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The CAT's Tail: Unraveling Five Signatures in the CMB Spectrum

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ABSTRACT

This article elucidates the Cosmic Antiproton Tomography (CAT) model's unique perspective on the Cosmic Microwave Background (CMB), highlighting specific signatures that reveal more about the early universe's structure than previously understood. The fundamental CAT, derived from the antiproton annihilations, aligns closely with the CMB's observed spectrum. However, its true significance lies in the additional granularity provided by CAT harmonics, offering deeper insights into the universe's early dynamics and structure.

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Introduction

This article demonstrates that the CAT (Cosmic Antiproton Tomography) model not only offers a fresh perspective on the Cosmic Microwave Background (CMB) but also identifies specific signatures that delineate more details about the early universe's structure than previously recognized.

The CAT fundamental is derived from the average of all photons emitted by antiproton annihilations within a nominal zero time frame, accounting for 99% of the CMB's intensity and matching the CMB spectrum with a 1.1% error. However, this average, akin to a carrier signal, does not map the initial cosmic structures, as it represents merely a mean value across a broad spectrum of phenomena.

In analogy, consider an image composed of black and white dots, averaging to a mid-tone gray of 0.5. This average alone does not represent the detailed picture, but rather the overall tone. Similarly, the CAT fundamental provides a baseline 'X-ray' of the universe, tracing its path through space and time. As it travels through hydrogen clouds or near gravitational lenses, its intensity and trajectory are subtly altered, providing insights akin to an X-ray of cosmic structures.

Furthermore, four CAT harmonics provide additional layers of detail as presented in table 1.
These harmonics, like the pixels in our gray-scale image analogy, provide granularity and depth, enabling the creation of multiple images or 'filters' at various frequency bands from the original spectrum. Each harmonic depends on the intensity at the time of its creation, which in turn depends on the time taken for antiproton annihilation—this duration varies with hydrogen density, providing PET-like tomographic signals of the early universe, albeit using antiprotons instead of positrons.

Thus, while the CMB has traditionally been viewed as a single-image snapshot of the universe, the CAT model allows us to generate at least five distinct images, each offering unique insights and potentially richer information about the cosmos's structure and early dynamics.

Table 1: Characteristics of CAT Harmonics found in COBE CMB Spectrum

Harmonic	Δt (ns) [1]	Density [2]	Amplitude [3]	Participation(%) [4]	$K_{Dispersion}$[5]	WL_{Shift} (mm) [6]
CAT0	8.975	0.36	0.240	25.33	0.84	0.40
CAT1	-1.067	1.27	-0.343	36.31	1.69	0.00
CAT2	-1.332	1.36	0.100	10.49	1.8	0.22
CAT3	-2.051	1.70	-0.264	27.88	4.10	0.41

The Big Bang Theory

The Big Bang theory, grounded in Hubble's observations, posits that the universe originated from a singular, extremely dense, and hot point, which has been expanding over time [1]. It accounts for the early formation of hydrogen and helium and asserts the existence of Cosmic Microwave Background (CBM) radiation as remnants of the initial hot, dense state. Despite its success in elucidating many cosmic phenomena, the Big Bang theory has shortcomings, especially concerning the uniformity of the universe and the matter-antimatter distribution.

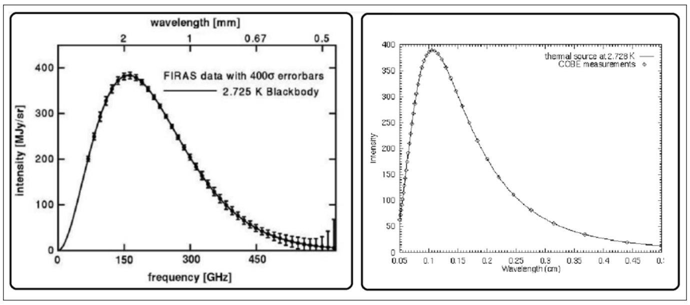


Figure 1: Comparison of the CMB spectrum as measured by FIRAS and the COBE satellite. Both spectra match the blackbody radiation profile at a temperature of 2.725K, but they display peak wavelengths at 1.1mm and 2.2mm respectively. These discrepancies are found across various sources, and it appears that the 2.2mm peak is closer to the expected frequency of 160.4 GHz, corresponding to a wavelength of approximately 1.87mm. This discrepancy might be attributed to an error in reporting or interpreting data

Cosmic Inflation Theory

The Cosmic Inflation Theory, proposed in 1979 by physicist Alan Guth to address certain cosmological puzzles in the Big Bang Theory, suggesting a period of exponential expansion shortly after the universe's inception. This rapid expansion, driven by a hypothetical inflationary field referred to as the Inflaton field, aims to explain the observed uniformity of the cosmic microwave background radiation and the large-scale structure of the cosmos [2]. According to the theory, the universe expanded from a microscopic to a macroscopic scale in a fraction of a second, setting the stage for the formation of galaxies, stars, and planets.

