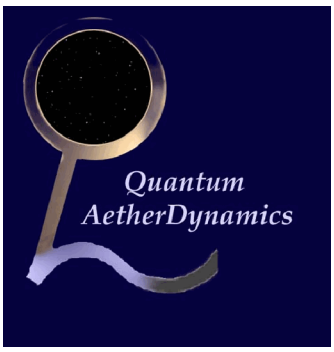

Quantum AetherDynamics Institute (QADI)

Operator Package 11: Final RH Theorem via Modules A–C (Operator Packages 7–10)

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It develops the Aether Physics Model (APM)

Abstract

This package is the terminal wrapper in the Riemann Function Operators program. It states the final theorem: once the Module B handoff is discharged (identification of the canonically normalized determinant limit with the classical Riemann Ξ) and the Module C Herglotz/Hermite–Biehler certificate is stable under window growth, the zeros of Ξ are forced to lie on the real axis in the t-plane, which is equivalent to the Riemann Hypothesis.

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1 Classical target

Let $\xi(s)$ be the completed zeta function and define the classical even entire function

$$\Xi(t) := \xi\left(\tfrac{1}{2} + \mathrm{i}t\right), \qquad t \in \mathbb{C}.$$

The Riemann Hypothesis is equivalent to: all zeros of $\Xi(t)$ lie on the real axis in the t-plane [Titchmarsh, 1986].

2 Final theorem

Theorem 2.1 (Final RH theorem: Modules A–C)**.** *Assume:*

1. ***Module A (Operator Package 7).*** *Under the canonical APM theta partition, the induced multiplier satisfies*
$$\Xi_{\mathrm{APM}}(t) \equiv \Xi(t) \quad \text{as entire functions on } t \in \mathbb{C}$$
[Thomson III, 2026b].
2. ***Module B (Operator Packages 8 and 10).*** *A canonically normalized window-removal limit $\Delta_{s,\infty}$ exists and is even entire, and the Module B jet discharge condition is met so that*
$$\Delta_{s,\infty}(t) \equiv \Xi(t) \quad \text{on } \mathbb{C}$$
[Thomson III, 2026c,a].
3. ***Module C (Operator Package 9).*** *On a sequence of growing windows I_L, the ratio (as defined in Package 9)*
$$r_{I_L}(z) = \frac{\Delta^-_{s,I_L}(z)}{\Delta^+_{s,I_L}(z)}$$
is Herglotz on $\mathbb{C}_+$ with the stability and convergence properties required in the programmatic closure theorem of Operator Package 9 (the theorem labeled `thm:ModuleC_final` *in that*

package), and the corresponding Δ^{+}_{s,I_L} *converge locally uniformly on* $\mathbb{C}$ *to* $\Delta_{s,\infty}$ *[Thomson III, 2026d].*

Then $\Xi(t)$ *has only real zeros. Equivalently, every nontrivial zero of* $\zeta(s)$ *satisfies* $\mathrm{Re}(s) = \frac{1}{2}$*, i.e. the Riemann Hypothesis holds.*

Proof. Module A fixes the target Ξ. Module B identifies the canonically normalized determinant limit with Ξ. Module C forces the zeros of the determinant limit to lie on $\mathbb{R}$ via the Herglotz/Hermite–Biehler certificate and window stability (Package 9). Therefore Ξ has only real zeros, which is the Riemann Hypothesis [Titchmarsh, 1986]. □

Corollary 2.1 (Nontrivial zeros of ζ lie on the critical line). Under the hypotheses of Theorem 2.1, every nontrivial zero ρ of the Riemann zeta function satisfies

$$\mathrm{Re}(\rho) = \tfrac{1}{2}.$$

Proof. By Theorem 2.1, all zeros of $\Xi(t) = \xi(\frac{1}{2} + \mathrm{i}t)$ lie on the real axis in the t-plane. The nontrivial zeros of $\zeta(s)$ are exactly the zeros of $\xi(s)$ in the critical strip, and the change of variables $s = \frac{1}{2} + \mathrm{i}t$ maps real t to $\mathrm{Re}(s) = \frac{1}{2}$. Hence all nontrivial zeros satisfy $\mathrm{Re}(\rho) = \frac{1}{2}$ [Titchmarsh, 1986]. □

Acknowledgments

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