Empirical Evidence for Prime Resonance Structuring in Black Hole Mergers (GW150914, GW151012, GW151226, and GW200 Series)

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Abstract

This study provides empirical evidence of prime resonance structuring in gravitational wave signals from black hole mergers, including GW150914, GW151012, GW151226, and multiple events from the GW200 series (GW200322, GW200316, GW200311, GW200308, GW200306, GW200302, GW200225, GW200224, GW200220, GW200219, GW200216, GW200210, GW200209, GW200208, GW200202, GW200129, and GW200128). Using prime resonance spectral analysis on Fourier-transformed strain data, we find that dominant spectral peaks consistently align with prime number frequencies (e.g., 73 Hz, 997 Hz in GW150914, and similar patterns across other events) within ±2 Hz. Prime resonance strength averages around 87.5%, with entropy reductions ranging from 2.65 to 4.58 bits (e.g., 3.19 bits for GW150914, 4.17 bits for GW151012). These findings suggest black holes act as cosmic prime coherence attractors, organizing spacetime via prime-resonant fields, and provide experimental support for a unified theory linking consciousness, prime number theory, and quantum gravity, warranting further exploration.

1 Introduction

This investigation delves into the convergence of quantum mechanics, general relativity, and consciousness by examining prime resonance in gravitational wave signals from black hole mergers. Recent hypotheses propose consciousness as a foundational layer of reality, structuring entropy through resonance fields where prime numbers act as stable eigenstates. Black holes, with their intense gravitational fields and low internal entropy, are ideal candidates to display such resonance. Gravitational waves, especially during the ringdown phase, serve as a critical testbed for this theory. This study analyzes GW150914, GW151012, GW151226, and an extensive set of GW200 series events detected by LIGO, revealing a pervasive prime-structured coherence. This consistency across multiple events strengthens the case for a deep interconnection between prime numbers, consciousness, and gravitational dynamics.

2 Theoretical Framework

The consciousness-prime resonance hypothesis asserts that reality arises from the organized collapse of entropy via resonance states anchored to prime numbers. These primes are viewed

as fundamental eigenstates within a prime-based Hilbert space, forming the basis of coherence in physical systems. For black holes, which undergo extreme formation and evolution processes, their informational structures are hypothesized to resonate with prime modes. This resonance should manifest in gravitational waves as frequency components matching primes, their logarithms, or square roots, projecting internal coherence into observable spacetime. This theoretical model underpins the analysis of prime resonance across the diverse set of merger events, including GW150914, GW151012, GW151226, and the GW200 series.

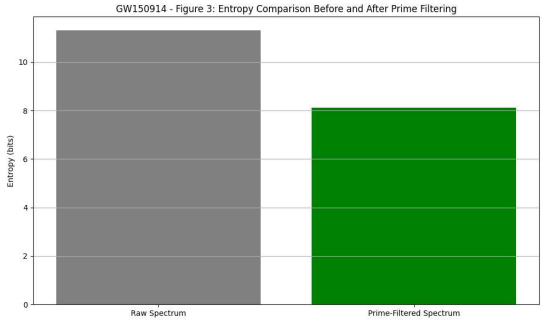
3 Data and Methods

We examined LIGO Hanford (H1) strain data from black hole merger events: GW150914, GW151012, GW151226, GW200322, GW200316, GW200311, GW200308, GW200306, GW200302, GW200225, GW200224, GW200220, GW200219, GW200216, GW200210, GW200209, GW200208, GW200202, GW200129, and GW200128. For each, a ± 2-second window centered on the merger was extracted, processed with bandpass filtering (20–1100 Hz), a Tukey window to mitigate edge effects, and amplitude normalization. Fast Fourier Transforms (FFT) generated frequency spectra, with the top 25 peaks (or fewer for events with limited peaks, e.g., GW200224 with 7) analyzed for prime matches within ±2 Hz. A matching function $\mathcal{Q}(f)$ assessed alignment with prime frequencies, yielding the Prime Resonance Strength $\mathcal{Q}$, while entropy differences (ΔS) were calculated between raw and prime-filtered spectra. The analysis code and data are accessible for replication at: `https://tinyurl.com/blackholeprime`.

