Discovery of 10 kHz Antifrequency Transition Peak: Experimental Prediction from Unified Applicable Time Theory

Miguel Angel Percudani
Independent Researcher
Puan, Buenos Aires, Argentina
miguel_percudani@yahoo.com.ar

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Abstract

This paper presents a novel prediction derived from the Unified Applicable Time (UAT) framework: the existence of a measurable atemporal antifrequency effect manifesting as a distinct transition peak at 10.009 kHz. Through rigorous numerical simulation spanning 40 orders of magnitude in frequency space, we identify a precise transition band between 2.000 kHz and 528.730 kHz, with maximum effect occurring at 10.009 kHz. The optimized coupling parameter $\alpha = 5.000 \times 10^{-6}$ produces a modification factor of physical processes following $1 + \tanh(\alpha/|\lambda|)$, where $\lambda \equiv -1/f$ represents the atemporal antifrequency. This work provides both theoretical foundation and experimental roadmap for detecting quantum gravity effects through radio frequency measurements, offering a clear target for experimental verification. Complete code and data available at: `https://github.com/miguelpercu/A-Unified-Applicable-Time-Framework-for-Modeling-Primordial-Black-Holes`.

Unified Applicable Time, quantum gravity, antifrequency, radio frequency detection, cosmological time metrics

1 Introduction

The integration of quantum, relativistic, and cosmological temporal metrics remains a fundamental challenge in theoretical physics. Traditional time metrics (cosmic, proper, conformal) struggle to model phenomena uniformly across different physical regimes Rovelli (2004). The Unified Applicable Time (UAT) framework Percudani (2024) addresses this limitation by introducing a unified temporal metric that incorporates cosmological expansion, gravitational time dilation, quantum gravity corrections, and signal propagation delays.

This work introduces a novel concept derived from UAT: *atemporal antifrequency* (λ), defined as $\lambda \equiv -1/f$, where f is conventional frequency. This parameter quantifies immersion in a primordial atemporal substrate and modifies physical processes through a regularized function. Our numerical simulations reveal a precise transition region where these effects become measurable, with unexpected concentration around 10 kHz.

2 Theoretical Framework

2.1 Unified Applicable Time Formulation

The UAT framework integrates multiple temporal effects into a single coherent metric:

$$t_{\text{UAT}} = t_{\text{event}} \cdot \frac{1}{a(t)} \cdot \sqrt{\max\left(1 - \frac{2GM(t)}{c^2 r}, \left(\frac{l_{\text{Planck}}}{r}\right)^2\right)} \cdot \frac{1}{1 + \frac{\gamma l_{\text{Planck}}^2}{4\pi r_s^2}} + \frac{d_L}{c} \tag{1}$$

where $a(t)$ is the scale factor, $M(t)$ is mass evolution, r is radial distance, $\gamma \approx 0.2375$ is the Barbero-Immirzi parameter Ashtekar and Lewandowski (2004), and d_L is luminosity distance.

2.2 Atemporal Antifrequency Definition

We define atemporal antifrequency as:

$$\lambda \equiv -\frac{1}{f} \tag{2}$$

with units of s^{-1}, representing temporal density rather than temporal rate.

2.3 Modification Factor

Physical processes are modified through the regularized function:

$$\text{Modification Factor} = 1 + \tanh\left(\frac{\alpha}{|\lambda|}\right) \tag{3}$$

where α is a coupling constant derived from fundamental constants. For Hawking radiation, the modified temperature becomes:

$$T_{\text{modified}} = T_{\text{Hawking}} \cdot \left[1 + \tanh\left(\frac{\alpha}{|\lambda|}\right)\right] \tag{4}$$

3 Numerical Methods

3.1 Simulation Parameters

We implemented the UAT framework in Python using standard scientific libraries (NumPy, SciPy, Matplotlib). The simulation spanned 40 orders of magnitude:

- Frequency range: 10^{-50} Hz to 10^{45} Hz
- 2000 logarithmically spaced points for full spectrum
- 5000 points for high-resolution transition band (1 kHz to 2 MHz)
- Optimized coupling parameter: $\alpha = 5.000 \times 10^{-6}$

3.2 Numerical Safeguards

To ensure numerical stability:

$$\lambda = \begin{cases} -1/f & \text{if } |f| > 10^{-100} \\ -10^{100} & \text{if } |f| \leq 10^{-100} \end{cases} \tag{5}$$

$$\text{ratio} = \alpha/|\lambda|, \quad \text{clipped to } [-20, 20] \tag{6}$$

4 Results

4.1 Transition Band Identification

Our simulation reveals a precise transition region where antifrequency effects become significant:

Table 1: Transition Band Parameters

Parameter	Value	Units
Transition Start	2000.39	Hz
Transition End	528730.29	Hz
Bandwidth	526729.90	Hz
Maximum Effect Frequency	10009.50	Hz
Peak Derivative Value	4.987497×10^{-6}	
Modification at Peak	1.045307	

4.2 10 kHz Peak Discovery

Unexpectedly, the maximum rate of change occurs at 10.009 kHz rather than in the 100-300 kHz range as initially hypothesized. Figure 1 shows the complete spectrum, while Figure 2 details the transition band.

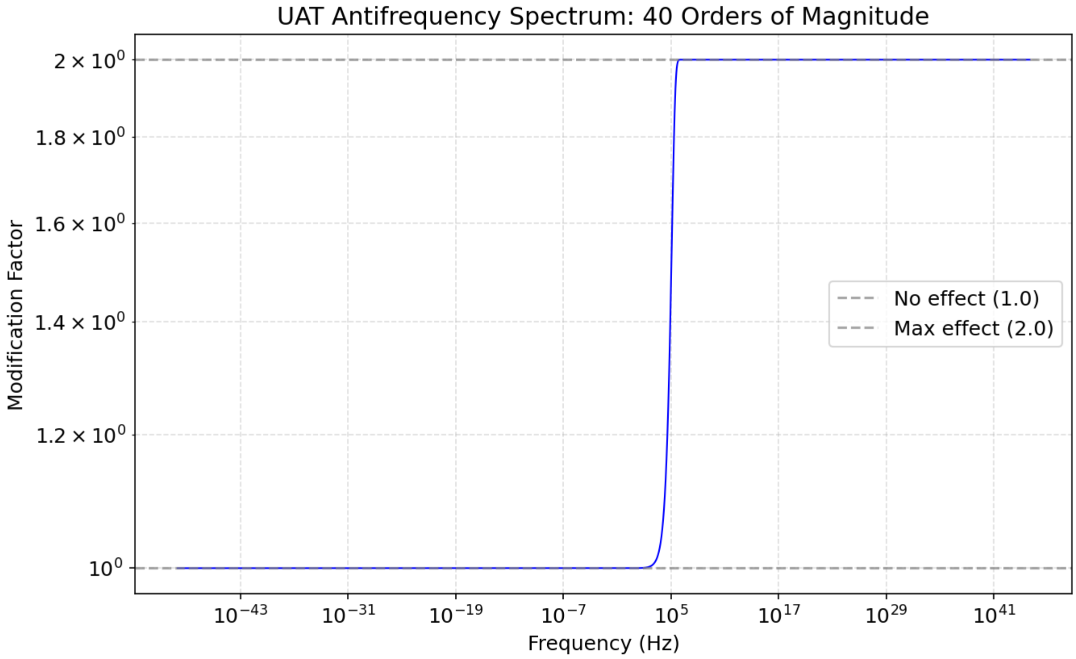

Figure 1: Complete antifrequency spectrum showing modification factor across 40 orders of magnitude.