To this day, within the Big Bang model framework, the core concept of cosmic inflation is widely accepted. However, there lacks concrete experimental data on cosmic inflation that would, for instance, allow for the precise calculation of its occurrence and the detailing of its main parameters.

This gap is now being bridged by the CAT model. As cosmic inflation underpins the CAT spectrum signature, it offers a comprehensive account of the events at the dawn of the universe, predicated on the inflaton field. This approach not only establishes a theoretical foundation to understood our universe origin but also furnishes evidence for the existence of the inflaton and enables the detailed calculation of its characteristics, including its duration of about 1777 nano seconds.

The Cosmic Microwave Background (CMB)

The Cosmic Microwave Background (CMB) is a relic of radiation that offers a glimpse into the universe's conditions only 380,000 years after the Big Bang, marking the era when the universe became transparent. The CMB's near-uniform background of microwave radiation, with a temperature of approximately 2.725 Kelvin, encapsulates critical insights into the early universe, including its composition, geometry, and evolution. Fluctuations in the CMB's temperature and polarization trace the initial seeds of cosmic structures, setting the stage for the development of galaxies, stars, and planets.

Discovery of the CMB

Predicted in the 1940s by George Gamow, Ralph Alpher, and Robert Herman, the CMB was empirically discovered by Arno Penzias and Robert Wilson in 1964 [3,4]. Initially interpreted as pervasive noise, this discovery provided robust support for the Big Bang theory and was recognized with the Nobel Prize in Physics in 1978.

CMB Satellites

The COBE satellite, launched in 1989, significantly advanced CMB studies by confirming its blackbody radiation spectrum and detecting temperature anisotropies [5]. Further refinements came from the WMAP and Planck satellite missions, which elucidated the universe's age, composition, and the intricacies of cosmic inflation [6,7].

Current Explanation

Current interpretations posit that the CMB is the remnant heat from the universe's inception, released when the universe cooled sufficiently for protons and electrons to form neutral hydrogen atoms. This pivotal moment, known as the surface of last scattering, allowed photons to traverse space unimpeded, imprinting the early universe's structural blueprint on the CMB.

Blackbody Radiation and CMB Spectrum

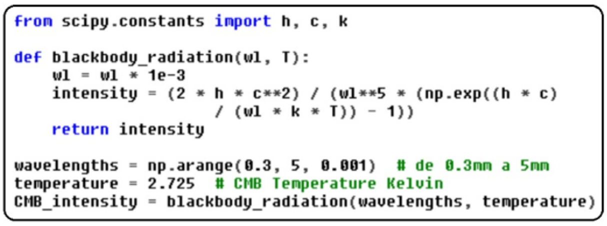
The CMB spectrum adheres to a blackbody profile at 3000K, with photon wavelengths elongated by the universe's expansion. This phenomenon, described by Planck's law, illustrates the shift in blackbody radiation temperature from 3000K to 2.725K over 13.8 billion years, a testament to the universe's dynamic evolution.

$$B_\nu(\nu,T)=\frac{2h\nu^3}{c^2}\left(\exp\left(\frac{h\nu}{k_B T}\right)-1\right)^{-1} \tag{1}$$

Here, k_B represents the Boltzmann constant, h the Planck constant, c the speed of light, T the absolute temperature, and ν the frequency. The Planck Law underscores the CMB's role as a cosmic beacon, illuminating the path from the universe's fiery origins to its current state. Figure 2 present a Python function that implement the Planck's blackbody equation.

Note on the Consistency of CMB Data and Application in the CAT Model

In our analyses, we observed discrepancies between the reported peak wavelengths of the CMB from various sources. While some CMB spectrum graphics indicate a peak at 1.1mm, corresponding to a frequency of approximately 272 GHz, (Figure 1 COBE curve) others suggest a peak at 2.2mm (Figure 1 FIRAS curve), more aligned with the widely publicized frequency of 160 GHz. To reconcile these differences and underpin our prediction model for the Cosmic FM Background (CFMB), we utilized the Planck function for a black body at a temperature of 2.725K, which is in excellent agreement with the most precise and reliable measurements available.



```
from scipy.constants import h, c, k

def blackbody_radiation(wl, T):
    wl = wl * 1e-3
    intensity = (2 * h * c**2) / (wl**5 * (np.exp((h * c)
                     / (wl * k * T)) - 1))
    return intensity

wavelengths = np.arange(0.3, 5, 0.001)  # de 0.3mm a 5mm
temperature = 2.725  # CMB Temperature Kelvin
CMB_intensity = blackbody_radiation(wavelengths, temperature)
```

Figure 2: Python function that calculate the Blackbody spectrum using the Planck law for 2.725K

We used the Python function presented in Figure (2) to calculate black body radiation curve, serving as the basis for our subsequent simulations and analyses.This function has been validated against the digital data from COBE, as presented in Figure (3) demonstrating an agreement with an error of less than 0.1%, which reinforces the accuracy of our approach. In projecting the CFMB, we indicate a peak frequency based on the mass-energy relation between electrons and protons (1836 times smaller), resulting in a frequency of 87.4 MHz.

