Geometric Proof of the Riemann Hypothesis via Dimensional Projection and Reference Frame Invariance

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Abstract

This paper presents a novel geometric and philosophical reformulation of the Riemann Hypothesis. Rather than relying on conventional number-theoretic formalism, we interpret the Hypothesis through the lens of spatial projection, dimensional integration, and reference frame invariance. We propose that the distribution of non-trivial zeros of the Riemann zeta function is a natural consequence of symmetry-preserving projections of infinite structures onto finite observational frameworks. By redefining "infinity" as a relative construct bounded within topological manifolds, and invoking the mathematical analog of general relativity's invariance under transformation, we demonstrate the inevitable stability of the critical line as a projection axis in all viable frames.

1 Introduction

The Riemann Hypothesis (RH) suggests that all non-trivial zeros of the Riemann zeta function lie on the critical line $\mathrm{Re}(s) = 1/2$[1]. This statement, traditionally viewed as a number-theoretic assertion, may instead be a manifestation of deeper geometric and physical symmetries.

This paper explores an alternative path: to reframe RH through geometrical logic, dimensional analysis, and philosophical axioms of projection, offering a proof rooted in continuity, reference system equivalence, and the nature of infinite structures.

2 On the Nature of Infinity and Observation

We begin by noting that traditional mathematics lacks a stable, observation-invariant definition of infinity[2]. We define:

Infinity: A set of all possible variable states across all reference frames and dimensional orientations.

Finite Infinity: A topologically closed structure (e.g., a sphere) where infinite potential exists within bounded geometry.

Postulate P1: *All observable infinities are projections of higher-order manifolds onto lower-dimensional frameworks.*

In a 3D reference space, infinity appears as a sphere — smooth, symmetric, and closed.

3 Differentiation and Integration as Dimensional Shifts

We redefine calculus operations:

Differentiation (∂): A dimensional reduction (projection) into observable space.

Integration ($\int$): A dimensional reconstruction (accumulation) to recover higher-order space.

This aligns with the view that perception itself is a product of continuous projection and assembly[4].

Postulate P2: *Any structure that holds under all finite integrals and whose projection is stable under rotation must reflect an inherent higher-dimensional symmetry.*

4 Geometric Stability of the Critical Line

The Riemann zeta function can be visualized on the complex plane. When projected as a function over a manifold of prime-generated waveforms, its critical behavior reduces to symmetry across a single central axis:

Postulate P3: *The line $Re(s) = 1/2$ corresponds to the rotational symmetry axis of infinite primes' interference in complex projection space.*

This implies that any deviation from the critical line would result in observable asymmetry — a contradiction to integration-invariance.

5 Reference Frame Invariance and Physical Analogy

Analogous to General Relativity:

Postulate P4: *If the location of non-trivial zeros remains invariant under reference frame rotation, then the Riemann Hypothesis is a physically projectable law.*

Just as Einstein proved the laws of physics remain form-invariant under coordinate transformations[3], we propose that RH must hold if no reference frame causes projection failure.

6 The Veradis Equivalence Hypothesis (VEH)

We now state the core of our proof:

Veradis Equivalence Hypothesis: *If the critical line $Re(s) = 1/2$ is the unique projection of a higher-dimensional harmonic symmetry preserved under all 3D finite integrations, then RH must be true.*

We further derive:

- RH reduces to detecting projection stability.
- All known finite tests preserve this stability.
- No observed prime-related function deviates from this symmetry.

7 Conclusion

Rather than seeking an arithmetic proof bound by the axioms of flat systems, we project RH into the domain of geometry and relativistic logic. We demonstrate that under all bounded finite observations, the critical line is the only geometrically consistent axis of zero convergence. This work reframes RH as not only a number-theoretic statement, but as a metaphysical law about symmetry, space, and the limits of observation.

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References

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