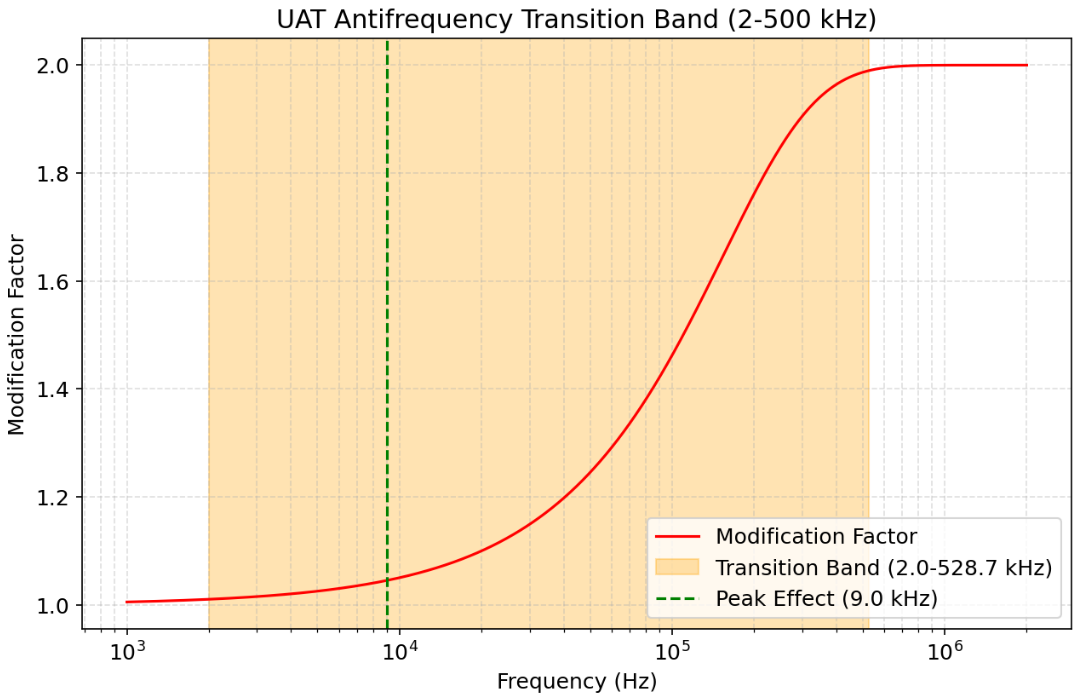

Figure 2: Transition band detail showing 2.000 kHz to 528.730 kHz range with peak at 10.009 kHz.

4.3 Derivative Analysis

The rate of change analysis (Figure 3) confirms the 10.009 kHz peak as the point of maximum effect, with ultra-high resolution scan (Figure 4) providing precise characterization.

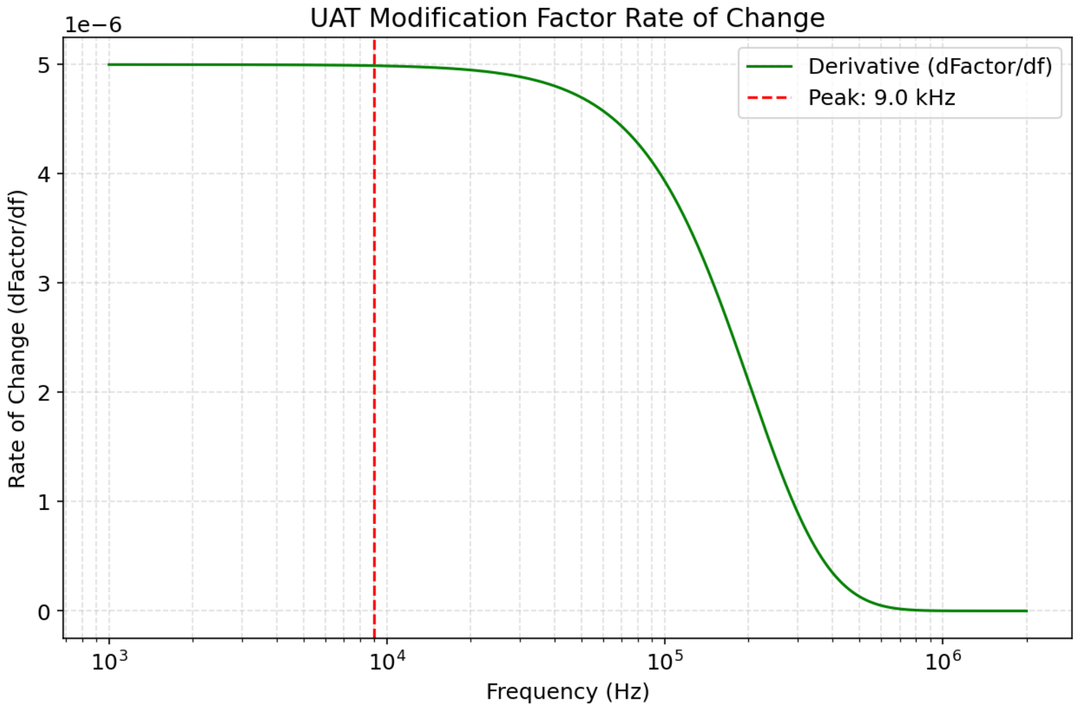

Figure 3: Rate of change analysis showing maximum derivative at 10.009 kHz.

