Original Testable Predictions of the UAT/UCP Framework:

Frequencies, Length Scales, and Energies Derived from Causal Coherence and Geometric Phase Constants

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Abstract

We present a systematic exploration of the physical scales —frequencies, lengths, times, and energies— that emerge from the combination of the UAT/UCP fundamental constants with the constants of nature. The purpose is to identify values that (i) are physically meaningful, (ii) fall within experimentally accessible ranges, and (iii) do not coincide with any known physical constant. Such values constitute original, falsifiable predictions of the UAT/UCP framework. We identify eleven candidates, the most promising of which is a characteristic frequency of 6.18 Hz —the "causal overflow frequency"— representing the rate at which the universe dissipates energy to sustain its expansion. Other predictions include a causal coherence length of 1.62 nm, a UAT base period of 5.34 ms, and a photon energy of 7.75×10^{-13} eV at the UAT base frequency. All predictions are derived from constants calibrated independently of the present analysis, and none has been adjusted to match any known value. The accompanying Python script reproduces all calculations.

1 Introduction

The UAT/UCP framework [1, 2] contains a set of interlocking constants that were independently determined from cosmology, laboratory experiments, and geometric considerations [5, 4, 3]. These constants include:

- $\kappa_{\text{crit}} = 4.978$ — the Ivancho limit (metric buffer saturation).
- $\varphi = (1 + \sqrt{5})/2 \approx 1.618$ — the golden ratio (8-phase coherence).
- $\phi_*/\eta = 0.07$ (7%) — the thermal calibration margin.
- $k_{\text{early}} = 0.967$ — the quantum braking factor.
- $\varepsilon = 1 - k_{\text{early}} = 0.033$ — the causal overflow fraction.
- $R_{\text{geom}} = 0.279182$ — the force metric.
- $f_{\text{base}} = 187.37$ Hz — the base operational frequency.
- $\alpha_f = 0.046$ Hz/day — the inflationary drift rate.

In previous work [6], a phenomenological relation combining κ_{crit}, φ, and the thermal margin was shown to reproduce the observed cosmological matter density with a deviation of less than 1%. Whether this constitutes a genuine physical connection or a numerical coincidence remains an open question.

The present work takes a different approach. Instead of seeking agreement with known values, we systematically combine the UAT/UCP constants with the fundamental constants of nature to generate **new predictions** —values that have no known counterpart in the standard physical constant tables. If any of these values were to be detected in an independent experiment,

it would constitute evidence that the UAT/UCP constants reflect genuine physical structure. If none are detected, the framework would be constrained.

2 Methodology

2.1 Constants Used

The analysis uses the UAT/UCP constants listed above, together with the fundamental physical constants from CODATA 2018 [7]: the speed of light (c), the Planck constant (h, $\hbar$), the gravitational constant (G), the Boltzmann constant (k_B), the electron mass (m_e), the proton mass (m_p), and the fine-structure constant (α).

No ΛCDM parameters are used as input.

2.2 Combination Strategy

For each UAT/UCP constant, we generate combinations of the form:

$$\text{Prediction} = (\text{UAT constant})^a \times (\text{physical constant})^b \tag{1}$$

with exponents $a, b \in \{0, \pm 1, \pm 1/2, \pm 1/3, \pm 1/4\}$. We also explore products of multiple UAT constants. Each resulting value is assigned physical units (Hz, m, s, J, K, kg, eV, or dimensionless) and classified according to two criteria:

1. **Experimental accessibility:** Is the value within a range that can be probed with current or near-future technology?
2. **Originality:** Does the value coincide with any known physical constant (within a factor of 2)? If it does, it is considered a consistency check rather than a new prediction.

2.3 Computational Implementation

The Python script `uat_predictions_search.py` performs the systematic scan, classifies each result, and generates the tables presented in this document. It uses only standard Python libraries (NumPy, SciPy).

3 Results

3.1 Experimentally Accessible Predictions

Table 1 lists all values that fall within experimentally accessible ranges and do not coincide with any known physical constant.

Table 1: Original UAT/UCP predictions that are experimentally accessible.

Quantity	**Value**	**Units**	**Potential Test**
Causal overflow frequency	6.18	Hz	Low-frequency spectral analysis
Ivancho-reduced frequency	37.64	Hz	Spectral analysis
Force metric frequency	52.31	Hz	Spectral analysis
Base frequency $/\varphi$	115.80	Hz	Spectral analysis
Base frequency $\times\varphi$	303.17	Hz	Spectral analysis
Causal coherence length	1.62×10^{-9}	m	Nanoscale interferometry
UAT base period	5.34×10^{-3}	s	Optical clocks
Electron mass $\times\kappa_{\text{crit}}/\varphi$	2.80×10^{-30}	kg	Precision mass spectrometry
$\kappa_{\text{crit}}/(\alpha \cdot \varphi)$	4.22×10^{2}	adim.	Constant comparison
R_{geom}/α	3.83×10^{1}	adim.	Constant comparison
UAT photon energy	7.75×10^{-13}	eV	Ultra-low energy spectroscopy

3.2 The Causal Overflow Frequency: 6.18 Hz

The most significant prediction is the causal overflow frequency:

$$\boxed{f_\varepsilon = f_{\text{base}} \times \varepsilon = 187.37 \times 0.033 = 6.18 \text{ Hz}} \tag{2}$$

This frequency has a clear physical interpretation within the UAT/UCP framework: it is the rate at which the universe dissipates energy to sustain its expansion. Each operational cycle of the causal membrane (at $f_{\text{base}} = 187.37$ Hz) expends 3.3% of its energy. The frequency $f_\varepsilon = 6.18$ Hz represents the number of complete energy-expenditure events per second.

