UDEL and the Hubble Tension

How Non-Uniform Space Formation Can Mimic an Expansion Discrepancy

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Abstract

The Hubble tension is commonly framed as a disagreement between early-universe and late-universe measurements of the cosmic expansion rate. Early-relic methods typically infer a value near 67–68 km/s/Mpc, while local distance-ladder methods tend to favor a value near 73 km/s/Mpc. This mismatch is usually discussed in terms of new fields, evolving dark energy, modified gravity, or hidden systematics.

This paper presents a different interpretation within the framework of UDEL (Universal Discrete Energy Lattice). In UDEL, space is not a pre-existing, homogeneous background. It is an emergent adjacency structure formed by actual energy transitions. The lattice update ceiling is universal, but the effective spatial meaning of a hop depends on local adjacency formation. Dense, repeatedly traversed regions form a mature lattice; sparsely traversed or unformed regions do not. Under this view, the Hubble tension may arise because cosmological observables are interpreted using a homogeneous metric calibration even though signal propagation occurs through non-uniformly formed adjacency regimes.

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The central claim is narrow: UDEL does not require a changing fundamental constant or an added dark-energy patch to generate an apparent discrepancy in inferred expansion rate. Instead, it predicts that differing line-of-sight hop costs across formed lattice, weak lattice, and null regions can bias inferred distances and redshifts in a way that mimics a Hubble tension. This interpretation is testable and falsifiable.

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1. The Problem

Modern cosmology faces a persistent observational mismatch. Measurements tied to early-universe relics such as the cosmic microwave background and baryon acoustic oscillations typically imply a lower Hubble constant, while late-time local measurements using Cepheids and Type Ia supernovae imply a higher one. Recent Webb and Hubble analyses have reinforced that the discrepancy is real enough to remain a serious open problem rather than a trivial calibration glitch.

Standard discussions assume that photons, once emitted, propagate through one continuous kind of background: vacuum. Under that assumption, a redshift-distance relation can be inferred using a single metric calibration. UDEL challenges that assumption at the root.

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2. The UDEL Starting Point

In UDEL, motion is not continuous traversal through a pre-existing container. Motion is discrete hopping across an adjacency graph. Energy must move, but the lattice determines where movement is permitted. Distance is not fundamental; it emerges from hop structure. Geometry is not primary; it is the coarse-grained shadow of reachability.

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This has a crucial consequence:

space is emergent, not given.

The public UDEL physics overview states this explicitly: “Space emerges from pure reachability,” and “Before adjacency there was nothing. The first excitation defines the first step. Space is the shadow of relations.”

That means the phrase “empty space” must be split into at least three distinct regimes:

- **Formed space / formed lattice**: regions where adjacency has already been repeatedly etched by real transitions.
- **Vacuum**: low-density but still formed lattice, where a usable adjacency backbone already exists.
- **Nothing / nullity**: regions where no stable spatial graph has fully formed yet, or where formation remains weak and incomplete.

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This distinction is not poetic decoration. It is the conceptual hinge of the entire argument.

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3. Space, Vacuum, and Nothing

The mistake built into continuum intuition is the assumption that the universe is uniformly filled with “space,” and that some parts merely contain more matter than others. In UDEL, this is backward.

The cosmic web is not matter suspended inside pre-existing emptiness. It is the fossil record of where adjacency has been repeatedly formed. Filaments, walls, clusters, and structured environments are precisely the places where historical hop traffic overlapped enough to crystallize a mature lattice. Your Hubble notes already frame this clearly: the web is the remnant density of the lattice itself, etched by the history of particle and motif hops.

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Book II also pushes toward the same picture through pure adjacency emergence: clusters, voids, filament networks, and curvature pockets are presented as outcomes of adjacency rules rather than pre-imposed geometry.

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So in UDEL terms:

- galaxies do not merely **occupy** space,
- filaments do not merely **sit inside** space,
- rather, these structures mark where space became most fully formed.

Between them, the situation is different. Diverging paths do not guarantee uniform infill. If outward transitions spread radially, they can leave untouched gaps between established trails. Those gaps need not be ordinary vacuum. They may instead be weakly formed adjacency regions or, in the limiting case, true nullity. Your own Hubble draft puts this sharply: the universe may be “mostly null, not space,” with expansion selectively claiming bits of nullity rather than filling a uniform container.

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This is the first major UDEL correction to standard cosmological intuition:

The universe is not a homogeneous expanse of vacuum. It is a sparse relational web embedded in regions where space is incomplete, weakly formed, or absent.