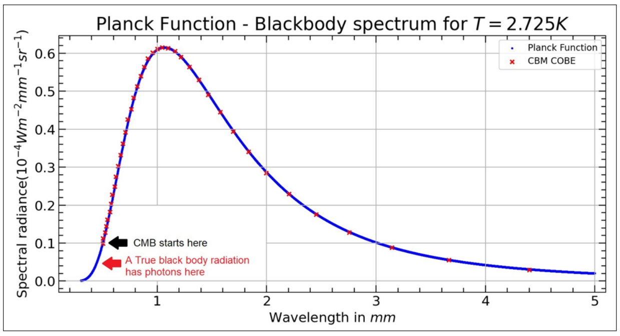


Figure 3: Black body spectrum calculated by the Planck law for 2.725 K and CMB spectrum measured by COBE satellite. Note that the CMB spectrum has a "cut" in 0.5mm (no signal below 0.5mm wavelength) and this behavior cannot be explained by the black body spectrum

The Impact of Cosmic Inflation on Virtual Particles in Void Space

Cosmic inflation, the rapid expansion following the universe's inception, plays a crucial role in shaping the cosmos. Quantum Mechanics suggests that quantum fluctuations can create virtual particle pairs in void spaces, including various particles of matter and antimatter, for example protons and antiprotob like is presented in Figure 4 [8].

During cosmic inflation, the accelerated expansion of space has the capability to separate these virtual particle pairs, turning them into real particles of matter and antimatter. The inflaton field's vast energy deferentially affects particles: while the protons and electrons sizes remain unaffected with the photons growing the wavelength and losing energy, and micro black holes growing the event horizon radii and increasing it's masses.

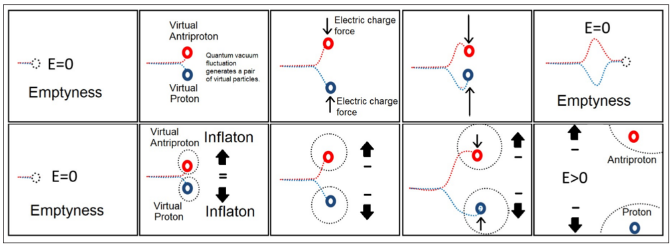


Figure 4: Formation of Proton-Antiprotons Pair from Virtual Particles powered by the Inflaton Field Energy

Cosmic Antiproton Tomography (CAT) Radiation

Cosmic Antiproton Tomography (CAT) Radiation is derived from the Small Bang Model (SBM), underpinned by the speculative Ulianov Theory and Ulianov String Theory and Ulianov Sphere Network [9-15]. The SBM proposes a universe originating from a state of void, with all matter and energy emerging during cosmic inflation, facilitated by the inflaton field. This framework suggests two primary mechanisms for generating the universe's initial energy:

Photon Generation through Space Expansion

The SBM suggests that cosmic inflation transforms virtual photon pairs into real photons. This transformation is thought to be volume-dependent and inversely related to the photon's wavelength, leading predominantly to high-energy photons. This process accounts for the Last Inflaton Ultra-High-Energy Photons (LIUHEP), which, akin to CMB, could be observable today but in the gamma ray spectrum.

Creation of Matter-Antimatter Pairs

Inflation also catalyzes the conversion of virtual proton-antiproton (see Figure (4) and electron-positron pairs into real pairs. Their subsequent annihilation generates high-energy photons, leading to Cosmic Antiproton Tomography (CAT) and Cosmic Positron Tomography (CPT) radiation. This radiation offers insights into the early universe's energy dynamics with a distinct spectrum and an exponential intensity increase during inflation.

