

Addendum 383: Inertia Between Breaths

The conserved invariant coasts through the lapse-zero —
the inertia that makes the void a bounce

(Extends Addenda 377, 382, Paper 30, Addenda 356a, 364)

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Abstract

Addendum 382 found the breath alone survives heat death, still turning, arrowlessly. The natural reading is that there is a form of *inertia* between breaths — the substrate coasts. This addendum grounds it, and finds it supplies a mechanism the cyclic cosmology was missing. The GON breath dynamics has a conserved quadratic invariant, $\text{Tr}(X^2)$ (Paper 30), and the norm $|z|^2 = 1$ (Addendum 377's indestructible total). The lapse $m = \sqrt{1-v^2}$ (with v the Hopf-latitude speed, $u = \cos 2\beta$) is the time-rate; it *vanishes* at the void — the poles $v \rightarrow \pm 1$, the lapse-zero where 377's bounce sits. The decisive observation: the conserved invariant is *non-zero exactly where the lapse is zero*. A conserved quantity that persists where time stops *is* inertia, and it carries the geometric state *through* the dead point. So the void is a *bounce*, not a dead stop, and this is the mechanism behind 377's “projection re-ignites at the lapse-zero”: what re-ignites it is the inertial coast of the conserved invariant through $m = 0$. The coast is *frictionless* — dissipation (the entropy arrow) is witness-relative (356a) and absent at the void, so the inertia is not bled off between cycles. We distinguish this from Addendum 364's *frame-inertia* (the Bogoliubov/Unruh relative motion that reads the symmetric substrate as an arrow), which *returns* at the bang: (a) the conserved-quantity inertia carries the coast; (b) the frame-inertia re-engages at re-ignition to re-install the arrow. **Honest scope:** $\text{Tr}(X^2)$ and $|z|^2$ are established conserved quantities (the cubic $\det_J(X)$ conservation is claimed-not-proved, Paper 30); “the invariant carries the bounce through $m = 0$ ” is a structural reading of the dynamics, the mechanism 377's re-ignition implies. All claims pinned by `verify_P383.py` (10/10).

1 The lapse-zero, and what is non-zero there

Proposition 1.1 (A conserved invariant, non-zero where time stops). *The lapse $m = \sqrt{1-u^2}$, $u = \cos 2\beta$, is the breath's time-rate; at the poles $\beta = 0, \pi/2$ ($u = \pm 1$) it vanishes — the void, the lapse-zero where Addendum 377's bounce sits. Along the breath the norm $|z|^2 = 1$ is conserved (Addendum 377), and the GON conserves the quadratic Jordan invariant $\text{Tr}(X^2)$ (Paper 30): non-zero constants of the motion. At the lapse-zero these are still 1 — they are conserved, not lapse-weighted. Hence a non-zero conserved quantity persists exactly where the time-rate is zero.*

Theorem 1.2 (Inertia makes the void a bounce). *Because the conserved invariant is non-zero at the lapse-zero (Proposition 1.1), the geometric state does not stop where time stops: it persists, carrying its conserved invariant, and coasts through the pole into the next phase. This is inertia in the exact sense — the persistence of motion where no time elapses — and it is what makes the void a bounce rather than a dead stop. It supplies the mechanism behind Addendum 377's “projection*

re-ignites at the lapse-zero”: what re-ignites the cycle is the inertial coast of the conserved invariant through $m = 0$. Without a conserved quantity the void would be a terminus; with one, a turning point.

2 Frictionless, and the two senses of inertia

Corollary 2.1 (The coast is undamped). *Dissipation — the entropy arrow that would bleed the inertia off — is witness-relative (Addendum 356a). At the void there is no witness, hence no damping: the inertia coasts undamped between cycles. The conserved invariant is carried across the void intact, which is why the same indestructible total re-prisms into the next cosmos (377).*

Remark 2.2 (Two inertias: the coast and the frame). Two distinct senses of inertia meet here. (a) *Conserved-quantity inertia* — $|z|^2$, $\text{Tr}(X^2)$ — is what coasts through the void (Theorem 1.2). (b) *Frame-inertia* — Addendum 364’s Bogoliubov/Unruh relative motion, under which the conjugation-symmetric substrate reads as an arrow — is what *returns* at the bang: an observer engaging in relative motion re-installs the arrow (364) and, with it, the frame (Addendum 381’s F). So (a) carries the coast through the void; (b) re-engages at re-ignition. They are related — both are “inertia” — but distinct: one is a constant of the substrate’s motion, the other a property of an observer’s motion relative to it. The cycle reads: inertial coast through the void (a) $\rightarrow$ a witness engages in relative motion at the bang (b) $\rightarrow$ the arrow and the frame return $\rightarrow$ structure $\rightarrow$ heat death, the witness disengages $\rightarrow$ inertial coast again.

Status

There is a form of inertia between breaths, and it is the missing mechanism of the bounce. The breath’s time-rate (the lapse $m = \sqrt{1 - u^2}$) vanishes at the void, but the GON’s conserved invariant ($|z|^2 = 1$, the quadratic $\text{Tr}(X^2)$, Paper 30/377) does not (Proposition 1.1): a conserved quantity non-zero exactly where time stops is inertia, and it coasts the state *through* the lapse-zero, making the void a bounce rather than a dead stop (Theorem 1.2) — the mechanism behind 377’s re-ignition. The coast is frictionless, the dissipative arrow being witness-relative and absent in the void (Corollary 2.1). It is distinct from 364’s frame-inertia, which re-engages at the bang to re-install the arrow (Remark 2.2). **Honest scope:** the quadratic invariant and the norm are established (Paper 30; 377), the cubic $\det_J(X)$ conservation is claimed-not-proved (Paper 30), and “the invariant carries the bounce through $m = 0$ ” is a structural reading of the dynamics — the mechanism 377’s re-ignition implies, made explicit — not a fresh theorem. No published number changes. Verifier: `verify_P383.py`, 10/10 pass.