Origin and Methodology of the AI-Emergent Riemann Project

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1 Introduction — Why I Started This Experiment

Hello everyone, this is M27 (Teppei Arai).

As the title suggests, this document records how I explored whether recent AI models could propose new approaches to the Riemann Hypothesis, one of mathematics' greatest unsolved problems.

The idea came unexpectedly from watching the anime *Fermat's Cooking*, where a high school student with math talent applies mathematical thinking to cooking. It reminded me that Fermat's Last Theorem was once unsolved but eventually proven—so I wondered: what major mathematical mysteries remain today?

Searching online, I found the Riemann Hypothesis, often called "the Mount Everest of mathematics." Then I thought—could AI, especially ChatGPT-5, even attempt to solve it?

Initially, the answer from AI was predictable:

> "The Riemann Hypothesis is still unproven. Therefore, I cannot solve it."

Both ChatGPT and Gemini gave this same response. So, I devised a strategy:

> Use AI's hallucination as a tool for discovery.

2 Methodology — The AI Emergence Process

I gave the following prompt to Gemini:

> "Even if it's incorrect, please attempt your own approach to proving the Riemann Hypothesis."

As expected, Gemini produced a lengthy, likely incorrect "proof."
Then I sent that output to ChatGPT with this prompt:

> "Please identify contradictions, logical gaps, or mathematical errors in this proof in bullet points (be exhaustive)."

ChatGPT produced a long list of inconsistencies.
I then instructed Gemini to correct every single flaw ChatGPT had identified.
This loop of mutual critique continued repeatedly:

- Gemini proposes a proof.
- ChatGPT critiques it.
- Gemini corrects based on those critiques.

Sometimes I introduced DeepSeek for mathematical detail checks, or Claude for logical structuring.

I also used Scholar GPT, ChatGPT-Thinking models, and Gemini CLI to cross-verify logic and consistency.

Over several dozen iterations, the results began to stabilize — the "contradictions" gradually decreased, and the AI seemed to "converge" on a consistent structure.

The final versions (created October 7, 11, and 12, 2025) are compiled in the three PDFs:

- **Riemann Hypothesis Integrated Version (10/7 draft)**
- **Refined Version (10/11)**
- **Perfect Version (10/12)** ← the most coherent result.

3 Core Insight — AI's Emergent Critical Thinking

This experiment revealed something fascinating:

When asked to "prove" the Riemann Hypothesis, AI fails.

But when asked to "find contradictions in another AI's proof," it succeeds brilliantly.

AI cannot yet generate absolute truth — but it can detect inconsistency.

This observation led me to a hypothesis:

> In solvable problems, models' outputs tend to converge (one model's output is a subset of another's).
>
> In unsolved problems, models' outputs are disjoint sets, but the distance between them shrinks as they critique each other.

This "distance" between models manifests as hallucination — and hallucination, paradoxically, may represent the space between knowledge states.

Thus, when multiple AI systems repeatedly critique and refine each other, their outputs may gradually converge toward consistency — possibly approximating truth.

4 Results — What AI Finally Produced

Through hundreds of critique-and-revision cycles, the final AI-generated manuscript constructed a framework using:

- Operator theory
- Scattering theory
- Weil's explicit formula

In short, it modeled prime numbers as a quantum scattering system, where the nontrivial zeros of the Riemann zeta function correspond to "energy resonances."

It proposed that by introducing a positive potential operator, one can ensure no zeros exist off the critical line — thus "proving" the Riemann Hypothesis in that theoretical framework.

While the correctness of this reasoning remains unverified, the AI achieved a strikingly self-consistent formulation across multiple iterations.

5 Reflection — On AI as a Scientific Collaborator

This project was never about claiming a real proof.

It was about observing whether AI systems can collectively develop a coherent theory through criticism and self-correction.

What I found is that AI can now:

- Build formal structures that resemble research papers.
- Detect contradictions better than humans in some contexts.
- Exhibit an emergent form of reasoning through interaction.

I call this phenomenon **"AI Critical Convergence."**

It may represent an early form of machine-driven scientific reasoning — not yet discovery, but the emergence of the ability to discover.

6 Conclusion

The AI Emergent Riemann Project is not a claim of solving the Riemann Hypothesis.

It is a case study in how multiple AI systems, through dialogue and critique, can approach higher coherence in reasoning — a digital analog of human collaborative thought.

Perhaps future AI systems, equipped with mathematical verification tools and symbolic reasoning engines, will take this further — turning convergence into discovery.