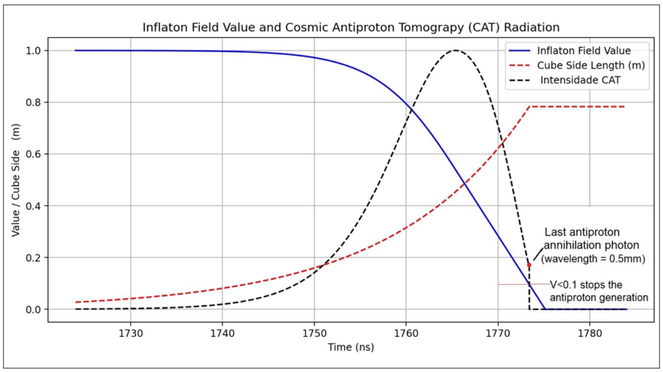


Figure 5: This figure illustrates the inflaton field level, the dimensions of a cube within which proton-antiproton pairs are generated, and the intensity of photons produced by the annihilation of antiprotons. These components collectively provide insights into the dynamics of cosmic inflation and matter generation in the early universe

Key Aspects of CAT Radiation Predicted by the Small Bang Model (SBM) Include:

- A particle number increase proportional to the cube of the universe's radius, reflecting the expansive nature of cosmic inflation.
- A gradual decrease in the intensity of the inflaton field, with the particle production rate being proportional to the square of the inflaton field energy. This decrease reflects natural decay processes in the inflaton field over time.
- A complex interplay between the universe's volumetric expansion and the diminishing intensity of the inflaton field, impacting the intensity and spectrum of CAT emissions. Specifically, until the annihilation occurs, the antiproton size is not affected by the inflaton field. Consequently, the wavelength of the photon generated by the proton-antiproton annihilation depends on the mean lifetime of the antiproton within a hydrogen cloud or even in the intergalactic void. Antiprotons that do not annihilate in time do not contribute to the CAT radiation.

The CAT model aligns with observations of the CMB, providing a fresh theoretical perspective on early cosmic phenomena. Adjusting for photon stretching and cosmic dust interactions, the SBM aligns with the observed CMB spectrum, suggesting the universe expanded significantly over 13.8 billion years. This alignment between CAT and CMB spectra underscores the

CAT model's explanatory power for the universe's early energy dynamics.

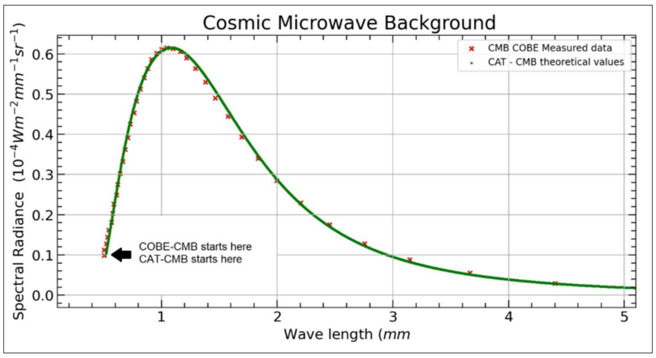


Figure 6: This figure illustrates a comparison between the Cosmic Microwave Background (CMB) spectrum as measured by the COBE satellite (indicated in red) and the predicted CAT radiation spectrum, shifted to align with the CMB range (indicated in green). The mean square error (MSE) between these curves is 1.1%. Notably, when considering four additional harmonic signals derived from the CAT model, the MSE is significantly reduced to 0.06%, showcasing a remarkable alignment between the observational data and theoretical predictions

The Small Bang Model

The Small Bang Model (SBM) integrates Quantum Mechanics, General Relativity, and Cosmic Inflation to propose a universe originating from zero initial mass and energy. This model suggests that micro black holes (µBHs), initially fueled by the inflaton field, evolved into the supermassive black holes (SMBHs) found at the centers of galaxies, avoiding the infinite energy density problem typical of the Big Bang theory.

Based on Ulianov Theory,SBM explains the observed matter dominance by the differential growth rates of antimatter and matter µBHs [12]. Antimatter µBHs grow faster and dominate during collisions, absorbing matter µBHs. This selective growth and annihilation cycle sequesters antimatter within SMBHs, proposing a universe where both matter and antimatter are unequally distributed.

Galaxies Formation in the Small Bang Model

SBM outlines galaxy formation initiated by an antimatter µBH at the start of cosmic inflation (t=1ns). For example, the mass of the largest known galaxies, around 6×10^42 kg, could have originated from a Planck-mass antimatter µBH, expanding by a factor of 2.7×10^50 during inflation. The model calculates that the inflaton field doubled the universe's radius 170 times at a steady 10ns interval over 1777ns, indicating an exponential growth post-inflation.

During cosmic inflation lasting two milliseconds, virtual particle pairs including µBHs and matter-antimatter particles broke apart. Only µBHs formed within the first 50 to 100 ns expanded sufficiently to become SMBHs surrounded by hydrogen clouds, akin to seeding a forest where early seeds grow into mature trees. Those appearing later struggled to develop under an established canopy.