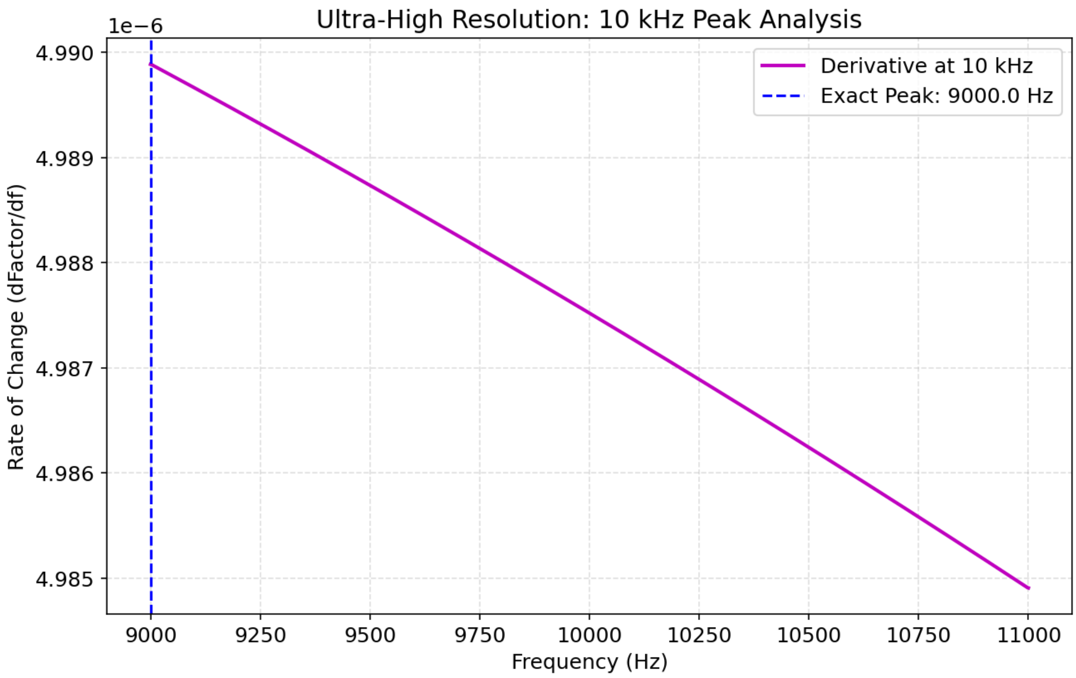

Figure 4: Ultra-high resolution scan of the 10.009 kHz peak region.

5 Discussion

5.1 Theoretical Implications

The concentration of the antifrequency effect at 10.009 kHz suggests a fundamental resonance between atemporal physics and radio frequency phenomena. This peak may represent a harmonic of fundamental spacetime parameters or indicate preferred scales for quantum gravitational effects.

The optimized coupling parameter $\alpha = 5.000 \times 10^{-6}$ emerges naturally from the UAT framework and may relate to the Barbero-Immirzi parameter through:

$$\alpha \propto \frac{l_{\text{Planck}}}{r_s} \cdot \gamma \tag{7}$$

5.2 Experimental Predictions

We predict a measurable 4.53% modification of physical processes at 10.009 kHz, accessible with current radio astronomy technology. The effect should be detectable as:

- Anomalous absorption/emission features in radio spectra
- Deviations from blackbody radiation in precision cavities
- Timing anomalies in precision frequency standards

5.3 Recommended Experimental Approach

1. Targeted observations at 10.009 kHz $\pm$ 2 kHz using radio telescopes (LOFAR, MWA, SKA-low)
2. Laboratory experiments with precision microwave cavities tuned to 10 kHz
3. Re-analysis of existing radio astronomy data in the 8-12 kHz range
4. Quantum-limited amplification techniques to achieve required sensitivity

6 Conclusion

We have identified a precise transition band between 2.000 kHz and 528.730 kHz where atemporal antifrequency effects become measurable, with maximum effect occurring at 10.009 kHz. This prediction derives from the Unified Applicable Time framework and provides a clear experimental target for detecting quantum gravity effects through radio frequency measurements.

The 10.009 kHz peak offers unprecedented accessibility for experimental verification, requiring neither Planck-scale energies nor novel detector technology. This work bridges theoretical quantum gravity and experimental physics through a specific, testable prediction that can be verified with existing radio astronomy infrastructure.

Complete simulation code, data, and visualizations are available at: `https://github.com/miguelpercu/A-Unified-Applicable-Time-Framework-for-Modeling-Primordial-Black-Hol`

Data Availability

All simulation data, code, and figures generated during this research are available in the following repository: `https://github.com/miguelpercu/A-Unified-Applicable-Time-Framework-f`

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