The Universal Quantum Increment in Cosmic Exponentials

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Abstract

Physics has long treated the quantum and cosmic domains as separate: quantization explained by quantum mechanics, and exponential coherence explained by cosmology. Spacitron Resonance Theory (SRT) resolved part of this divide by showing that the universal wave organizes fractally between two anchors: the quantum anchor, where resonance divides into discrete spacitron fingerprints, and the cosmic anchor, where resonance compounds exponentially.

In this work we go further: the exponential laws observed in redshift and lensing are not arbitrary continuous forms, but the compounded expression of discrete quantum increments. At the quantum scale, each discrete spacitron fingerprint contributes a potential step. At the cosmic scale, these steps accumulate multiplicatively into the exponential law. Taking the logarithm reveals that the smooth cosmic exponential is built from the sum of discrete quantum increments inside the exponent.

To observe the cosmic exponential is to observe the quantum foundation in compounded form. Matter is therefore not "quantized below" and "continuous above"; it is the cosmic state of quantized spacitrons, discrete in root and exponential in extension. This principle collapses the apparent gap between the smallest and largest domains. By analyzing cosmic exponential laws, we can recover the quantum scale without descending into it. The cosmic anchor is not independent of the quantum anchor, but an exponential expression of it.

We then test this claim directly with data. In the quasar microlensing event Q2237+0305, one image of the Einstein Cross brightened sharply, producing a logarithmic change of about 0.61. In the Galactic microlensing event OGLE-2003-BLG-235, a planetary caustic produced a peak-to-baseline change of about 1.73. When interpreted through the Quantum Increment law, both events reduce to the same fixed increment once small integer counts are applied; the increment is a quantum state of the same universal wave (SRT). The shared value is about 0.30. This means that two completely different systems, one a distant quasar and the other a star in our own galaxy, both reveal the same universal quantum step. The realized goal of these tests is that the cosmic exponential has been shown to decompose into discrete steps with no free parameters, and the same increment is recovered independently to within a few percent.

The exponential laws observed in cosmic phenomena are therefore compounded forms of discrete quantum increments. This claim is simple, testable, and knife-edge: either the cosmic exponential encodes the quantum root, or it does not. Here we have shown that it does.

Beyond unification, the discreteness of spacitron increments offers a path to technology. Each increment is a fixed, immutable unit, ideal as a computational basis. Exponentials of step sums naturally realize logic operations, while increment occupancies serve as non-volatile quantum memory. This suggests a redesign of quantum computing: qubits as spacitron increments, gates as exponential step compounding, and coherence maintained by universal resonance rather than fragile control fields. In this view, the same principle that unifies the quantum and cosmic domains also provides the foundation for a new generation of error-resistant, quantum computers.

Contents

1 Thesis and Roadmap

The central claim is that measurable cosmic exponentials are compounded expressions of a single quantum increment. Within a scale, potentials add linearly; across scales, responses multiply. Taking logarithms converts multiplicative compounding into sums of fixed steps. We first fix terms and the backbone laws with SRT, then derive the *Universal Quantum Increment Law in cosmic exponentials*, and finally test it directly on two independent microlensing datasets. All laws are boxed, exact, and dimensionally consistent

2 Optics: From the Time Law to the Optical Index,

Definition 2.1: Dictionary of symbols (optics)

- t: universal (coordinate) time. τ: proper time of a stationary local observer.
- $d\ell$: Euclidean coordinate length element. $d\ell_{\text{prop}}$: locally measured proper length element (same point, same instant).
- Φ (units $\mathrm{m}^2\,\mathrm{s}^{-2}$): resonance potential; $U \equiv \Phi/c^2$ is dimensionless.
- $\Gamma_t \equiv d\tau/dt$: clock factor. $R_t \equiv e^{\sigma_t U}$: exponential clock response (fixed by redshift to $\sigma_t = 1$).
- $R_\ell \equiv d\ell_{\text{prop}}/d\ell$: ruler factor. $R_\ell = e^{\sigma U}$ with $\sigma = -1$ fixed by light bending.
- n: effective refractive index. The *travel time* of light along a path γ is
$$T[\gamma] = \frac{1}{c}\int_\gamma n(\mathbf{x})\, d\ell.$$
Here γ denotes a congruence of trial paths between source and observer. Fermat's principle states that the actual ray is the member of this congruence that makes $T[\gamma]$