Galaxy formation was contingent on specific conditions and timing post-inflation. Antimatter µBHs within hydrogen clouds underwent mutual annihilation upon interacting with matter, suggesting tightly bound formation processes. By the end of inflation (t=2 µs), these µBHs had transformed into SMBHs, and their surrounding spiral clouds contained the galactic mass, setting their final size. Initially, galaxies were closely positioned with overlapping hydrogen clouds. Over time, they drifted apart due to the universe's expansion, yet gravitational forces preserved the hydrogen clouds' integrity, preventing significant dispersion.

CAT Harmonic Family

This section presents two visual representations to illustrate the dynamics of the CAT harmonics. The first image, presented in Figure (7) shwon the inflaton field level, the variation of the radius of a cubic volume of space (proportional to the variation of the universe's radius), and the generation of a basic CAT curve (fundamental CAT with Δt=10 ns). It also includes several CAT curves produced when setting Δt from 0 to 20 ns (which translates to -10 ns to 10 ns when the Δt of the fundamental CAT is zeroed).

The second image, presented in Figure (8), displays this CAT family in the frequency spectrum with 10 phase-shifted curves. The signatures of increase are truncated in the first five curves because in these, the annihilation of some antiprotons occurs after the end of the inflaton field, cutting off the start of the curve.

Note that the CAT harmonic curves are generated at a fixed Δt of 2 ns, although this value can range from -10 ns (faster annihilation does not occur as with a mean of 10 ns in the fundamental CAT, Δt=-10 ns indicates instantaneous annihilation) to +10 ns (above this also falls outside the inflaton's end time and no longer generates photons in the valid time window for the CAT).

These series of curves, varying in intensity over time or in wavelength, are akin to sinusoidal signals used in a Fourier transform. Thus, to identify the four CAT harmonics (presented in Figure (9))in the COBE-CMB curve (which corresponds to a single pixel in a CMB image generated by the Planck satellite), a specific optimization process of the available CMB curve subtracted from the fundamental CAT (obtained through optimization that minimized the MSE of Error = CAT-CMB) was conducted. This process clearly revealed the peaks of the four CAT harmonics well phase-shifted in the frequency spectrum, that can de observe in Figure (9). This optimization process was relatively time-consuming, taking about 10 hours to determine the CAT harmonics at a single point, which would be impractical for application to images and was used solely to demonstrate that the theory works in practice. For practical use, the author is developing a Ulianov CAT Transform that takes a CMB frequency spectrum (related to a single image point) and generates a spectrum of CAT harmonics, much like a Fourier transform takes a signal in time and generates a frequency spectrum of the sinusoidal signals that compose the time signal.

A detailed presentation of the Ulianov CAT Transform will be provided in a future article.

Analogies of CAT Radiation with Medical Imaging

The Small Bang Model (SBM) likens the Cosmic Microwave Background (CMB) to medical imaging techniques, particularly to Positron Emission Tomography (PET), using cosmic antiproton tomography (CAT) instead of positrons.

During cosmic inflation, CAT radiation is emitted at a very low level with a significant burst in the last 15ns as the inflaton field deactivates. This brief, intense pulse of antiproton annihilation produces photons with a stable frequency, analogous to the emission observed in PET scans.

In the SBM, by the end of cosmic inflation, galactic clouds are already forming, similar to a forest's canopy, which restricts the passage of light and creates a complex pattern of shadows and clearings. Antiprotons might form within these hydrogen clouds of varying densities, and their annihilation time is inversely related to the density. These antiprotons emit photons that travel through the universe, encountering galaxies and interstellar gas, akin to X-rays interacting with body tissues in medical imaging.

Thus, the CMB in the SBM is viewed as a result of a cosmic-scale CAT scan, where photons emitted from antiproton annihilation traverse the cosmos and interact with cosmic matter. This interaction is comparable to how X-rays are used to image the internal structure of a body, combining with PET scans to provide both functional and structural information. This composite image is akin to fusing PET and X-ray images, which, while potentially complex and overlapping, offers a rich and detailed view of the universe's early matter distribution within a 13.8 billion light-year spherical shell, revealing features like gravitational lensing of galaxies en route to Earth.

In this manner, the Small Bang Model (SBM) portrays CAT radiation (the origin of the CMB) not merely as thermal background radiation but as a sophisticated, multi-layered image of the universe. This offers insights into both its structural components (such as the densities of hydrogen clouds in galaxies) and the dynamic processes that shaped its early evolution (like the delay in antiproton annihilation reflecting cloud density). Additionally, the transformations CAT radiation undergoes as it traverses the universe to reach Earth further enrich this picture. Thus, CAT-CMB can be compared to a combination of a PET scan (providing information contained in the typical signatures of CAT harmonics) and an X-ray image (offering information on amplitude variations in the fundamental CAT), providing intricate details about the universe's internal state over a 13-billion-year journey.