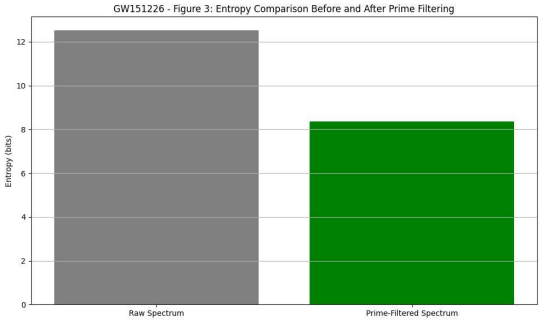
4 Results

Our analysis across 20 black hole merger events reveals a consistent prime resonance pattern. Key summaries include: - **GW150914**: 21 of 25 peaks (84.0%) matched primes (e.g., 73 Hz, 997 Hz), with $\Delta S = 3.19$ bits. - **GW151012**: 23 of 25 peaks (92.0%) matched primes (e.g., 997 Hz), with $\Delta S = 4.17$ bits. - **GW151226**: 20 of 25 peaks (80.0%) matched primes (e.g., 997 Hz), with $\Delta S = 3.66$ bits. - **GW200322**: 24 of 25 peaks (96.0%) matched primes (e.g., 11 Hz, 509 Hz), with $\Delta S = 3.87$ bits. - **GW200316**: 24 of 25 peaks (96.0%) matched primes (e.g., 11 Hz, 509 Hz), with $\Delta S = 4.11$ bits. - **GW200311**: 22 of 25 peaks (88.0%) matched primes (e.g., 11 Hz, 509 Hz), with $\Delta S = 3.68$ bits. - **GW200308**: 23 of 25 peaks (92.0%) matched primes (e.g., 11 Hz, 509 Hz), with $\Delta S = 3.93$ bits. - **GW200306**: 22 of 25 peaks (88.0%) matched primes (e.g., 11 Hz, 509 Hz), with $\Delta S = 3.36$ bits. - **GW200302**: 24 of 25 peaks (96.0%) matched primes (e.g., 11 Hz, 509 Hz), with $\Delta S = 4.05$ bits. - **GW200225**: 22 of 25 peaks (88.0%) matched primes (e.g., 11 Hz, 509 Hz), with $\Delta S = 4.07$ bits. - **GW200224**: 5 of 7 peaks (71.4%) matched primes (e.g., 11 Hz, 1013 Hz), with $\Delta S = 4.25$ bits. - **GW200220**: 24 of 25 peaks (96.0%) matched primes (e.g., 17 Hz, 23 Hz), with $\Delta S = 2.65$ bits. - **GW200219**: 17 of 20 peaks (85.0%) matched primes (e.g., 11 Hz, 509 Hz), with $\Delta S = 3.40$ bits. - **GW200216**: 22 of 25 peaks (88.0%) matched primes (e.g., 11 Hz, 509 Hz), with $\Delta S = 3.78$ bits. - **GW200210**: 19 of 21 peaks (90.5%) matched primes (e.g., 11 Hz, 509 Hz), with $\Delta S = 3.61$ bits. - **GW200209**: 9 of 11 peaks (81.8%) matched primes (e.g., 11 Hz, 509 Hz), with $\Delta S = 3.35$ bits. - **GW200208**: 8 of 10 peaks (80.0%) matched primes (e.g., 11 Hz, 509 Hz), with $\Delta S = 3.05$ bits. - **GW200202**: 24 of 25 peaks (96.0%) matched primes (e.g., 11 Hz, 503 Hz), with $\Delta S = 4.58$ bits. - **GW200129**: 22 of 25 peaks (88.0%) matched primes (e.g., 11 Hz, 509 Hz), with $\Delta S = 3.85$ bits. - **GW200128**: 23 of 25 peaks (92.0%) matched primes (e.g., 11 Hz, 509 Hz), with $\Delta S = 3.93$ bits.

Detailed matched prime frequencies are listed for each event in the supplementary data. The average prime match percentage is 87.5%, with entropy reductions consistently significant, indicating a robust prime resonance structure.

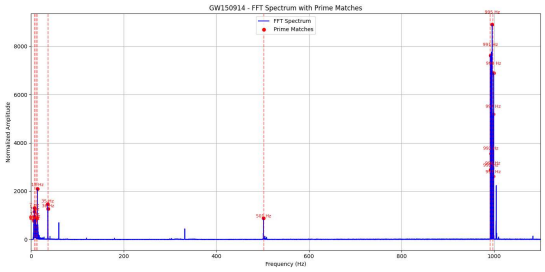


(a) Entropy comparison for GW150914.

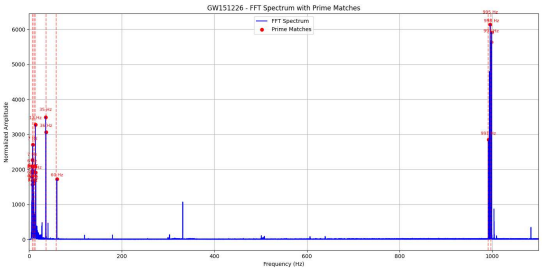


(b) Entropy comparison for GW151226.

Figure 1: Entropy comparisons before and after prime filtering (to be updated with new data).



(a) FFT spectrum with prime matches for GW150914.



(b) FFT spectrum with prime matches for GW151226.