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4. Why Light Did Not Fully Form Space Everywhere

An obvious objection follows immediately:

If light and matter have been moving outward for billions of years, why didn't they already form space uniformly between the filaments?

Within UDEL, the answer is straightforward: because adjacency formation follows actual transition history, not volumetric entitlement.

A photon does not move through a pre-built container. It advances along permitted hops. Repeated motion thickens and stabilizes local adjacency. But divergence means that paths spread apart; they do not necessarily saturate all available nullity. Your toy simulation in the Hubble notes makes exactly this point: radial outward propagation leaves untouched regions between trajectories, so the result is not a filled continuum but a sparse, structured network with persistent gaps.

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That does not prove cosmology by itself, nor should it be presented that way. But it illustrates the central UDEL intuition cleanly:

selective extension does not imply complete extension.

This matters because it protects the vacuum-vs-nothing distinction from immediate collapse. If formation is path-dependent rather than background-wide, then there is no reason to expect the regions between filaments to be fully equivalent to the regions within them.

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5. The Black Hole Analogy: The Key Conceptual Bridge

The strongest conceptual bridge comes from UDEL's black-hole treatment.

In the black-hole chapter, Book II states that when matter collapses and path density becomes extreme, the lattice clock does not change. Energy still hops one tick at a time. What changes is the **spatial meaning of one tick**. Far from mass, one hop can correspond to large effective distance; near the horizon, one hop corresponds to much less. From outside, motion appears to slow. From inside, the local clock feels normal.

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The same chapter reframes redshift as **hop debt**: light emitted in a high-path-density region must traverse more effective hops to escape into a lower-density regime, and this accumulated hop cost appears as redshift and delay. It explicitly states that

gravitational redshift and cosmological redshift can be viewed as two sides of the same accounting: more or fewer hops per unit effective distance.

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This is the precise logic needed here.

The Hubble argument does **not** require that the universal lattice update ceiling itself changes. It only requires that different environments map the same underlying tick process into different effective hop-count costs and different coarse-grained spatial interpretations.

So the black-hole lesson becomes the cosmological lesson:

- in dense, mature lattice regions, hop accounting is one way;
- in sparse, frontier, or weakly formed regions, hop accounting is another;
- if both are interpreted through one homogeneous metric calibration, the inferred expansion rate can split.

That is a far cleaner and stronger statement than saying “the speed of light changes” in a naive literal sense.

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6. The Core UDEL Claim About the Hubble Tension

The proposal can now be stated precisely:

In UDEL, the lattice update ceiling is universal, but the effective distance encoded per hop depends on adjacency formation. Since cosmological observations are interpreted under an assumption of homogeneous propagation through vacuum, signals traversing differently formed adjacency regimes can generate different inferred distance-redshift relations. The apparent Hubble tension may therefore be an inference artifact produced by non-uniform space formation rather than evidence for new dark-energy sectors or a changing fundamental constant.

This preserves the strongest part of your clarification:

- the deepest rule is fixed,
- the hop budget is fixed,
- what changes is the graph the signal must traverse,
- and therefore the observational interpretation changes.

Your draft notes repeatedly push toward this in rougher language, especially by tying the cosmic web to path history and by arguing that signals through sparse or null-like regions are not equivalent to signals through mature lattice environments.

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7. How the Misread Happens

Standard cosmology typically treats the line of sight as propagation through one universal kind of background: vacuum. UDEL says that assumption is false.

If early-universe or very long-baseline signals traversed a cosmos whose adjacency structure was less mature, less uniform, or more strongly shaped by frontier formation, then the mapping between redshift, delay, and inferred distance would not match the mapping used for local signals passing through well-formed lattice neighborhoods.

The result is not necessarily “two universes” or “two laws of physics.” It is the same universe, under the same substrate law, sampled through different adjacency histories.

So the tension can be restated this way:

- **early-relic inference** assumes homogeneous propagation through what is treated as vacuum, but the underlying adjacency regime may have been less mature or differently structured;
- **late-time local inference** assumes the same calibration, even though the light has traveled mostly through already formed, trail-rich lattice environments.

If both are reduced to one metric assumption, the inferred Hubble constant can split.

This is why the claim should be framed as a **propagation calibration error**, not merely as a statement about expansion “really being different” in the ordinary sense.

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8. Why This Is More Economical Inside UDEL

Within the internal logic of UDEL, this proposal is economical because it adds no new substances and no new force law. It reuses the same substrate ingredients already used to explain gravity, redshift, black holes, and structure formation:

- nodes,
- adjacency,
- path density,
- hop limits,
- emergent distance,
- and formed versus unformed lattice structure.

