TOQ KIN01

Kinematics of the Quantum Flip and Inherited Temporal Phase Shift

Sequentiality of invagination and derivation of the structural phase-shift quantum

(TOQ Framework)

THEORY OF QUANTUM OCEANS (TOQ)

Zenodo Prepublication — TOQ-KIN Series (Kinematics)

Style note: HAL-ready version (structure, traceability, reproducibility).

TOQ-KIN Series — Substrate kinematics

The TOQ-KIN series documents the elementary kinematic building blocks of the Quantum Ocean: sequentiality of events, topological durations, phase differentials, temporal quanta. It provides the anchors required by the phenomenological applications of the framework (EXP, ZEN series) without embedding the observable developments themselves.

Status: kinematic foundation note — TOQ canonical corpus

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Methodological note. The present note is part of the TOQ framework defined in [ZEN00] and [ZEN08]. Testability criteria, validation protocols and falsification conditions are spelled out there. The mechanics presented here is grounded in the published ontological axioms (O1–O10) and on the geometric invariants established in the published corpus LGU, LiGHT, ZEN and iℏ.

Position within the corpus. TOQ-KIN-1 articulates ZEN04 (E_unit, T_{11}), LiGHT00 (2:1 asymmetry, CTH/CTA/CTHb), LGU20 (FCC coordination) and iℏ-001 (structural invariants 11, 12, 66). It establishes the Flip kinematics as a foundational building block independent of its subsequent phenomenological applications.

Abstract

This note details the internal kinematics of the Quantum Flip, the fundamental topological event that transforms a Higgs Temporal Cell (CTH) into an Agonesis Temporal Cell (CTA) at the compression threshold P_0. We demonstrate that the Apex invagination is not an instantaneous global inversion, but a sequential wave-by-wave process proceeding through 65 successive frictions across the T_{11} = 66 strata of the cellular pyramid.

Two fundamental kinematic invariants follow from this sequentiality. First, each Flip event has a strict dimensionless duration τ_Flip = $1/T_{11}$ corresponding to the crossing of a single stratum of the substrate. Second, coupled with the kinematic differential Δv = 1 imposed by the 2:1 asymmetry of the Ocean between the CTA (v=1) and the ambient CTH (v=2), this quantum generates a structurally non-resolvable inherited temporal phase shift δ = Δv × τ_Flip = $1/T_{11}$, imprinted in every nascent CTA.

The present note establishes these three building blocks — sequentiality, quantum duration, inherited phase shift — as autonomous kinematic results, derived from the TOQ axioms without recourse to any phenomenological observation. It provides a foundational anchor for subsequent derivations mobilizing these blocks — notably the application to the leptonic magnetic moment (EXP01, DOI 10.5281/zenodo.19697987), published alongside the present note.

Global status: [DER] for the sequentiality of the invagination, the structure of the 65 frictions, the 1/3 twist, the quantum duration τ_Flip = $1/T_{11}$, the differential Δv = 1 and the inherited phase shift δ = $1/T_{11}$. The complete topological developments will be addressed in Book III of the TOQ (in preparation).

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1. Introduction

1.1 The Flip within the TOQ architecture

In the ontology of the Theory of Quantum Oceans, matter emerges from a local coherence rupture in the fabric of the Temporal Cells. This rupture occurs when a CTH, having reached the paroxysm of its internal compression at the P_0 threshold, undergoes a topological invagination of its Apex — the Flip — triggered by a depressive diaphasic contact with its neighborhood (LiGHT00 Chap.1 §1.3).

The Flip has been described until now at the macroscopic scale as a geometric overturning event. The present note descends to the intra-cellular scale in order to detail its quantized kinematics, stratum by stratum, and to derive the temporal invariants that follow from it.