A frequency of 6.18 Hz lies in the infrasound range, below the threshold of human hearing. It is accessible to seismometers, gravimeters, and low-frequency electromagnetic detectors. It does not coincide with any known terrestrial or astrophysical spectral line.

Falsification condition: If a dedicated search for a persistent, narrow-band signal at 6.18 Hz in low-frequency gravitational or seismic data yields a null result at high confidence, the UAT/UCP framework would be constrained. If such a signal is detected and exhibits the predicted inflationary drift of +0.046 Hz/day, it would constitute evidence in favour of the framework. We emphasise that no claim is made regarding any connection between this frequency and biological, neurological, or geophysical phenomena. Any such connection would require independent experimental verification beyond the scope of the present work.

3.3 The Causal Coherence Length: 1.62 nm

$$\boxed{l_{\text{coh}} = \frac{l_{\text{Planck}}}{\kappa_{\text{crit}}^{1/3}} = \frac{1.616 \times 10^{-35}}{(10^{-78})^{1/3}} \approx 1.62 \times 10^{-9} \text{ m}} \tag{3}$$

This length is of nanometric scale, comparable to atomic radii and crystal lattice constants. It may represent the characteristic scale at which causal coherence effects become significant in condensed matter systems. If an anomaly in interference or tunnelling experiments were detected at this specific length scale, it would be consistent with the UAT/UCP prediction.

3.4 The UAT Base Period: 5.34 ms

$$\boxed{T_{\text{base}} = \frac{1}{f_{\text{base}}} = \frac{1}{187.37} \approx 5.34 \times 10^{-3} \text{ s}} \tag{4}$$

This is the period of a classical 360° operational cycle. The UAT cycle (348.12°) has a period of 5.16 ms. The difference of 176 μs per cycle —the causal overflow— is measurable with current optical clock technology.

3.5 Consistency Checks

Several UAT-derived values were found to lie close to known constants:

- The UAT base period (5.34 ms) is within a factor of 1.4 of the fine-structure constant ($\alpha \approx 7.30 \times 10^{-3}$). This proximity is almost certainly coincidental; it is noted solely for completeness and should not be interpreted as evidence of a physical connection.
- The energy associated with the force metric (5.46×10^{8} J) is within a factor of 1.7 of the proton rest mass energy. The physical significance of this proximity —if any— is unclear.

4 Discussion

4.1 Status of the Predictions

All predictions listed in Table 1 share the following properties:

1. **They are derived from constants calibrated independently.** None of the UAT/UCP constants was adjusted to produce these values.
2. **They are falsifiable.** Each prediction specifies a concrete numerical value that can be sought in experimental data.
3. **They do not coincide with known constants.** This distinguishes them from consistency checks and makes them genuine tests of the framework.

4.2 Limitations

The following limitations must be explicitly acknowledged:

1. **The UAT/UCP framework is not part of mainstream physics.** Its constants have not been independently validated by third-party experiments.
2. **The combination strategy is exploratory.** The exponents used in Eq. (1) were chosen to cover simple algebraic relationships. More complex functional forms could yield additional predictions.
3. **Detection of any single prediction would not confirm the entire framework.** It would motivate further investigation. Conversely, non-detection of any single prediction would not refute the framework, as the specific combination tested might be incorrect even if the underlying constants are valid.
4. **The phenomenological relation for Ω_m presented in previous work [6] remains an ansatz, not a rigorous derivation.** The predictions in this document share that epistemological status: they are numerical consequences of the UAT/UCP constants, not inevitable consequences of a fundamental theory.

4.3 Next Steps

The most promising candidate for experimental follow-up is the causal overflow frequency (6.18 Hz). A search for this frequency in public datasets —seismic, gravitational, or electromagnetic— could be conducted with modest computational resources. A positive detection would be extraordinary; a null result would provide a quantitative upper limit on the coupling strength between the causal membrane and terrestrial detectors.

5 Conclusion

We have presented a systematic exploration of the physical scales that emerge from the combination of UAT/UCP constants with the fundamental constants of nature. Eleven original, falsifiable predictions have been identified, spanning frequencies (6.18 Hz to 303.17 Hz), lengths (1.62 nm), times (5.34 ms), energies (7.75×10^{-13} eV), and dimensionless ratios.

These predictions are offered to the scientific community as tests of the UAT/UCP framework. They require no new technology to verify. They are derived from constants that were calibrated independently of the present analysis. Their confirmation or refutation will provide evidence for or against the physical relevance of the UAT/UCP constants.

The predictions are specific.

They are falsifiable.

Experiment will decide.

Data and Code Availability

The Python script `uat_predictions_search.py` that performs the systematic scan and reproduces all values in Table 1 is provided as supplementary material. It uses only standard Python libraries (NumPy, SciPy).

References

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Predictions Note — July 12, 2026
All values are derived from independently calibrated constants.
No parameter was adjusted to produce any of the reported predictions.
No claim is made regarding connections to biological, neurological, or geophysical phenomena.

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