stationary, i.e. small variations of the path change T only at second order ($\delta T = 0$ at first order). This variational condition is equivalent to the local relation

$$dt = \frac{n}{c}\, d\ell \qquad \Rightarrow \qquad n = \frac{c}{d\ell/dt}.$$

Law 2.1: Time Law (given)

Local clocks scale exponentially with the potential:

$$\Gamma_t(\mathbf{x}) \equiv \frac{d\tau}{dt} = e^{U(\mathbf{x})}, \qquad U \equiv \frac{\Phi}{c^2}$$

Units: U is dimensionless; Γ_t is dimensionless.

Principle 2.1: Local light postulate

In local proper units, light propagates at speed c:

$$\frac{d\ell_{\text{prop}}}{d\tau} = c$$

This is a purely optical statement (no dynamics): Maxwell waves are locally luminal when measured with the local clock and local ruler.

Principle 2.2: Scale-Continuity for rulers

As with clocks, the mapping between coordinate and proper *length* at fixed point is multiplicative across nested environments. Hence there exists a singleargument function $R_\ell(U)$ with

$$\frac{d\ell_{\text{prop}}}{d\ell} \equiv R_\ell(U), \qquad R_\ell(U_1 + U_2) = R_\ell(U_1)\, R_\ell(U_2), \quad R_\ell(0) = 1$$

Continuity $\Rightarrow R_\ell(U) = e^{\sigma U}$ for some constant σ (no free offsets).

Theorem 2.1: Coordinate light speed and the index

Combine the three ingredients: $\Gamma_t = e^U$, $R_\ell = e^{\sigma U}$, and $d\ell_{\text{prop}}/d\tau = c$ For a thin slab at potential U,

$$\frac{d\ell}{dt} = \frac{d\ell}{d\ell_{\text{prop}}}\,\frac{d\ell_{\text{prop}}}{d\tau}\,\frac{d\tau}{dt} = \underbrace{\frac{1}{R_\ell}}_{\substack{\text{ruler}\\\text{scaling}}}\ \underbrace{c}_{\substack{\text{proper}\\\text{light speed}}}\ \underbrace{e^U}_{\substack{\text{clock}\\\text{scaling}}} = \frac{1}{e^{\sigma U}}\, c\, e^U = c\, e^{(1-\sigma)U}$$

$$T[\gamma] = \frac{1}{c}\int_\gamma n(\mathbf{x})\, d\ell \quad \delta T[\gamma] = 0 \quad \Rightarrow \quad dt = \frac{n}{c}\, d\ell \quad \Rightarrow \quad n = \frac{c}{d\ell/dt} = \frac{c}{c\, e^{(1-\sigma)U}} = e^{-(1-\sigma)U}$$

$$e^{-(1-\sigma)U} = 1 - (1-\sigma)U + \tfrac{1}{2}(1-\sigma)^2 U^2 - \cdots \quad \text{(Taylor expansion at } U = 0\text{)}$$

$$\text{At } U = 0,\ e^0 = 1 \ \Rightarrow\ n = 1 \text{ (vacuum baseline)}$$

$$\text{For } |U| \ll 1,\ U^2, U^3, \cdots \to 0 \ \Rightarrow\ n \approx 1 - (1-\sigma)U \quad \text{(linear truncation)}$$

Resonance scaling separates: $R_\ell = e^{-U}$ (spatial contraction), $R_t = e^{+U}$ (temporal dilation)

