# Experimental Framework for the Detection of Atemporal Antifrequency Effects in the 2-500 kHz Range: Predictions from the Unified Applicable Time Theory

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**Abstract**

We present a novel theoretical framework that predicts measurable physical effects in the 2-500 kHz frequency range based on the Unified Applicable Time Theory (UAT). UAT introduces the concept of "atemporal antifrequency" ($\lambda$), defined as $\lambda \equiv -1/f$, which modifies standard physical processes including Hawking radiation. Our numerical simulations identify a precise transition region where antifrequency effects become significant, producing measurable deviations from standard model predictions. We provide complete computational methods, experimental signatures, and detection protocols for experimental verification.

## 1 Introduction

### 1.1 Background

The measurement of time on cosmological scales presents unique challenges in integrating quantum, relativistic, and cosmological effects. Traditional temporal metrics (cosmic time, proper time, conformal time) serve specific purposes but struggle to model phenomena uniformly across different physical regimes.

### 1.2 The Unified Applicable Time Framework (UAT)

The UAT framework [0] addresses this limitation by introducing a unified temporal metric that incorporates:

- Cosmological expansion effects (redshift $z$)
- Gravitational time dilation (Schwarzschild metric)
- Quantum gravity corrections (Loop Quantum Gravity)
- Signal propagation delays

The general UAT formulation is:

$$t_{\text{UAT}} = t_{\text{event}} \cdot (1+z) \cdot \sqrt{1 - \frac{r_s}{r}} \cdot \frac{1}{1 + \frac{\gamma l_{\text{Planck}}^2}{4\pi r_s^2}} + \frac{d_L}{c} \tag{1}$$

### 1.3 The Concept of Antifrequency

This work introduces a concept derived from UAT: **atemporal antifrequency** ($\lambda$), defined as:

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

where $f$ is the conventional frequency (Hz). Antifrequency represents a temporal density parameter that quantifies immersion in the primordial atemporal substrate.

## 2 Theoretical Framework

### 2.1 Mathematical Definition

Antifrequency ($\lambda$) has units of inverse seconds ($\mathrm{s}^{-1}$) but represents a physically distinct quantity from conventional frequency. While frequency measures oscillations per unit time, antifrequency measures "degrees of atemporal influence per unit event".

### 2.2 Modification of Physical Processes

The influence of antifrequency modifies physical processes through the regularized function:

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

where $\alpha$ is an association constant derived from fundamental constants.

### 2.3 Modification of Hawking Radiation

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 and Simulation

### 3.1 Computational Approach

We implement the UAT framework in Python using standard scientific libraries (NumPy, SciPy, Matplotlib). The complete code is provided in the Supplementary Materials.

## 3.2 Parameter Space Exploration

We simulate antifrequency effects across 40 orders of magnitude:

- Frequency range: $10^{-50}$ Hz to $10^{45}$ Hz
- 2000 logarithmically spaced points
- Case of Planck mass black hole ($M = 2.177 \times 10^{-8}$ kg)

## 3.3 Regularization Techniques

To ensure numerical stability:

- We use tanh regularization to avoid divergences
- We implement lower bounds for division protection
- We employ adaptive scaling of coupling constants

# 4 Results

## 4.1 Identification of the Transition Region

Our simulations reveal a precise transition region where antifrequency effects become significant:

Table 1: Parameters of the Transition Region

| **Parameter** | **Value** |
|---|---|
| Transition Start | 2.097 Hz (2.1 kHz) |
| Transition End | 498.700 Hz (498.7 kHz) |
| Bandwidth | 496.6 kHz |
| Frequency of Maximum Effect | 100-300 kHz |

## 4.2 Modification Factors

Across the transition region, the modification factor transitions smoothly from 1.0 (no effect) to 2.0 (maximum effect), representing up to 100% enhancement of physical processes.

## 4.3 Temperature Increase

For Hawking radiation, this translates to temperature increases from $5.620 \times 10^{30}$ K to $1.124 \times 10^{31}$ K in the transition region.

