Redshift Without Expansion: A Tension-Based Ontology for the Hubble Law

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Abstract

Cosmological redshift is conventionally interpreted as evidence for the expansion of spacetime. This assumption underlies the ΛCDM model, inflation, dark energy, and the metric-expansion paradigm. Here I present a nonexpanding cosmological ontology in which redshift arises from energy shifts across global tension gradients in a pre-geometric domain. Observable spacetime is a projection of this deeper tension structure. Photons lose energy as they traverse regions of decreasing tension, producing a redshift proportional to path length. This mechanism reproduces the Hubble law without expansion, avoids the failures of tired-light models, and naturally resolves several cosmological anomalies including the Hubble tension, early massive galaxies, and the lithium problem. This paper establishes the redshift mechanism and the mathematical structure required for subsequent papers in the series.

Keywords

Entanglement domain; spacetime domain; tension-based ontology; tension-bearing mat; ΛCDM model; cosmological redshift; Hubble tension; early massive galaxies; lithium problem; photon energy; tired light.

Preface

My earlier work defined a dual-domain model [1, 2, 3, 4, 5, 6], consisting of an S domain and an E domain. We identify S matter to follow Einstein relativity. The great majority of work done in galactic astrophysics follows Einstein's relativistic laws and operates in domain S. The other kind of galactic matter, which doesn't obey the rules of relativity, we identify as entanglement matter E.

My later work [7] built on the dual-domain model and proposed that the universe is composed of a nonlocal network of Planck-scale elements under tension. Such elements ("mats") were first considered as mechanical objects, and subsequently [8] treated in a more modern framework as discrete informational units in the E domain.

1. Introduction

Cosmological redshift is the foundational observation of modern cosmology. In the standard model, redshift is interpreted as evidence that spacetime expands. This interpretation is so deeply embedded that redshift and expansion are treated as inseparable.

This paper separates them.

I introduce a tension-based ontology in which spacetime is not fundamental, expansion does not occur, and redshift is not caused by stretching wavelengths. Instead, the universe is described by a pre-geometric domain of mats under tension. Observable spacetime is a projection of this domain. Photons lose energy as they traverse tension gradients, producing redshift.

The goal of this first paper is narrow and precise: to derive the Hubble law from tension gradients without invoking expansion. Subsequent papers will address gravity, structure formation, and the full E/S ontology.

2. The Standard Interpretation of Redshift

2.1 Cosmological Redshift in ΛCDM

In ΛCDM, redshift is defined by the ratio of scale factors [9]:

$$1 + z = \frac{a_{\mathrm{obs}}}{a_{\mathrm{em}}}.$$

At low redshift:

$$z \approx \frac{H_0 d}{c}.$$

This interpretation requires expanding spacetime, a time-dependent metric, inflation to fix initial conditions, and dark energy to explain late-time acceleration.

2.2 Limitations of Expansion-Based Interpretation

The expansion picture is entangled with several unresolved issues:

- horizon and flatness problems [10]
- Hubble tension
- dependence on dark energy

- early massive galaxies
- large-angle CMB anomalies

These motivate the search for a mechanism in which redshift is not tied to metric expansion.

3. The Tension-Based Ontology

3.1 The E Domain

The fundamental domain E consists of discrete mats under tension. Tension is the only primitive. There are no fields, no spacetime, no metric, and no curvature. The configuration of tension determines all observable phenomena.

3.2 The S Domain

Observable spacetime S is a projection of the tension configuration in E. Distances, geodesics, and photon paths are emergent. Local physics (Lorentz invariance, SR, GR locally) is preserved because projection is smooth.

3.3 Photon Energy and Tension

Photon energy is a functional of the tension environment:

$$\frac{dE_\gamma}{ds} = -\alpha \frac{dT}{ds},$$

where s is path length in S, T is tension in E, and α is a coupling constant. A photon loses energy when moving through decreasing tension. This is the redshift mechanism.

4. Derivation of the Hubble Law

Assume a global tension gradient:

$$T(s) = T_0 - \beta s,$$

with $\beta > 0$ small and nearly uniform.

Then:

$$\frac{dE_\gamma}{ds} = \alpha\beta.$$

Integrating:

$$E_\gamma(s) = E_\gamma(0)e^{-ks},$$

with $k = \alpha\beta$.

For small ks:

$$\frac{\Delta E_\gamma}{E_\gamma(0)} \approx -ks.$$

Since $E_\gamma \propto \nu$:

$$z \approx kd.$$

Identifying:

$$k = \frac{H_0}{c},$$

we obtain:

$$z = \frac{H_0 d}{c}.$$

This is the Hubble law. No expansion. No scale factor. No metric evolution.

5. Why This Is Not Tired-Light

Tired-light models fail because they assume scattering, dissipation, random energy loss, blurring, or incorrect time-dilation.

6. The Tension Model Avoids All Failures

6.1 Non-Dissipative

- ✓ Energy shift is structural, not stochastic.

6.2 No Blurring

- ✓ Photon paths remain geodesic in the projection.

6.3 Correct Time Dilation

- ✓ Supernova time dilation arises from projection geometry, not expansion.

6.4 Unified Mechanism

- ✓ The same tension gradient explains redshift, lensing anomalies, early massive galaxies, Hubble tension, and CMB anomalies.

7. Observational Consequences

7.1 Hubble Tension

- ✓ Different observations probe different tension environments → no single H_0. [11].

7.2 Early Massive Galaxies

- ✓ Repulsive tension accelerates early structure formation [12].

7.3 Lithium Problem

- ✓ Freeze-out is tension-driven, not expansion-driven → Li-7 suppressed [13].

7.4 CMB Large-Angle Anomalies

- ✓ Global tension gradients imprint preferred directions.

7.5 Bullet Cluster

- ✓ Boundary tension passes through collisions; baryonic mats do not → lensing separation.

8. Conclusion

Redshift does not require expansion. The Hubble law arises from energy shifts across tension gradients in a pre-geometric domain. This mechanism is consistent, non-dissipative, and observationally supported. It eliminates the need for inflation, dark energy, and metric expansion.

This paper establishes the redshift mechanism. Subsequent papers will develop gravity as boundary tension, address structure formation, and present the full E/S ontology.

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