1.2 Published conceptual framework mobilized

The conceptual framework rests upon three properties of the TOQ substrate, all already established in the published corpus:

- The discretization of the Plenum into T_{11} = 66 strata per Chronocyte, chain 3D → 4 → 5 → 11 → 66 (ZEN04, iℏ-001, status [CERTIFIÉ]);
- The fundamental 2:1 asymmetry between the relaxation (v=2) and compression (v=1) phases of the CT cycle (LiGHT00 Chap.2 §2.2, status [ANCH]);
- The FCC coordination of the lattice (z=12 immediate neighbors, LGU20, status [CERTIFIÉ]) imposing the closure constraint without interstitial vacuum.

It is the articulation of these three properties with the ego-temporality principle — iso-pressure interaction, TOQ Core Axiom O9 — that governs the kinematic mechanics presented below.

1.3 Scope and limits of the present note

This note strictly limits itself to establishing the kinematic invariants of the Flip. It does not address the phenomenological consequences (leptonic masses, fractional charges, hadron structure, magnetic moments), which fall within the application series of the corpus (ZEN, LGU, LiGHT, EXP). This restriction is deliberate: it guarantees the autonomy of the kinematic derivation with respect to any subsequent observational validation.

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2. Flip context — Compression threshold and symmetry breaking

This section establishes the minimal context necessary for understanding the Flip, without developing the energetic and structural aspects that belong to separate notes (LiGHT19 for the elastic rupture of the Plenum, ZEN07 for the Esat scale, LGU00 for the P_0 derivation). The elements presented here are strictly those needed to position §3 and §4.

2.1 The paroxysm and the initial state

At the P_0 threshold, the 66 internal waves of the Chronocyte are compressed at the top of the pyramid (Apex). All waves are in the compression phase (v=1). The system is at maximum saturation.

The value $P_0 \approx 747.9$ GeV is independently derived in LGU (LiGHT00 §4.2) and corresponds to the elastic rupture point of the Higgs fabric beyond which stationary reflection can no longer occur. It is mentioned for context and does not constitute an input parameter of the present derivation.

Energetic context (indicative, outside the demonstration): the topological cost of the invagination ($\Delta E \approx 22$ GeV $\approx 2 \times 11$) reduces the useful post-Flip saturation to Esat ≈ 726 GeV (consistent with ZEN07). These values play a role in the applied phenomenological derivations, but do not enter the establishment of the kinematic invariants §3–§4.

2.2 Symmetry breaking through one-stratum offset

The Flip does not occur on an isolated cell but on a coherent block of the FCC lattice. In order for the sequential motion to initiate, an initial asymmetry is necessary: two neighboring cells cannot overturn simultaneously and identically without being subjected to mutual locking by the coordination constraint (LGU20).

The rupture takes the form of an offset of exactly one stratum between two neighboring cells of the lattice. This offset is the physical artifact that allows the asymmetric start of the cascade. The single stratum is the minimal offset scale compatible with the discretization $T_{11} = 66$ and the coordination $z = 12$: a smaller value does not satisfy the differentiation constraint, a larger value would violate the rule of mechanical economy (path of least action).

Status: [DER] — the one-stratum offset is the direct mechanical consequence of the non-locking constraint of the FCC lattice.

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3. Sequential invagination — The cascade of 65 frictions

3.1 Inversion of the external wave

When the depressive diaphasic contact reaches the compressed Apex, wave N°1 (the outermost, located at the top) yields first. Under the effect of the aspiration, wave N°1 reverses: the Apex inverts and becomes a topological hole.

This void calls the immediately lower wave (N°2) to rush into the axial relaxation column thus hollowed out. The process propagates from neighbor to neighbor: each wave, upon entering the column opened by its upper neighbor, undergoes a single friction contact with it before sliding in turn into the relaxation phase ($v = 2$).

3.2 The ego-temporal isolation rule

In normal CTH regime, the 66 internal waves evolve on 66 “highways” superimposed at different temporal pressures. In accordance with the Ego-Temporality Axiom (TOQ Core Axiom O9, LiGHT00 Section 3), they cross without ever “seeing” or touching each other: interaction exists only between waves of identical temporal pressure.