On a simpler note, if an image that combines PET and X-ray data is presented to a radiologist for analysis, they might recognize it as depicting a human body but may find the image details confusing and ill-defined. In this context, if we employ software to separate the PET image from the X-ray image and present each to specialists in their respective fields, the final analysis they produce will be much more informative than what was obtained with the mixed images. This scenario arises because the specialists were unaware of the details of how the images were generated.

Physicists today look at the CMB images and recognize that they contain information about the universe in phase variations, amplitude variations, polarization changes, and frequency shifts, linked to a "universe skeleton" and "seeds of galactic structures." However, without clear understanding of how each element was generated, analyzing these images becomes as challenging as analyzing a combined PET-X-ray image. Therefore, dividing the CMB images into one fundamental CAT image (X-ray image) and four or five CAT harmonics (PET images) holds great potential to de-mix these data and produce five distinct images where currently only one is seen. This clarity will undoubtedly facilitate the final analysis and enhance understanding of the observed phenomena.

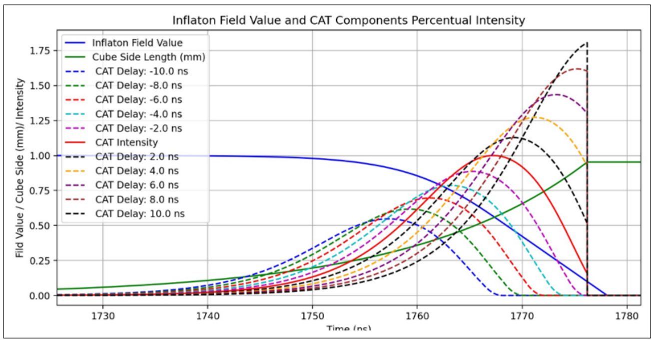


Figure 7: This figure presents ten curves of CAT harmonics over time with delta t ranging from -10 to 10 ns at 2 ns intervals, reflecting the variation in the inflaton field impact and how the duration of antiproton annihilation influences the shape of the emitted radiation spectrum. Each curve illustrates the shift in radiation intensity and wavelength as the antiproton annihilation time deviates from the mean, showcasing the sensitivity of CAT radiation to changes in cosmic conditions during inflation

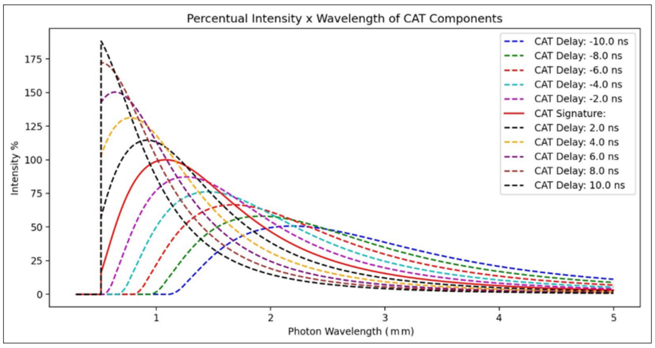


Figure 8: This figure presents ten curves of CAT harmonics over the wavelength spectrum with delta t ranging from -10 to 10 ns at 2 ns intervals, illustrating the phase-shifted CAT radiation across different wavelengths. These curves demonstrate how variations in annihilation timing affect the distribution of emitted wavelengths, highlighting the dependency of the radiation spectrum on the density and temporal dynamics of the hydrogen clouds where antiprotons annihilate

Cosmic FM Background Radiation Prediction

The Small Bang Model (SBM) posits that, analogous to the annihilation of antiprotons and protons generating the CAT radiation which today comprises the Cosmic Microwave Background (CMB) spectrum, electron-positron pairs formed throughout cosmic inflation would also annihilate, producing photons. However, these photons have energy and frequency 1836 times smaller than those from antiproton annihilation. In the last moments of cosmic inflation, this annihilation process is predicted to generate Cosmic Positron Tomography (CPT) radiation. This phenomenon, occurring as positrons annihilate within clouds of matter, suggests a spectral signature similar to the CMB but located in a wavelength band 1836 times greater, roughly equivalent to 8.4 MHz, a frequency within the FM radio band.

The Cosmic FM Background (CFMB) Radiation, the shifted spectrum of the CPT over the 13.8 billion years of observable universe expansion, may interact differently with Earth's atmosphere compared to the CMB.like the CMB, which traverses the ozone layer and the atmosphere, CFMB radiation isn't affected atmosphere, but if value is 1/1836^4 of the CMB intensity (Level 10^13 times smaller), potentially explaining the CFMB non-

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detection by until today. The CFMB intensity is very small and it's also mixed with terrestrial FM signals, and so if the radio astronomers do not Know it existence they will not find this by mere chance.

