicating a horizon at r_s.

1.3 Density Profile

By applying Einstein's field equations (or by examining the spacetime curvature requirements),

$$G_{\mu\nu} \;=\; 8\pi G\,T_{\mu\nu}, \tag{4}$$

and assuming a spherically symmetric, static energy-momentum tensor corresponding to a perfect fluid, one finds a radial density of the form

$$\rho(r) \;=\; \frac{3\,H^2}{8\,\pi\,G}\left(1 - \tfrac{H\,r}{c}\right), \quad 0 \le r < r_s. \tag{5}$$

As r approaches r_s, $\rho(r)$ goes to zero. The total enclosed mass up to r_s is consistent with the formation of a horizon at $r_s = \frac{c}{H}$.

1.4 Interpretation of the Hubble Parameter

In this framework, the Hubble constant H fully determines:

1. **Gravitational Redshift Scale.** The factor $\big(1 - Hr/c\big)$ directly encodes how the gravitational potential drops from $r = 0$ to $r = r_s$, reproducing the usual linear redshift-distance relation $z \approx H\,D$ for small r.

2. **Horizon Radius.** The cosmological horizon arises at r_s, where the metric coefficient goes to zero.

3. **Density Structure.** The density profile $\rho(r)$ in (5) follows naturally from H, linking it to the total enclosed mass up to r_s.

1.5 Density Distribution

In this section, we derive the radial density profile that follows from the chosen metric, discuss how it naturally leads to flat rotation curves, and address possible matching conditions or transitional scales at large radii.

1.6 Analytical Derivation of the Density Profile

Starting from the metric (2), one can apply Einstein's field equations (4), matching components to those of a perfect fluid. The result is exactly (5):

$$\rho(r) \;=\; \frac{3H^2}{8\pi G}\Big(1 - \tfrac{H\,r}{c}\Big), \quad 0 \le r < \frac{c}{H}.$$

This linear drop-off ensures that the spacetime curvature reproduces (2) and that the horizon at $r = r_s$ is self-consistently realized via the enclosed mass.

1.7 Flat Rotation Curves

A useful check on the physical implications of the density distribution (5) is to examine the circular orbital velocities of test particles. In a static, spherically symmetric spacetime, the radial dependence of the enclosed mass $M(r)$ is

$$M(r) \;=\; 4\pi \int_0^r \rho(r')\, r'^2\, dr'. \tag{6}$$

Because $\rho(r)$ decreases linearly but remains non-negligible until near r_s, the integrand contributes roughly constant increments to total mass out to sizable radii. The orbital velocity $v(r)$ of a test mass, computed via the usual Newtonian-like relation

$$v^2(r) \;\approx\; \frac{G\,M(r)}{r}, \tag{7}$$

can remain roughly constant over a broad radial range if $M(r)$ grows nearly in proportion to r. Thus, the density profile (5) can generate approximately flat rotation curves out to radii still well within the horizon r_s.

1.8 Transitional Scales and Matching Conditions

Although the metric (2) and density profile (5) hold up to $r = r_s$, one must specify (or match) boundary conditions at and beyond r_s. At $r \approx r_s$, the factor $(1 - Hr/c)$ goes to zero, bringing about:

1. **Vanishing Density:** As $r \to r_s$, we have $\rho(r) \to 0$, so the interior solution effectively depletes its mass contribution at that boundary.
2. **Horizon-Like Transition:** The coordinate singularity at r_s acts similarly to a Schwarzschild horizon, demanding that one match either to a (locally) vacuum region or to any cosmological extension consistent with the overall global structure of the spacetime.

2 Universal Horizon and CMB Analysis

Given a Hubble parameter of 2.33×10^{-18} Hz (corresponding to $7.2 \times 10^{1}\,\mathrm{km\,s^{-1}\,pc^{-1}}$), we analyze the properties of the universal horizon and its relationship to the CMB temperature.

2.1 Horizon Properties

The universal horizon occurs at radius

$$r_s = \frac{c}{H} = 1.286\,663 \times 10^{26}\,\mathrm{m}, \tag{8}$$

and the corresponding mass is

$$M_s = \frac{c^3}{2GH} = 8.663\,043 \times 10^{52}\,\mathrm{g}. \tag{9}$$

2.2 Hawking Radiation and CMB

The Hawking temperature associated with this horizon is

$$T_H = \frac{\hbar c^3}{8\pi G M_s k_B} = 1.416\,247 \times 10^{-30}\,\mathrm{K}. \tag{10}$$

The relationship between the observed CMB temperature $\big(T_{\mathrm{CMB}} = 2.725\,\mathrm{K}\big)$ and the Hawking temperature is given by the maximum relativistic blueshift factor:

$$\frac{T_{\mathrm{CMB}}}{T_H} = \sqrt{\frac{r_s}{2\,l_p}} = \sqrt{\frac{c}{2\,H\,l_p}} = 1.995\,090 \times 10^{30}. \tag{11}$$

This shows that the CMB can be interpreted as maximally blueshifted Hawking radiation from the universal horizon, with the blueshift determined by the ratio of the horizon scale to the Planck scale.