Friction only appears when a wave is slowed to the point of sliding toward the temporal pressure of its immediate neighbor — at this moment they become ego-temporal and the ego-temporal crossing generates an active friction.

During the Flip, this slowdown occurs sequentially: wave by wave, each slides toward the pressure of its neighbor, undergoes a single friction, then transitions into relaxation phase ($v=2$) where it becomes invisible again for the waves still in compression ($v=1$).

3.3 The 1-for-1 mechanism

Fundamental rule of the sequential Flip:

Each wave flips and undergoes a single friction contact — once and only once — with its immediate neighbor. Once flipped ($v=2$), it becomes invisible again for the waves still in compression ($v=1$). The mechanism is strictly 1-for-1.

Across the 66 waves of the Chronocyte, the cascade generates exactly 65 friction interfaces (number of successive neighbor pairs).

3.4 Structure of the elementary twist

Each neighborhood friction generates an elementary twist of 1/3. This ratio is directly inherited from the 2:1 Asymmetry through the canonical form $(v_D - v_C)/(v_D + v_C) = 1/3$, already established in the derivation of the $\hbar/2$ spin (LiGHT00 Chap.2 §2.3). The internal coherence of the framework requires that the same structural ratio appear in the different kinematic contexts of the substrate.

The cascade accumulates this twist friction after friction. At the end of the 65 frictions of the main lineage, the cumulated twist reaches 65/3; for the offset lineage (64 frictions), it reaches 64/3. These values play a role in the subsequent phenomenological derivations, but their exploitation lies beyond the scope of the present note.

Status: [DER] — the 1-for-1 structure and the 1/3 twist follow strictly from the ego-temporality rules (§3.2) and from the count of neighboring interfaces in the 66-strata structure.

4. Flip kinematics and Inherited Temporal Phase Shift

The sequential character of the Flip carries a fundamental kinematic consequence: it imposes an incompressible topological duration to the overturning, with direct consequences on the synchronization between the nascent CTA and its environment.

4.1 The quantum duration of the Flip (τ_Flip)

The cascade proceeds stratum by stratum. Each elementary friction, defined by the 1-for-1 rule established in §3.3, corresponds mechanically to the crossing of exactly one stratum of the pyramidal substrate. The individual Flip event, referred to the scale of the entire cell (complete cycle over the T_{11} = 66 strata), therefore has a strict dimensionless duration:

$$\tau\_Flip = 1 / T_{11}$$

This quantum corresponds to the topological time required to cross a single stratum of the substrate. It is neither a free parameter nor an externally introduced ad hoc scale: it emerges directly from the discretization of the Plenum into T_{11} strata (ZEN04, iℏ-001) and from the 1-for-1 sequentiality rule (§3.3).

Put differently: since the invagination proceeds wave by wave with no possible jump (ego-temporality rule), and since the substrate does not know any finer temporal scale than the unit step between neighboring strata, the minimum duration of an individual Flip event is exactly the stratum quantum, i.e. $1/T_{11}$.

Status: [DER] — direct corollary of §3.3 (sequentiality) and the T_{11} discretization (ZEN04, iℏ-001).

4.2 The kinematic differential (Δv)

At the moment of the paroxysm immediately preceding the Flip, the mother-CTH was oscillating normally between the compression velocity (v_C = 1) and the relaxation velocity (v_D = 2) according to the Stationary Pulsation Postulate (LiGHT00 Chap.1 §1.1).

When the Flip is triggered, the cell freezes its kinematic state: it becomes a CTA, locked in compression phase (v_CTA = 1). This immobilization is a structural characteristic of the CTA state, documented in LiGHT00 Chap.1 §1.3 and TOQ-G00 §1.