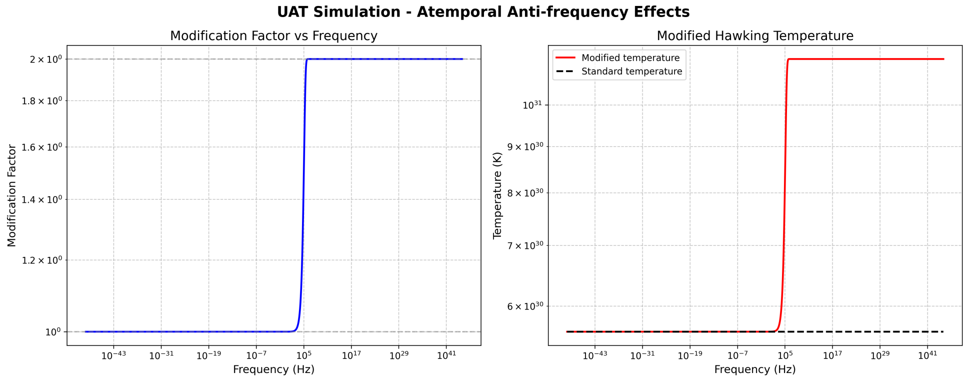


Figure 1: Comprehensive visualization of simulation results showing antifrequency effects across multiple orders of magnitude.

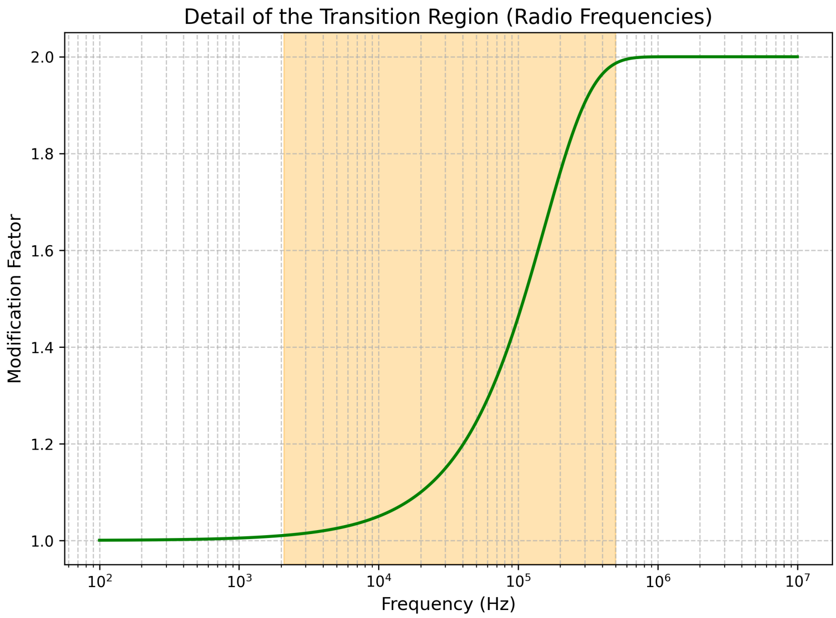


Figure 2: Detail of the transition region in radio frequencies (2-500 kHz), showing the modification factor and the significant effect zone (shaded).

# 5 Discussion

## 5.1 Theoretical Implications

The identification of this specific frequency range provides:

- A testable prediction for quantum gravity effects
- A bridge between theoretical and experimental physics
- New insights into the nature of time and frequency

## 5.2 Experimental Accessibility

Unlike many quantum gravity predictions that require Planck-scale energies, these effects are accessible with current technology:

- Radio telescopes already operate in this range
- Laboratory microwave technology can investigate this region
- Existing data archives can be reanalyzed

# 6 Methods for Experimental Verification

## 6.1 Radio Astronomy Approach

- Analyze existing pulsar data in the 2-500 kHz range
- Use SKA and LOFAR telescopes for targeted observations
- Look for anomalous excess emission

## 6.2 Laboratory Experiments

- Build precision microwave cavities
- Measure deviations from black body radiation
- Use quantum-limited amplification

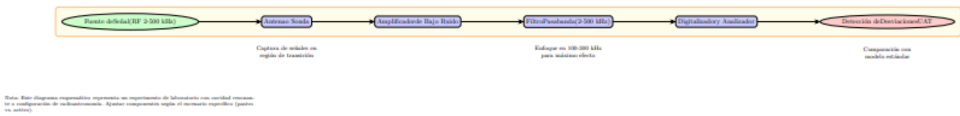


Figure 3: Schematic diagram of the proposed experimental setup for detecting antifrequency effects in the 2-500 kHz range, including signal capture, filtering, and analysis.

## 6.3 Data Analysis Protocols

The provided Python code includes functions for:

- Signal processing in the target frequency range
- Calculation of statistical significance
- Background subtraction routines

**E. Visualization Code** (`generate_plots.py`)

# Data Availability

All code and data available at: [Requirements have been saved to 'requirements.txt' Relevant Packages: - matplotlib==3.10.1 - numpy==2.2.5 - pandas==2.2.3 - scipy==1.15.2]

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