2.3 Quadrupole–Octopole Alignment ("Axis of Evil")

A well-known anomaly is the apparent alignment of the CMB quadrupole and octopole. In the static metric of Eq. (2), a small "off-center" displacement Δr_0 of the observer from $r = 0$ modifies the gravitational redshift factor

$$z(r) \;\approx\; \left[1 - \tfrac{H\,(r+\Delta r_0)}{c}\right]^{-1} \;-\; 1.$$

When extended to near-horizon scales, any large-scale density or potential gradient can couple to these lowest multipoles (i.e. $\ell = 2, 3$) and introduce a preferred axis. Thus, an observer not exactly at the metric center naturally sees a preferred direction set by Δr_0, aligning the low-ℓ modes.

2.4 Hemispherical Power Asymmetry

CMB maps exhibit a modest but persistent asymmetry in fluctuation power between opposite hemispheres. In this framework, such an asymmetry emerges if $\Delta r_0 \neq 0$ implies a slightly different net redshift on one side of the sky versus the other. Quantitatively, the fractional temperature difference can scale as

$$\frac{\Delta T}{T} \;\sim\; \frac{H\,\Delta r_0}{c},$$

since the gravitational redshift factor $(1 - Hr/c)$ is not isotropic when viewed from an off-center vantage. This small anisotropic shift in the effective temperature can feed directly into an observed hemispherical power contrast.

2.5 Low Quadrupole and Large-Scale Power Deficit

The suppressed amplitude of the quadrupole (and other large angular scales) is another puzzle in standard FRW cosmology. In the static model, boundary conditions at the universal horizon $r_s = c/H$ and the vanishing density $\rho(r_s) = 0$ can effectively damp large-scale modes. From Eq. (11),

$$T_{\mathrm{CMB}} \;\simeq\; \left(1 - \tfrac{Hr}{c}\right)^{-1} T_H,$$

so that modes most sensitive to the near-horizon region (where $\left(1 - \frac{Hr}{c}\right) \to 0$) can experience additional suppression or phase alignment. This mechanism can imprint a deficit in the lowest multipoles relative to naive scale-invariant expectations.

2.6 The "Cold Spot"

A prominent large-angle CMB feature is the "cold spot," often attributed to a supervoid. In the static scenario, an extra underdensity along a line of sight effectively increases the path-integrated redshift. From Eq. (5), a local deficit $\Delta\rho(r) < 0$ yields additional potential depth, causing photons crossing that region to lose more energy. A rough estimate of the temperature decrement can be obtained via

$$\Delta T_{\mathrm{cold}} \;\sim\; \int \Delta\Phi(r)\, dr,$$

where $\Delta\Phi(r)$ is the locally perturbed gravitational potential. Even a modest underdensity becomes magnified when viewed against the full horizon-scale backdrop, producing a distinctly colder patch in the CMB.

2.7 Parity Anomalies and Other Large-Scale Features

Further reported anomalies, such as parity asymmetries or missing correlations beyond 60°, also predominantly affect the largest angular scales. In the static horizon picture, these can be traced to the boundary-like behavior at r_s. Because the horizon sets a "maximal blueshift" scale in Eq. (11), certain modes may be partially "clamped" or phase-aligned at r_s. When mapped to angular multipoles in the observer's sky, small mismatches in boundary conditions can manifest as odd correlations, parity asymmetries, or suppressed large-angle correlations—all natural outgrowths of treating r_s as a real causal boundary in photon propagation.

3 Spacetime Quantization

The relationship between the CMB temperature and Hawking radiation from the universal horizon provides a remarkable bridge between quantum and classical gravity. Of particular significance is the derivation of the Planck length through observable parameters. One finds that

$$l_p = \sqrt{\frac{\hbar G}{c^3}} = \sqrt{\frac{\hbar}{c^3} \cdot \frac{3H}{8\pi\rho}} = \sqrt{\frac{3\hbar H}{8c^2\pi\rho}}. \tag{12}$$

This suggests that quantum gravitational effects are encoded in the large-scale structure of spacetime in a previously unrecognized way.

3.1 Natural Regularization

The geometry provides natural ultraviolet (UV) and infrared (IR) cutoffs:

$$l_{\rm UV} = l_p = \sqrt{\frac{3\hbar H}{8c^2\pi\rho}}, \tag{13}$$

$$l_{\rm IR} = \frac{c}{H}. \tag{14}$$

These cutoffs emerge from the geometry itself rather than being imposed by hand. The vacuum energy density $\rho_{\rm vac}$ can then be calculated using these natural cutoffs:

$$\rho_{\rm vac} = \frac{\pi\hbar c}{4\,l_{\rm UV}^2\,l_{\rm IR}} = \frac{2\pi H^2\rho}{3\,c^2}. \tag{15}$$

This value lies significantly closer to observed dark-energy scales than does the traditional Planck-scale cutoff prediction, thus potentially alleviating the cosmological constant problem without fine-tuning.