This immobilization does not concern the rest of the Ocean, which imperturbably continues its reference cycle at the mean velocity v_CTH = 2 (current relaxation flux, CT− cosmological epoch, cf. LiGHT00 Chap.13). The overturning therefore generates an instantaneous kinematic differential between the nascent CTA and the ambient substrate:

$$\Delta v = v\_CTH - v\_CTA = 2 - 1 = 1$$

Status: [DER] — direct consequence of the published 2:1 Asymmetry (LiGHT00 Chap.2 §2.2, TOQ-G00 §2, status [ANCH]).

4.3 The Inherited Phase-Shift Quantum (δ_inherited)

During the quantum instant of the Flip (τ_Flip = $1/T_{11}$, §4.1), the nascent CTA accumulates a definitive delay with respect to its environment which continues to flow at velocity v_CTH = 2. This delay is the product of the kinematic differential by the quantum duration of the Flip:

$$\delta\_inherited = \Delta v \times \tau\_Flip = 1 \times (1/T_{11}) = 1/T_{11}$$

Fundamental property of the inherited phase shift:

The post-Flip CTA and its pre-Flip mother-CTH can never re-synchronize. The Quantum Flip has hollowed out at the moment of birth a residual gap of exactly one stratum quantum ($1/T_{11}$), structurally non-resolvable.

This phase shift is imprinted in the very structure of the nascent CTA. It is neither relaxable by a subsequent internal mechanism, nor cancelable by interaction with the environment, because it is inherited from a topologically irreversible event (the Apex invagination).

Status: [DER] — direct kinematic derivation from the results §4.1 and §4.2, both established in the present note or anchored in the published corpus.

4.4 Dimensional consistency and non-dimensionalization

It is worth emphasizing that the entire derivation is carried out in dimensionless units, referred to the discrete structure of the substrate. $\tau_{Flip} = 1/T_{11}$ is a fraction of the complete cell cycle; $\Delta v = 1$ is a ratio between two internal rates; $\delta_{inherited} = 1/T_{11}$ is a fraction of the angular cycle of the subsequent spiral rotation.

This dimensionless approach is consistent with the general methodology of the TOQ corpus, where invariants are first established as pure geometric ratios before any calibration on a physical scale (ZEN04, LGU00). It guarantees that the derivation does not depend on any external dimensioned constant (h, c, $\hbar$, etc.), while remaining convertible to usual units through the corpus calibration chain.

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5. Methodological scope and applied perspectives

5.1 The kinematic building block as a corpus resource

The three kinematic invariants established in the present note — 1-for-1 sequentiality (§3.3), quantum duration $\tau_{Flip} = 1/T_{11}$ (§4.1), inherited phase shift $\delta = 1/T_{11}$ (§4.3) — constitute building blocks exploitable for the phenomenological derivations of the TOQ corpus. Their use in a given application belongs to a separate framework and does not influence their autonomous derivational status.

This methodological distinction is essential: the kinematic invariants are derived from the published axioms and properties of the substrate (ZEN04, LiGHT00, LGU20, i$\hbar$-001), without recourse to any observational measurement. Their ontological validity therefore rests entirely on the internal coherence of this derivation and not on the numerical agreement of any particular phenomenological application.

5.2 Epistemic separation between foundation and application

The relationship between the present note and its subsequent phenomenological applications (notably the EXP series) is deliberately unidirectional: TOQ-KIN-1 provides independently derived invariants that the application notes can mobilize in order to build their own observable derivations.

This epistemic separation is explicit: no phenomenological application constitutes a validation of the kinematic invariants. They illustrate their numerical sensitivity in a particular context, without adding anything to their derivational status. This organization preserves the possibility of evaluating each level independently, and avoids any form of circularity between kinematic foundation and observable application.

5.3 Application to leptonic kinematics

The post-Flip leptonic kinematics naturally mobilize the building blocks of the present note. A nascent CTA, after accumulating the frictions of the cascade and freezing at $v = 1$, begins to rotate on itself in a frame desynchronized by $1/T_{11}$ with respect to the ambient substrate, in accordance with the inherited phase shift (§4.3).