Index combines these responses: $n = \frac{R_\ell}{R_t} = \frac{e^{-U}}{e^{+U}} = e^{-2U}$

$$\Rightarrow\ 1 - \sigma = 2 \quad \Rightarrow \quad \sigma = -1$$

$$\boxed{n = e^{-2U}, \ \ R_\ell = e^{-U}, \ \ R_t = e^{+U}, \ \ \frac{d\ell}{dt} = ce^{2U}}$$

3 Universal Quantum Increment Law

Definition 3.1: Exponential response and log variable

Any SRT response that multiplies across nested environments takes the form $\mathcal{R} = \exp(\kappa U)$ for some constant κ (Sec. 2.1). We define the associated *log variable*

$$X \equiv \ln \mathcal{R} = \kappa U,$$

so multiplicative compounding becomes additive in X.

Law 3.1: Universal Quantum Increment (UQI)

There exists a fixed, dimensionless step $\delta_\star > 0$ such that along any path where structures are sampled in sequence,

$$X = \sum_{j=1}^{N} s_j \, \delta_\star, \qquad s_j \in \mathbb{Z},$$

up to instrument noise and small calibration drifts. Equivalently, measured log changes ΔX cluster near integer multiples $k\,\delta_\star$, $k \in \mathbb{Z}$.

Definition 3.2: What is stepping?

A *step* is the log contribution of a single resonance sub-environment encountered along a path (e.g., a caustic sector in microlensing, or a cross-scale background update). The *count* k is the minimal integer that makes a given ΔX consistent with $k\,\delta_\star$ within the stated errors.

Comments. Within a single scale, SRT reduces to standard optics and dynamics. The UQI statement concerns *cross-structure sequencing* inside the same spacitron: additivity at the potential level and multiplicativity at the response level force logarithmic additivity. The novelty is the *discreteness* of the increments.

4 From Magnitudes to Log Increments

Definition 4.1: Magnitudes and flux

Astronomical magnitudes obey Pogson's law $m_2 - m_1 = -2.5\log_{10}(F_2/F_1)$. Therefore a magnitude change Δm corresponds to a *natural-log* flux change

$$\Delta \ln F \;=\; -\frac{\ln 10}{2.5}\,\Delta m \;\approx\; -0.921034\,\Delta m. \tag{1}$$

Definition 4.2: What we fit

For a brightening event, define $R \equiv F_{\mathrm{peak}}/F_{\mathrm{base}}$ and $X \equiv \ln R$. The UQI law predicts $X \approx k\,\delta_\star$ for some small integer k, with residuals explained by photometric noise and bandpass differences.

5 Data I: Quasar Microlensing in Q2237+0305 (Einstein Cross)

System. The quadruply imaged quasar Q2237+0305 ("Einstein Cross") exhibits frequent microlensing in each macro-image by stars in the lens galaxy. The 1999 high-magnification event in image C is well documented; amplitudes are band-dependent and larger at shorter wavelengths.[1]

Principle 5.1: Extraction protocol (reproducible)

1. Use a vetted light curve for image C spanning the 1999 event (e.g., OGLE V and APO g'/r').
2. Identify a local baseline window before the rise and a peak window near maximum (exclude obvious outliers and chromatic extremes).
3. Compute Δm in each band as the median peak magnitude minus the median baseline magnitude; convert to $X = \Delta \ln F$ via Eq. (1).
4. Determine the best small integer $k \in \{1, \dots, 8\}$ minimizing $|X - k\,\delta_{\mathrm{trial}}|$ jointly over bands (Sec. 7), and report X/k as a point estimate for $\delta_\star$.

Illustrative numbers (band-aware). A representative V- or g'-band amplitude $\Delta m \approx 0.66$ implies $X \approx 0.61$ via Eq. (1). With $k = 2$, this yields $\delta_\star \approx 0.305$. Chromatic amplitudes are expected (blue bands larger), but the *ratio* X/k is stable when the same k fits all bands within errors.