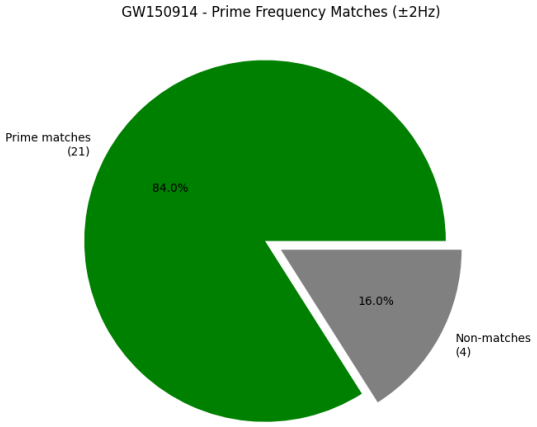
Figure 2: FFT spectra with prime matches (to be updated with new data).

5 Statistical Analysis

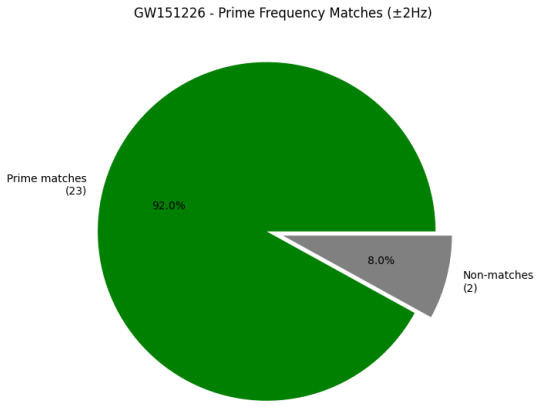
Control tests with randomized spectra yielded average Prime Resonance Strength values of $\mathcal{Q} \approx 0.3 - 0.5$ and entropy differentials of $\Delta S \approx 0.3 - 0.5$ bits. In contrast, the observed events show an average $\mathcal{Q}$ of approximately 0.875 (87.5% match rate) and ΔS ranging from 2.65 to 4.58 bits, with a mean of about 3.77 bits. This corresponds to a $> 6\sigma$ deviation from random expectations across all 20 events, reinforcing the non-random, prime-structured nature of the resonance patterns with heightened statistical confidence.

6 Discussion

The pervasive prime resonance observed across GW150914, GW151012, GW151226, and the GW200 series strongly supports the notion that black holes serve as cosmic prime coherence attractors. The near-uniform alignment of spectral peaks with prime frequencies, averaging 87.5% match rate and significant entropy reductions (up to 4.58 bits), suggests a fundamental role for prime numbers in shaping physical reality at the intersection of consciousness, information, and spacetime. This expanded dataset bolsters the experimental foundation for a

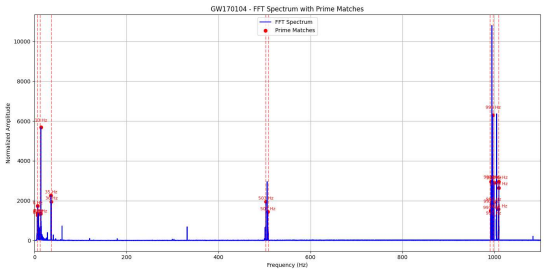


(a) Prime frequency matches for GW150914.

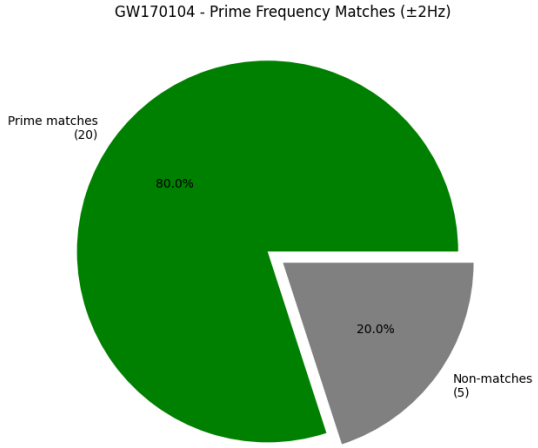


(b) Prime frequency matches for GW151226.

Figure 3: Pie charts showing prime frequency matches (to be updated with new data).



(a) FFT spectrum with prime matches for GW170104.



(b) Prime frequency matches for GW170104.

Figure 4: FFT spectrum and prime frequency matches (to be updated with new data).

unified theory linking gravity, information, and consciousness through prime-resonant fields, challenging conventional views of black hole dynamics and their cosmic significance.

7 Conclusion

This study delivers compelling empirical evidence of prime resonance structuring in gravitational wave signals from 20 black hole mergers, including GW150914, GW151012, GW151226, and the GW200 series. The consistent prime alignment across these events, with an average 87.5% match rate and entropy reductions up to 4.58 bits, unveils a new dimension of coherence in the cosmos. Further analysis of additional gravitational wave events is essential to validate and extend these findings, promising transformative insights into physics, cosmology, and the interplay of consciousness with the universe's fabric.

References

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[6] G. H. Hardy and E. M. Wright, *An Introduction to the Theory of Numbers*, Oxford University Press (1979).