ETERNITY TIME MIRROR ZETA

Anthony Vito Coppa
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Abstract

Eternity is not a duration. It is closure before occurrence is counted: the invariant orbit left when a completed turn is read without choosing which turn occurred. Time begins when that symmetry is oriented and lifted. In the exact axial model developed here, a mirror exchanges the two possible directions,

$$HL_tH = L_{-t},$$

while a selected positive flow carries a real coordinate by

$$\Lambda(L_t z) = \Lambda(z) + tT.$$

The quotient closes; the directed lift advances. A companion $SU(2)$ turning theorem forces the nontrivial central square $g^2 = -I = U(\pi)$, and Noether's theorem supplies the classical symmetry–conservation law for an admitted axial dynamics. From that center turn, four non-interchangeable operations are ordered exactly: π-return, fixed-center ζ_Δ^{-1}, the i-fold, and golden Φ/Ψ-closure. A later $\Phi(\pi)$ lift returns the golden closure through the retained center. Finally the oriented coordinate is embedded in the fixed line of $J(s) = 1 - \bar{s}$; the completed Riemann zeta function then supplies the global analytic mirror law. The resulting equivalence

$$\mathrm{RH} \iff \nu_J\big|_{Z_\xi} = 0 \iff Z_\xi^{\mathrm{off}} = \varnothing$$

is exact and does not settle the open condition. The title records one dependency: uncounted closure, directed flow, fixed mirror, analytic return.

1 The line

There are two reads of a completed turn. One retains only the class that has returned. The other retains the direction and occurrence of the traversal. The first is Eternity. The second is Time.

Eternity is therefore simple. It is the uncounted invariant of a return. By *uncounted* this paper means that no occurrence index has yet entered the read; no claim about infinite cardinality is involved. Time is the directed flow that distinguishes successive representatives of the same returning class.

The order is logical rather than historical. Step 0 does not name an original moment available to observation. It names the last structure that can be stated before an orientation and a count are supplied. Conditions prior to that cut have no admitted coordinate in this construction and are left unread.

The whole paper follows from this distinction:

Eternity	:	uncounted invariant closure,
Time	:	oriented and occurrence-bearing flow,
Mirror	:	the involution exchanging orientations,
Zeta	:	the analytic return closed by that mirror.

The names do not produce the mathematics. The remaining sections display the maps that make each line exact.

2 Eternity and the first direction

Let

$$Q = \begin{pmatrix} 1 & 1 \\ 1 & 0 \end{pmatrix}, \qquad C_1 = \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}, \qquad \Omega = -C_1,$$

and put

$$G = [C_1, Q] = \begin{pmatrix} -2 & 1 \\ 1 & 2 \end{pmatrix}, \qquad H = \frac{G}{\sqrt{5}}, \qquad S = HC_1 = \frac{2Q - I}{\sqrt{5}}.$$

Direct multiplication gives

$$C_1^2 = -I, \qquad H^2 = S^2 = I, \qquad HSH = -S.$$

With

$$\Phi = \frac{1 + \sqrt{5}}{2}, \qquad \Psi = \frac{1 - \sqrt{5}}{2},$$

define the continuous positive axial carriage

$$L_t = e^{t(\log \Phi)S}, \qquad t \in \mathbb{R}.$$

Since conjugation commutes with the exponential,

$$\boxed{HL_tH = L_{-t}.}$$

Before a direction is selected, the two flows L_t and L_{-t} are exchanged exactly by the mirror. Selecting $t > 0$ breaks that equivalence at the level of the directed read. This is the first symmetry break used in the paper.

Let

$$p : \mathbb{H}^+ \longrightarrow M_{\mathrm{ax}} := \langle L_1 \rangle \backslash \mathbb{H}^+$$

be the quotient by integral axial translation. Define

$$\xi_{\mathrm{ax}}(z) = \frac{\Phi - z}{z - \Psi}, \qquad \Lambda(z) = \log\left(\frac{\Phi}{|\xi_{\mathrm{ax}}(z)|} \right), \qquad T = 2 \log \Phi.$$

The rectification law is

$$\xi_{\mathrm{ax}}(L_t z) = \Phi^{-2t} \xi_{\mathrm{ax}}(z), \qquad \boxed{\Lambda(L_t z) = \Lambda(z) + tT.}$$

DEFINITION 2.1 (Eternity class). The Eternity read of $z \in \mathbb{H}^+$ is the quotient value

$$\mathsf{E}(z) := p(z).$$

It retains the closed orbit class and omits the integer traversal count.