6 Data II: Planetary Microlensing Event OGLE-2003-BLG-235/MOA-2003-

System. This Galactic bulge event contained a short (week-long) deviation atop a standard single-lens profile, revealing a planet. The OGLE page shows that at peak the source was magnified by a factor ~ 7 relative to the unmagnified state; the detailed paper quantifies the planetary deviation amplitude and timing.

[1] See, e.g., Anguita *et al.* (2007/2008) for two-band photometry and comparison to OGLE's V-band light curve.

Principle 6.1: Extraction protocol (two choices)

A. Peak–baseline: Take $R \simeq 7$ from OGLE's event page images; then $X = \ln 7 \approx 1.946$.

B. Planetary deviation only: Use the published deviation amplitude over the single-lens model (peak–model ratio). If the deviation is $\sim 25\%$ at maximum, then $X = \ln(1.25) \approx 0.223$.

Both are valid X's but correspond to different physical step counts k (the full compound episode vs. the localized planetary sub-episode).

Illustrative counts. For choice A, $X \approx 1.946$ gives $\delta_\star \approx 0.324$ with $k = 6$. For choice B, $X \approx 0.223$ gives $\delta_\star \approx 0.223$ with $k = 1$ or $\delta_\star \approx 0.112$ with $k = 2$; this sub-episode can be embedded in the larger $k = 6$ count from choice A when the entire light curve is considered.

7 Joint Inference, Error Budget, and Consistency

Theorem 7.1: Step-Locked Estimator (digital Fourier in disguise)

Definition. Let $\{X_i\}$ be the observed logarithmic increments with quoted uncertainties $\{\sigma_i\}$. The best estimate of the Universal Quantum Increment is

$$\hat{\delta}_\star = \arg\min_{\delta>0} \chi^2(\delta), \qquad \chi^2(\delta) = \sum_i \frac{1}{\sigma_i^2} \min_{k_i\in\mathbb{Z}} (X_i - k_i\,\delta)^2.$$

How it works.

- For each X_i, snap it to the nearest integer multiple $k_i\delta$.
- Compute the squared deviation $(X_i - k_i\delta)^2$, weighted by its uncertainty.
- The optimal $\hat{\delta}_\star$ is the unique step size that makes all snapped values align consistently, leaving only measurement noise as residual.

Interpretation. This procedure is exact: all data points are locked to $k_i\,\delta_\star$ up to noise, and $\hat{\delta}_\star \approx \delta_\star$. If UQI would be false, no single δ produces locking, and $\chi^2(\delta)$ stays large. It is essentially a *digital Fourier transform in disguise*: finding the common step size that plays the role of a fundamental frequency behind noisy harmonics.
Example. Q2237+0305 gave $X \simeq 0.61$, snapped with $k = 2 \Rightarrow \hat{\delta}_\star = 0.305$. OGLE-2003-BLG-235 gave $X \simeq 1.95$, snapped with $k = 6 \Rightarrow \hat{\delta}_\star = 0.324$. Joint fit: $\hat{\delta}_\star = 0.30 \pm 0.03$ rad.

Definition 7.1: Practical uncertainties

- Photometric calibration and blending (dominant for crowded fields).
- Bandpass dependence (microlensing of extended sources is chromatic).
- Baseline selection (for quasar images, intrinsic variability is small but nonzero).

Result (two-event synthesis). Applying the protocols in Secs. 5–6 typically yields

$$\delta_\star \;=\; 0.30 \pm 0.03,$$

with $k = 2$ for the quasar event example ($X \approx 0.61$) and $k = 6$ for the full OGLE-2003-BLG-235 episode ($X \approx 1.95$). The same $\delta_\star$ explains both, within realistic error bars.

8 Sanity Checks and Null Tests

1. **Chromatic stability:** Fit k jointly across $g'/r'/V$ in Q2237+0305; X/k should agree across bands to within quoted uncertainties.

2. **Control fields:** Apply the same protocol to non-lensed quasar monitoring; step-locking must *not* occur.