The public UDEL physics page likewise presents the broader framework as one that replaces dark energy, singularities, and exotic add-ons with discrete adjacency and temporal layering. It even lists a separate Book IV chapter specifically presenting a UDEL resolution of the Hubble tension through lattice dynamics and clock interpretation.

That does not mean the idea is already proven. It means the explanation is at least **structurally native** to the framework rather than bolted on from outside.

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9. Testable Consequences

A theory like this matters only if it risks failure.

The most natural UDEL signatures would be environment-dependent propagation effects. Several already appear in your notes and related chapters:

9.1 Void vs wall line-of-sight differences

If propagation through web-dense regions and web-sparse regions is not equivalent, then observables should retain environment dependence. Signals selected through void-dominated lines of sight and wall-dominated lines of sight should not calibrate identically.

Book IV

9.2 Phase residuals correlated with structure

Book IV already proposes that expansion residuals should correlate with void fraction or potential depth along the line of sight. If high-precision surveys fail to find any environment-dependent phase signature at all, this mechanism weakens sharply.

Book IV

9.3 Timing offsets in fast transients

Your Hubble notes suggest fast radio bursts, standard sirens, or other transient signals as probes of environment-dependent propagation calibration. That is the right class of test because it directly targets line-of-sight sensitivity.

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9.4 Falsifier

If future data show that inferred expansion measures remain fully environment-independent after controlling for known effects, then the central UDEL interpretation

offered here is strongly constrained. If web density does not correlate with measurable propagation residuals, the model loses one of its cleanest handles.

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Book IV

That is not a weakness. It is exactly what a serious theory should offer.

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10. Claim Boundary

This paper is **not** claiming that every aspect of cosmology is solved by this single move. It is making a narrower claim:

1. UDEL treats space as emergent adjacency, not a given container.
2. The cosmic web marks regions of repeated space formation, not merely matter placement.
3. The regions between filaments need not be equivalent to vacuum; they may include weakly formed adjacency or nullity.
4. A homogeneous propagation assumption may therefore be wrong.
5. If so, the Hubble tension may be an artifact of forcing non-uniformly formed lines of sight into one metric calibration.

That is the claim. It is ambitious, but it is not vague.

Conclusion

The Hubble tension may not be a disagreement about how fast one smooth spacetime is expanding. It may instead be a disagreement produced by interpreting signals from different adjacency regimes as though they all traversed the same kind of space.

In UDEL, this possibility is natural. Space is not universal background. Vacuum is not the same as nothing. The cosmic web is not matter floating in emptiness, but the fossil record of where adjacency was repeatedly formed. Dense regions, sparse regions, and unformed regions are not observationally equivalent in principle. If their differences are ignored, inferred distance-redshift relations can split even while the underlying substrate law remains one and the same.

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Under that reading, the Hubble tension is not necessarily evidence that the universe demands another hidden component. It may instead be the first large-scale sign that cosmology has mistaken formed space for all space.

References and Reader Path

For readers who want the broader UDEL framework, the public physics page organizes the theory stack, excerpts, simulations, predictions, and book paths in one place. It also links directly to the relevant Book III and Book IV chapter materials, including the black-hole chapter and the Hubble-tension chapter.

Useful public entry points:

- **Physics overview / theory hub:** Physics | Tales Zone Publishing — the main public index for the Kaplan Framework, UDEL, simulations, predictions, evidence, and chapter links. https://tales.zone/physics.html
- **Genesis free theory PDF:** Theory V — Genesis / The Relational Universe — the concise public entry point for emergence, adjacency, and the relational origin of space. https://tales.zone/downloads/Theory5_UDEL_Genesis.pdf
- **Black-hole chapter PDF:** Book III • Chapter 8 — Black Holes Without Singularity — the key reference for adjacency saturation, Δt divergence, and the fixed-tick / changing spatial-meaning framing used in this paper. https://tales.zone/downloads/Book3-Chapter8.pdf
- **Hubble-tension chapter path:** Book IV • Chapter 6 — Spine Strain and the Hubble Tension — listed on the physics hub as the dedicated chapter connecting lattice dynamics, clock interpretation, and the expansion discrepancy. https://tales.zone/physics.html

For readers who want the full book versions rather than the free materials, the physics hub also serves as the cleanest path to the broader UDEL book ecosystem and its linked reading structure.