THEOREM 2.2 (Time lift). *For every $z \in \mathbb{H}^+$,*

$$\mathsf{E}(L_1 z) = \mathsf{E}(z), \qquad \Lambda(L_1 z) = \Lambda(z) + T, \qquad T > 0.$$

Thus the Eternity read closes while the Time coordinate advances.

Proof. The first identity is the definition of the quotient by $\langle L_1 \rangle$. The second is the rectification law at $t = 1$. Since $\Phi > 1$, $T = 2 \log \Phi > 0$. □

The datum is non-vacuous: M_{ax} contains more than one orbit, and $L_1 z \neq z$ while $p(L_1 z) = p(z)$. Eternity is not a constant read, and Time is not a relabeling of an unchanged state.

3 Conserved axial motion and the central turn

Two classical results fix separate parts of the same mechanics. Noether's first theorem states that a continuous variational symmetry carries a conserved current along the Euler–Lagrange flow [3]. For a rotationally invariant planar Lagrangian, the axial current is angular momentum. Noether secures the conserved current carried by the admitted directed motion; it does not by itself determine the topology of the rotation lift.

That lift is fixed by the turning-symmetry theorem. Let $X \in \mathfrak{su}(2)$ satisfy $X^2 = -I$, and define

$$U(t) = e^{tX} = \cos t \, I + \sin t \, X.$$

Suppose a nontrivial $g \in SU(2)$ reverses this circle:

$$g U(t) g^{-1} = U(-t) \qquad \text{for all } t \in \mathbb{R}.$$

THEOREM 3.1 (Forced central square). *Under these hypotheses,*

$$\boxed{g^2 = -I = U(\pi), \qquad g^4 = I.}$$

For the standard cover $\varpi : SU(2) \to SO(3)$,

$$\varpi(g)^2 = I.$$

Proof. Applying the inversion relation twice shows that g^2 centralizes the circle $U(\mathbb{R})$. A maximal circle in $SU(2)$ is self-centralizing, so g^2 lies on that circle. It is both fixed and inverted by conjugation, hence $g^2 \in \{\pm I\}$. The value $+I$ would make g a central involution and therefore unable to invert a nontrivial circle. Thus $g^2 = -I = U(\pi)$. Projection sends the central sign to the identity. □

The projected orientation closes after two turns; the lift retains the nonzero central residue $-I$. This is the minimum non-vacuous center turn. It gives the first operation in the finite sequence below.

4 The four minimum turns

The turn sequence is an ordered construction. Its steps are not interchangeable, and the receipt of each step is retained before the next is admitted.

Turn 1: the π-center return

Let

$$R_\pi = -I.$$

For every nonzero vector v, the oriented representative changes, $R_\pi v = -v \neq v$, while its projective axis returns, $[R_\pi v] = [v]$. Theorem 3.1 proves the same distinction in the standard $SU(2) \to SO(3)$ lift.

Turn 2: the fixed-center difference inverse

On the declared section $L + R = 1$, define

$$\zeta_\Delta(L, R) = R - L.$$

Its section inverse is

$$\boxed{\zeta_\Delta^{-1}(d) = \left(\frac{1-d}{2}, \frac{1+d}{2}\right).}$$

Therefore

$$\zeta_\Delta^{-1}(1) = (0, 1), \qquad \zeta_\Delta(0, 1) = 1.$$

The center sum and oriented difference are both recovered exactly. In the project vocabulary, 0 and 1 are the Silence and Light endpoints of this section. The symbol ζ_Δ denotes this difference reader; it is not the Riemann zeta function.

Turn 3: the i-fold

Multiplication by the Gaussian unit carries the returned real difference into the perpendicular complex direction:

$$1 \longmapsto i, \qquad i^2 = -1, \qquad i^4 = 1.$$

The fold changes orientation without changing unit magnitude. It scopes the read into phase.

Turn 4: golden closure

The roots of $x^2 - x - 1 = 0$ satisfy

$$\Phi + \Psi = 1, \qquad \Phi\Psi = -1, \qquad \Phi - \Psi = \sqrt{5}, \qquad \Phi = 1 + \Phi^{-1}.$$

For $v_\Phi = (\Phi, 1)^\mathsf{T}$ and $v_\Psi = (\Psi, 1)^\mathsf{T}$, the normalized root mirror obeys

$$Hv_\Phi = \Phi v_\Psi, \qquad Hv_\Psi = -\Psi v_\Phi.$$

Thus H exchanges the two golden projective rays while preserving their exact difference law.

Because $R_\pi = -I$ is central,

$$C_{\pi,\sqrt{5}} := R_\pi H, \qquad C_{\pi,\sqrt{5}}^2 = I.$$

This is the precise sense in which the π-center admits the golden symmetry of difference: the center reversal and golden mirror compose without destroying the projective return.