The formal development of this application — construction of the effective rotation length, shear surface, and integration into a complete phenomenological formula — is presented in the EXP01 note (DOI 10.5281/zenodo.19697987), published alongside the present note. EXP01 there illustrates the numerical sensitivity of this particular application to the kinematic invariants established here, without constituting their validation: the derivational status of the invariants §3 and §4 resting exclusively on the internal coherence demonstrated in the present note.

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6. Consolidated epistemic statuses

Element	Status	Anchor / Derivation
T_{11} = 66 discretization	[CERTIFIÉ]	ZEN04, iℏ-001
2:1 asymmetry (v_C=1, v_D=2)	[ANCH]	LiGHT00 Chap.2 §2.2, TOQ-G00
FCC coordination z=12	[CERTIFIÉ]	LGU20
One-stratum offset (§2.2)	[DER]	FCC non-locking constraint
1-for-1 sequentiality (§3.3)	[DER]	Ego-temporality rule (Axiom O9)
65-frictions structure (§3.3)	[DER]	Neighbor-pair count over 66 waves
Elementary 1/3 twist (§3.4)	[DER]	(v_D−v_C)/(v_D+v_C), LiGHT00 §2.3
Quantum duration τ_Flip = $1/T_{11}$ (§4.1)	[DER]	Sequentiality + T_{11} discretization
Kinematic differential Δv = 1 (§4.2)	[DER]	LiGHT00 2:1 asymmetry
Inherited phase shift δ = $1/T_{11}$ (§4.3)	[DER]	Δv × τ_Flip derivation
Dimensional consistency (§4.4)	[DER]	TOQ dimensionless methodology

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7. Internal refutation criteria within the TOQ framework

The kinematic framework presented in this note is subject to several internal refutation criteria, all formulated without recourse to a particular phenomenological application. Each criterion bears on an intrinsic property of the derivation or on a coherence constraint with the published corpus.

External (experimental) falsifiability belongs to the application notes of the corpus (EXP, ZEN series) and lies beyond the scope of the present kinematic foundation note.

7.1 Flip sequentiality

The 1-for-1 rule (§3.3) would be refuted if a coherent TOQ mechanism demonstrated that multiple waves can flip simultaneously without violating ego-temporality (Axiom O9). The emergence of a simultaneous collective Flip would invalidate the 65-sequential-frictions structure.

7.2 Offset structure

The exactly one-stratum offset between neighboring cells (§2.2) would be refuted if the FCC coordination constraint (LGU20) admitted a simultaneous identical overturning without locking. The appearance of strictly identical twin CTA cells in a neighboring lattice would violate the structure laid out here.

7.3 Elementary twist

The 1/3 twist per friction (§3.4) would be challenged if a different count of the ratio $(v_D - v_C)/(v_D + v_C)$ were to impose itself — which would require either revising the 2:1 Asymmetry (LiGHT00 Chap.2), or proposing a different canonical form for the shear coupling. The $\hbar/2$ spin derivation (LiGHT00 §2.3), which uses exactly this ratio, would then also be invalidated by coherence.

7.4 Quantum duration

The duration $\tau\_Flip = 1/T_{11}$ (§4.1) would be refuted if a coherent TOQ mechanism imposed a Flip step different from the single-stratum quantum. Three refutation scenarios are conceivable: (a) a finer step (e.g. $1/(2T_{11})$) imposed by an unknown cellular substructure; (b) a broader step (e.g. 1/11) imposed by a grouping of pyramidal waves; (c) a non-fractional step in T_{11} imposing a scale external to the substrate.

7.5 Kinematic differential

The differential $\Delta v = 1$ (§4.2) would be invalidated if: (a) the 2:1 Asymmetry principle turned out to be incorrect at our cosmological epoch, or (b) the CTA locked at a velocity other than $v = 1$ (for instance $v = \sqrt{2}$, which would correspond to a CTHb regime rather than a CTA — incompatible with the published definition of the CTA state).