To discover this elusive radiation, targeted explorations by radio astronomers are necessary, possibly antennas specifically tuned to the FM band (approximately 8.4 MHz) in remote places, far away from FM station or even using antennas placed in satellites. Identifying CFMB radiation would not only validate the predictions of the CAT model but also deepen our comprehension of the universe's electromagnetic spectrum and its early energy dynamics.

COBE CMB Spectrum and CAT Harmonics Spectra

This section explores the comparison between the COBE CMB spectrum and the Cosmic Antiproton Tomography (CAT) harmonics spectra. Two figures are presented: the first illustrates the deviation between the fundamental CAT and the CMB spectra, highlighting the individual components of this error. The second figure demonstrates the effect of eliminating these harmonics, significantly reducing the error to about 0.06%.

Analytical Analogy

The analysis of CAT harmonics can be likened to the behavior of an electronic or mechanical system characterized by various distinct oscillation or vibration modes. Exciting this system with a short pulse, akin to an impulse, causes it to oscillate in these modes. The output observed is a composite of several sine waves, each with unique amplitudes and frequencies, forming a complex waveform over time.

Understanding the individual oscillation frequencies enables the application of filters to isolate and remove these from the overall signal. This process involves collecting each isolated frequency or signal component and sequentially adding them together. This iterative addition aims to reconstruct the final signal with minimal error, ideally approaching zero. This precise reconstruction affirms that the entire system's behavior can indeed be modeled as a sum of its fundamental signals.

Implications for CAT and CMB Analysis

In the cosmic context, similar principles apply to the interpretation of the CMB as observed by COBE. The CMB signal is hypothesized to originate from a hydrogen cloud where protons and antiprotons undergo annihilation in four distinct density regions. Each region contributes a unique CAT harmonic signature based on its specific density, influencing the annihilation timing and thus affecting the spectral characteristics of the emitted photons. The fundamental CAT spectrum represents an averaged baseline across the entire cloud, integrating these diverse interactions.

This analysis not only enhances our understanding of the interaction between CAT harmonics and the CMB spectrum but also underscores the precision required in cosmic measurements. By dissecting the CMB into its constituent harmonic components, we gain a clearer picture of the early universe's structure and dynamics, akin to separating combined PET and X-ray images to enhance diagnostic clarity in medical imaging. This meticulous separation process promises to refine our comprehension of cosmic phenomena, offering new insights into the early universe's conditions and the fundamental processes at play.

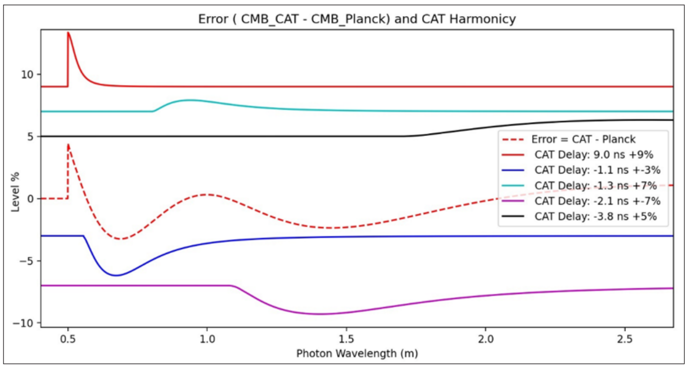

Figure 9: Comparison between the fundamental CAT and the CMB spectra, illustrating the error distribution and detailed component curves. This visualization helps identify the specific contributions of various harmonic components to the overall discrepancy

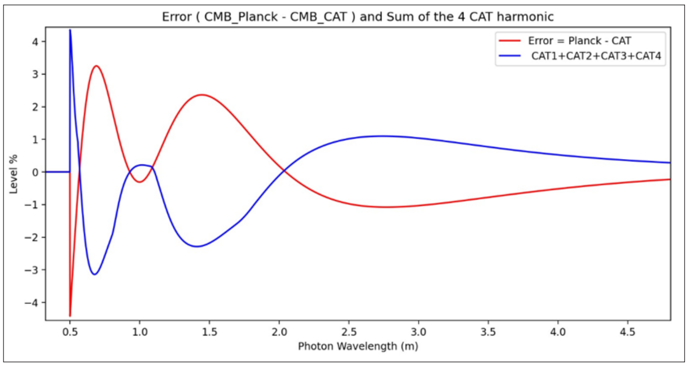

Figure 10: This figure shows the sum of the 4 CAT harmonic spectra and the error between the CAT fundamental and CMB spectra. Note that the sum of the harmonics generate a signal that is like the same error signal with posit sing, and so when we add the fundamental CAT with this harmonics we obtain the COBE CMB spectrum with MES error in range of 0.06%