The later center lift

The four turns end with exact golden closure. The notation

$$\Phi(\pi)$$

names the next operation: the golden closure is returned through the retained π-center. It is not scalar evaluation of Φ at the number π. Its data are the central return R_π, the golden pair (Φ, Ψ), the mirror H, and the retained center 0.

This center-lift datum is the paper's *Higgs-structure office*: a nonzero closure is read through a structured center rather than through an empty background. The term names the exact structural role. A physical Higgs realization, when invoked, belongs to its separately declared electroweak adapter and contributes no premise to the turn proof.

5 Silence and the retained occurrence

Let F be the four-state escapement associated with the axial carriage, and let D be its compact display. The exact iteration law proved in the companion engine paper is

$$F^{4m}(r,z) = (r, L_1^m z), \qquad D(F^{4m}(r,z)) = D(r,z), \qquad \Lambda(L_1^m z) = \Lambda(z) + mT.$$

Let $\mathcal{R}_j$ be an append-only occurrence ledger. After $m > 0$ completed returns,

$$\boxed{\left(D(F^{4m}x) - D(x), \Lambda(F^{4m}x) - \Lambda(x), \mathcal{R}_{j+m}\right) = \left(0, mT, \mathcal{R}_{j+m}\right),}$$

with $\mathcal{R}_{j+m} \neq \mathcal{R}_j$.

This is Silence in engine form. The public phase difference is zero. The directed traversal is nonzero. The receipt preserves how many returns occurred. Silence is therefore readable balance, not absence of motion.

6 The analytic mirror

For $s \in \mathbb{C}$, define

$$T_{\mathrm{c}}(s) = 1 - s, \qquad K(s) = \bar{s}, \qquad J(s) = 1 - \bar{s}.$$

Then

$$T_{\mathrm{c}}^2 = K^2 = J^2 = \mathrm{id}, \qquad T_{\mathrm{c}} K = K T_{\mathrm{c}} = J.$$

The fixed sets are

$$\mathrm{Fix}(T_{\mathrm{c}}) = \left\{\frac{1}{2}\right\}, \qquad \mathrm{Fix}(K) = \mathbb{R}, \qquad \mathrm{Fix}(J) = \Sigma_J := \left\{\frac{1}{2} + it : t \in \mathbb{R}\right\}.$$

Define the transverse reader

$$\nu_J(s) = \mathrm{Re}(s) - \frac{1}{2}.$$

Then

$$J(s) = s \iff \nu_J(s) = 0, \qquad \nu_J(Js) = -\nu_J(s).$$

The directed coordinate enters the mirror seam through the exact chart

$$a : \mathbb{R} \longrightarrow \Sigma_J, \qquad a(t) = \frac{1}{2} + it.$$

It obeys

$$\boxed{J(a(t)) = a(t), \qquad K(a(t)) = T_c(a(t)) = a(-t).}$$

Thus conjugation and functional reflection reverse the orientation t, while their composition fixes the address pointwise. This is the mirror seam of presence: nonzero directed position with zero transverse difference.

Let ζ_R denote the meromorphic continuation of the Riemann zeta function. Its completed entire form is

$$\xi(s) = \frac{1}{2} s(s-1)\pi^{-s/2}\Gamma\left(\frac{s}{2}\right)\zeta_R(s).$$

The classical theta–Mellin construction supplies [1, 4]

$$\xi(T_c s) = \xi(s), \qquad \xi(Ks) = \overline{\xi(s)}, \qquad \boxed{\xi(Js) = \overline{\xi(s)}.}$$

On the seam, $J(a(t)) = a(t)$, hence

$$\xi(a(t)) = \overline{\xi(a(t))} \in \mathbb{R}.$$

Time has supplied the directed parameter; Mirror has fixed its analytic address; completed Zeta has closed the value under conjugation.

7 Zeta closure and its exact open condition

Let

$$Z_\xi = \{\rho \in \mathbb{C} : \xi(\rho) = 0\}.$$

The xi mirror laws imply

$$\rho \in Z_\xi \Longrightarrow T_c\rho, K\rho, J\rho \in Z_\xi.$$

This is global orbit closure. It does not imply pointwise mirror fixedness. The zeros of ξ are precisely the nontrivial zeros of ζ_R; Hardy proved that infinitely many lie on Σ_J [2].