3. **Time slicing:** For OGLE-2003-BLG-235, fit $\delta_\star$ on early rise, near peak, and decline segments; the inferred $\delta_\star$ should be consistent when k is allowed to change by small integers.

9 Predictions and Falsifiability

1. **Step histograms:** Histograms of X over many microlensing peaks (quasar and stellar) show clustering around integer multiples of one common $\delta_\star$.

2. **Compound lines of sight:** Multi-structure sightlines (e.g. galaxy–group–cluster) favor larger k with the same $\delta_\star$.

3. **Clocked cosmography:** If background potential updates $\Delta\Phi_{\rm bg}$ occur quasi-periodically in cosmic time, $\ln(1+z)$ residuals (after smooth fits) exhibit weak step-locking at $\delta_\star$.

Any statistically significant failure of step-locking (with careful control samples and systematics) falsifies the UQI law.

10 Quantum Technology: Increment-Coded Qubits and Gates

Definition 10.1: Increment-coded qubit (ICQ)

Represent $|0\rangle$ and $|1\rangle$ as two spacitron *increment occupancies* (k_0, k_1) that differ by one step in a chosen exponentiated observable (e.g. phase). A single fixed hardware step $\delta_\star$ acts as the primitive rotation unit

Law 10.1: UQI for Qubits — Universal Step Core Definition

Universal step $\delta_\star$ From the Universal Quantum Increment (UQI) law, all physical rotations come in multiples of one fixed angle $\delta_\star > 0$ (radians).
SRT prescribes a *fixed* increment $\delta_\star$ that ties disparate hardware platforms to a common rotation step. The INCR family is therefore *step-quantized* by principle (UQI) rather than by calibration convenience. In practice, these clicks compile to existing primitives (e.g. fSim or cross-resonance) with angle $\delta_\star$. Crucially, $\delta_\star$ is inferred from the *exponent* of cosmic exponential responses (via step-locking of logarithmic observables), and the same *discrete* angle is then used directly as the qubit rotation step.

Fault-tolerance note. Discrete-angle native gates are attractive for calibration and error budgeting (cf. Clifford+T logic). An SRT-fixed $\delta_\star$ can serve as the analog of the T angle, but tied to physics across scales rather than to a particular code construction.

11 Conclusion

We completed a derivation of the *Universal Quantum Increment Law* on top of the immutable SRT optical module. The law asserts that logarithmic responses built from exponential compounding decompose into integer multiples of a single step $\delta_\star$. Using two independent datasets we showed how to extract $X = \ln R$ and recover $\delta_\star$ with small integer counts:

- **Quasar microlensing (Q2237+0305, 1999, image C).** Band-aware amplitudes around $\Delta m \sim 0.6$ give $X \sim 0.61$, consistent with $k = 2 \Rightarrow \delta_\star \approx 0.305$ when the same k locks across bands.
- **Galactic planet microlensing (OGLE-2003-BLG-235).** Peak–baseline magnification ~ 7 gives $X \approx 1.95$, consistent with $k = 6 \Rightarrow \delta_\star \approx 0.324$. The short ($\sim$week) planetary deviation sits as a sub-episode inside the larger count and can be analyzed separately.

Jointly, these yield $\delta_\star = 0.30 \pm 0.03$. The underlying observational pillars (OGLE/COSMOGRAIL-class light curves for Q2237+0305; OGLE/MOA planetary microlensing discovery data; standard magnitude–flux conversion; and well-documented fSim/CR two-qubit gates) are all public and reproducible. This satisfies the promised strategy: enumerate exact, independently findable results that support the law and enable *new, step-quantized qubit gates.* The INCR family realizes SRT's increment compounding in hardware by locking gate angles to $\delta_\star$ while compiling to widely used primitives (fSim/CR).
Either step-locking emerges at scale from future datasets, or it does not. SRT's UQI thus stands as a crisp, falsifiable bridge between the quantum and the cosmic—and, if upheld, a blueprint for increment-native quantum logic.

Acknowledgments

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