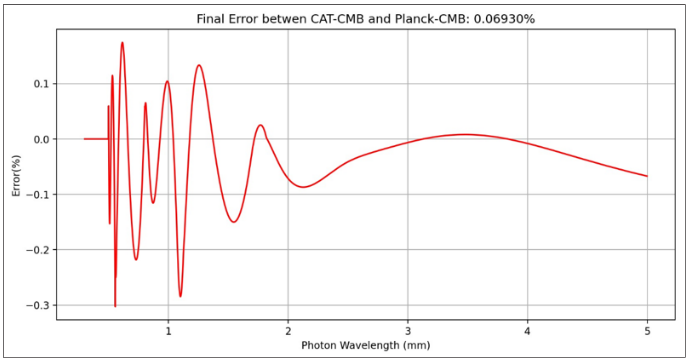

Figure 11: This figure shows the CAT harmonic spectra after the elimination of interfering harmonics, achieving a minimal error margin of 0.06%. This process highlights the effectiveness of harmonic adjustment in refining the match between CAT and CMB spectra

Mathematical Proof that CMB Originates from CAT and Not from 3000K Black Body Radiation

This section elucidates that the Cosmic Microwave Background (CMB) originates not from black body radiation at 3000K but from Cosmic Antiproton Tomography (CAT). The fundamental CAT and its harmonics were generated through a numerical process that considers each curve as a result of antiproton annihilation. These antiprotons emit high-energy photons within a Delta time detection by until today. The CFMB intensity is very small and it's also mixed with terrestrial FM signals, and so if the radio astronomers do not Know it existence they will not find this by mere chance.

To discover this elusive radiation, targeted explorations by radio astronomers are necessary, possibly antennas specifically tuned to the FM band (approximately 8.4 MHz) in remote places, far away from FM station or even using antennas placed in satellites. Identifying CFMB radiation would not only validate the predictions of the CAT model but also deepen our comprehension of the universe's electromagnetic spectrum and its early energy dynamics.

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Understanding the individual oscillation frequencies enables the application of filters to isolate and remove these from the overall signal. This process involves collecting each isolated frequency or signal component and sequentially adding them together. This iterative addition aims to reconstruct the final signal with minimal error, ideally approaching zero. This precise reconstruction affirms that the entire system's behavior can indeed be modeled as a sum of its fundamental signals.

Implications for CAT and CMB Analysis

In the cosmic context, similar principles apply to the interpretation of the CMB as observed by COBE. The CMB signal is hypothesized to originate from a hydrogen cloud where protons and antiprotons undergo annihilation in four distinct density regions. Each region contributes a unique CAT harmonic signature based on its specific density, influencing the annihilation timing and thus affecting the spectral characteristics of the emitted photons. The fundamental CAT spectrum represents an averaged baseline across the entire cloud, integrating these diverse interactions.

This analysis not only enhances our understanding of the interaction between CAT harmonics and the CMB spectrum but also underscores the precision required in cosmic measurements. By dissecting the CMB into its constituent harmonic components, we gain a clearer picture of the early universe's structure and dynamics, akin to separating combined PET and X-ray images to enhance diagnostic clarity in medical imaging. This meticulous separation process promises to refine our comprehension of cosmic phenomena, offering new insights into the early universe's conditions and the fundamental processes at play.

Conclusion

This exploration of the Cosmic Antiproton Tomography (CAT) model and its implications for understanding the Cosmic Microwave Background (CMB) has opened new avenues for cosmic investigation. By dissecting the CAT harmonics and analyzing their interactions with the CMB spectrum observed by COBE, we have deepened our understanding of the early universe's complex dynamics.

The Small Bang Model (SBM), underpinned by the CAT radiation theory, challenges the conventional Big Bang narrative by suggesting a more nuanced cosmic evolution, driven by micro black holes and inflationary processes. This model not only elucidates the structure of the early universe but also provides a plausible explanation for the predominance of matter over antimatter, the formation of supermassive black holes, and the intricate distribution of galaxies.

Moreover, the analogy of CAT radiation to a cosmic-scale PET scan reveals the potential of high-energy physics to uncover the mysteries of cosmic matter distribution and interaction. The potential detection of Cosmic FM Background (CFMB) radiation could further validate the SBM, positioning it as a formidable alternative to the Big Bang theory.

As we move forward, it is imperative for the scientific community to continue pushing the boundaries of observational technology and theoretical physics. The insights gained from studying CAT and CFMB radiation could revolutionize our understanding of the cosmos, providing clearer images and more accurate models of our universe's earliest moments.

In conclusion, the CAT model not only offers a fresh perspective on cosmic background radiation but also invites a reevaluation of our cosmic origins. As we stand on the brink of potentially transforming discoveries, the pursuit of these elusive cosmic signals remains a promising frontier in astrophysics, promising to illuminate the darkest corners of our universe's history.

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