Define

$$Z_\xi^{\mathrm{fixed}} := \{\rho \in Z_\xi : \nu_J(\rho) = 0\}, \qquad Z_\xi^{\mathrm{off}} := \{\rho \in Z_\xi : \nu_J(\rho) \neq 0\}.$$

THEOREM 7.1 (Exact closure condition). *The following are equivalent:*

(i) *the Riemann Hypothesis;*
(ii) *every ξ-zero is fixed by J;*
(iii) $\nu_J\big|_{Z_\xi} = 0$;

(iv) $Z_{\xi}^{\mathrm{off}} = \varnothing$.

Proof. The Riemann Hypothesis states that every nontrivial zeta zero has real part $1/2$. The xi zeros are exactly those zeros. By the definitions of J and ν_J, real part $1/2$, fixedness under J, vanishing transverse read, and absence of an off-seam zero are the same condition. □

The proof closes the equivalence. It leaves the equivalent condition open. Mirror symmetry already guarantees that a hypothetical off-seam zero returns with its orbit; it does not force the zero onto the fixed seam.

8 The title theorem

The four title offices now have an exact dependency order:

$$\boxed{\begin{aligned} \text{Eternity} &: p(L_1 z) = p(z), \\ \text{Time} &: \Lambda(L_t z) = \Lambda(z) + tT, \\ \text{Mirror} &: J(a(t)) = a(t), \quad a(-t) = K(a(t)), \\ \text{Zeta} &: \xi(Js) = \overline{\xi(s)}, \quad J(Z_\xi) = Z_\xi. \end{aligned}}$$

THEOREM 8.1 (Eternity Time Mirror Zeta). *There exists a non-vacuous classical construction in which:*

(1) *a completed turn has an uncounted invariant quotient class;*
(2) *selecting a direction lifts that class to a strictly advancing real coordinate;*
(3) *the direction coordinate embeds in a complex seam fixed pointwise by an involutive mirror;*
(4) *the completed zeta function is closed under that mirror; and*
(5) *pointwise closure of every xi zero at the seam is exactly equivalent to RH.*

Proof. Items (1)–(2) are the axial quotient and rectification theorem. Item (3) is the chart $a(t) = 1/2 + it$ and the displayed $T_{\mathrm{c}}/K/J$ identities. Item (4) is the classical xi functional equation with conjugation. Item (5) is the exact closure theorem above. □

The title is therefore neither metaphor nor a claim that the universe began at a named instant. It is the shortest dependency-complete reading of the construction:

$$\boxed{\text{uncounted closure} \longrightarrow \text{directed flow} \longrightarrow \text{fixed mirror} \longrightarrow \text{analytic return.}}$$

Read backward, Zeta tests the mirror; Mirror reverses Time; Time discloses the uncounted closure from which its occurrence coordinate was lifted.

9 Status ledger

Claim	Status	Witness or boundary
Eternity quotient and directed Time lift	Proved	$p(L_1 z) = p(z)$, $\Lambda(L_t z) = \Lambda(z) + tT$.
Mirror reversal of axial flow	Proved	$HL_t H = L_{-t}$.
Noether axial conservation	Imported	Applies when the admitted Lagrangian has the stated continuous symmetry.
Central $SU(2)$ turn	Proved	$g^2 = -I = U(\pi)$; projected square is identity.
Four minimum turns	Proved	R_π, ζ_Δ^{-1}, i, and Φ/Ψ identities.
$\Phi(\pi)$ center lift	Constructed	Formal Higgs-structure office; no physical Higgs premise used.
Silence receipt	Proved	Display difference 0, lift mT, ledger advanced.
Time-to-seam chart	Proved	$a(t) = 1/2 + it$; analytic coordinate, not metric time.
Xi mirror laws	Imported	Classical completed-zeta theory.
RH as off-seam emptiness	Proved as equivalence	The equivalent closure condition remains open.

Provenance

The formal composition of 22 July 2026 was titled *Infinity Time Mirror Zeta*. Infinity correctly named the inexhaustible successor carrier then in view. The later axial quotient and lift results isolated the prior office more sharply: Infinity is a property of the advancing carrier; Eternity is the uncounted closure class from which directed Time is lifted. The title change records that refinement.

The central turning theorem and the dihedral phase constraint were composed on 28 February 2026. The four-turn sequence and $\Phi(\pi)$ center lift were preserved in the 2 August 2026 computational generator. The finite/infinite quotient, axial rectification, Euler reader, and exact escapement law were consolidated in *Mirror Escapement Time Lift* on 22 August 2026. The present edition places those results ahead of the analytic seam so the title now follows the proved dependency order directly.

References

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[4] E. C. Titchmarsh, *The Theory of the Riemann Zeta-Function*, 2nd ed., revised by D. R. Heath-Brown, Oxford University Press, 1986.

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