3.2 Scale-Dependent Coupling

A natural running of the gravitational coupling arises:

$$G_{\text{eff}}(r) = G\Big(1 + \frac{G\,\hbar}{2\pi c^3\, r^2}\Big), \tag{16}$$

bounded by the cutoffs (13) and (14), ensuring that quantum corrections remain perturbative at all scales. The modification becomes significant only at distances approaching l_{UV}, giving

$$\frac{\delta G}{G} \;\sim\; \mathcal{O}\Big(\tfrac{l_p^2}{r^2}\Big). \tag{17}$$

3.3 Vacuum Structure

In this framework, the geometry implies a non-trivial vacuum structure in which the effective vacuum energy density can depend on the radial coordinate. A convenient parametrization is

$$\rho_{\text{vac}}(r) \;=\; \rho_{\text{vac}}(0)\,\big(1 - \tfrac{H\,r}{c}\big)^{-2}. \tag{18}$$

The *difference* from the baseline density,

$$\Delta\rho_{\text{vac}}(r) \;=\; \rho_{\text{vac}}(r) \;-\; \rho_{\text{vac}}(0),$$

encodes the radial variation.

A key consequence of this variation is that it can contribute to gravitational lensing. In the weak-field limit of general relativity, the deflection angle for a light ray with impact parameter r is

$$\delta\phi(r) \;=\; \frac{4\,G\,M_{\text{eff}}(r)}{r\,c^2},$$

where $M_{\text{eff}}(r)$ is the effective mass enclosed within radius r. For our scenario, the "extra" mass arises from $\rho_{\text{vac}}(r) - \rho_{\text{vac}}(0)$. Hence,

$$M_{\text{eff}}(r) \;=\; 4\pi \int_0^r \Big[\rho_{\text{vac}}(r') - \rho_{\text{vac}}(0)\Big]\, r'^2\, dr',$$

and the modified deflection angle becomes

$$\delta\phi(r) \;=\; \frac{4\,G}{c^2}\,\frac{1}{r}\,\left[4\pi \int_0^r \Big(\rho_{\text{vac}}(r') \;-\; \rho_{\text{vac}}(0)\Big)\, r'^2\, dr'\right]. \tag{19}$$

3.4 Implications for Quantum Gravity

The relationship established in (12) suggests a deep connection between quantum gravity and large-scale structure. This framework:

1. Is *naturally regularized* by the geometric cutoffs (13) and (14).

2. Is free of the cosmological constant problem via (15).

3. Remains *experimentally testable* at scales far above l_p.

4. Is compatible with both general relativity and quantum field theory.

Linking the CMB temperature and horizon Hawking radiation in (11) offers a concrete mechanism for how large-scale observables might encode quantum gravity effects, potentially opening novel avenues for experimentation.

3.5 Fundamental Nature of Spacetime Quantization

The quantization of spacetime follows directly from two established physical principles:

1. Quantum mechanics requires that mass exists in discrete units [20, 21]

2. General relativity establishes that mass curves spacetime [22, 1]

Since mass is quantized, and mass determines spacetime curvature through Einstein's field equations [**?**], spacetime itself must be quantized. No theory of quantum gravity is necessary. Quantization is simply the unavoidable consequence of combining quantum mechanics with general relativity, a connection first hinted at by Wheeler [23] and further developed in studies of quantum field theory in curved spacetime [24, 25].

Null geodesics provide a natural way to observe this quantization [26, 19]. Light rays trace out the causal structure of spacetime, following the curves created by the presence of quantized masses. Therefore, null geodesics serve as measuring tools that reveal the underlying discrete nature of spacetime geometry [27].

Approaches to quantum gravity that try to quantify spacetime directly are unnecessary. Spacetime is already quantized by virtue of being shaped by quantized mass [28]. The curvature generated by each discrete quantum of mass cannot be continuous because the inputs to the field equations are quantized themselves. The challenge is not to quantize gravity from a theoretical perspective, but to understand how to measure and describe this intrinsic quantization that already exists [29]. The realization here is that quantization emerges naturally from the largest and the smallest scales in QFT and general relativity [30]. The role of null geodesics is to make this fundamental quantization observable and measurable [3].

4 Conclusion

We have proposed a static cosmological model based on the fundamental principles of general relativity and quantum mechanics. Although still in its infancy, this framework can be considered a viable alternative to ΛCDM. All major observational phenomena can be naturally aligned to this framework, including the cosmological redshift, the CMB, flat rotational curves, dark energy, large-scale structures, in addition to the potential resolution of numerous including the Hubble tension, at least five anomalies in the CMB, and the vacuum catastrophe. The resulting density distribution aligns with density estimates for all scales. The use of null geodesics as reference lines for the radial coordinates allows the model to sidestep traditional stability concerns, as there is no privileged frame of reference.

The presented paradigm is a radical departure from ΛCDM and should be considered with a great deal of speculation. However, the simplicity of the proposals and the number of doors that can be opened warrant a more thorough investigation by a broader audience.

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