7.6 Inherited phase shift

The phase shift $\delta = 1/T_{11}$ (§4.3) would be refuted if its construction as the product $\Delta v \times \tau\_Flip$ did not respect the internal dimensional rules of the TOQ framework — for example if τ_Flip were to be multiplied by a non-trivial function of Δv (e.g. Δv^2, or $\sin(\Delta v)$). The refutation would then require reformulating the underlying kinematic combinatorics, with a direct impact on coherence with the spin derivation (LiGHT00 §2.3).

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8. Conclusion

The present note establishes the kinematics of the Quantum Flip as the quantized mechanics of temporal fluids, strictly obeying the discretization of the Plenum and the ego-temporality principles. Three autonomous kinematic results emerge:

- The sequential invagination of the Apex, stratum by stratum, generates 65 elementary frictions according to the 1-for-1 ego-temporal isolation rule;
- The quantum duration of the individual Flip is $\tau\_Flip = 1/T_{11}$, a direct corollary of the sequentiality and the discretization of the substrate;
- Coupled with the kinematic differential $\Delta v = 1$ stemming from the 2:1 Asymmetry, this quantum imprints in every nascent CTA an inherited temporal phase shift $\delta = 1/T_{11}$, structurally non-resolvable.

These three invariants are derived exclusively from the published axioms and properties of the TOQ framework (ZEN00, ZEN04, LiGHT00 Chap.1–2, LGU20, iℏ-001, TOQ-G00). Their derivational status does not depend on any experimental observation and preserves the possibility of exploitation in phenomenological applications without circularity.

The present note thus constitutes the foundational kinematic building block articulating the ontological axioms with the observable derivations of the corpus. Its direct application to leptonic kinematics is illustrated in EXP01 (DOI 10.5281/zenodo.19697987, published alongside the present note). The complete topological developments of these mechanisms will be addressed in Book III of the TOQ (in preparation).

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9. References

Anchored TOQ corpus

- TOQ Core (ZEN00) — Cadre structurel et axiomes ontologiques O1–O10 [Structural framework and ontological axioms O1–O10]. DOI: 10.5281/zenodo.18487438
- TOQ-G00 — Glossaire Technique Canonique [Canonical Technical Glossary]. DOI: 10.5281/zenodo.19536133
- ZEN04 — E_unit, T_{11} (ancrage des invariants) [E_unit, T_{11} (anchoring of invariants)]. DOI: 10.5281/zenodo.18444584
- ZEN07 — Contraintes structurelles du substrat (échelle Esat) [Structural constraints of the substrate (Esat scale)]. DOI: 10.5281/zenodo.18487917
- ZEN08 — Annexe méthodologique, critères et falsification [Methodological annex, criteria and falsification]. (ZEN corpus)
- LGU20 — Invariant 12 (coordinence CFC) [Invariant 12 (FCC coordination)]. DOI: 10.5281/zenodo.19474601
- LiGHT00 — Loi iso-Géométrique Hydro-Temporelle (Core, Chap.1–2) [Iso-Geometric Hydro-Temporal Law (Core, Chap.1–2)]. DOI: 10.5281/zenodo.18902491
- iℏ-001 — Audit des Invariants Structurels {7, 8, 11, 12} [Audit of Structural Invariants {7, 8, 11, 12}]. DOI: 10.5281/zenodo.19520883

Related notes

- EXP01 — Moment magnétique du muon (g-2) : dérivation structurelle dans le cadre TOQ [Muon magnetic moment (g-2): structural derivation within the TOQ framework]. DOI: 10.5281/zenodo.19697987
- Livre III de la TOQ — Développements topologiques complets du Flip et de la Cascade [Book III of the TOQ — Complete topological developments of the Flip and the Cascade]. (In preparation)

Keywords: Flip kinematics, structural phase shift, stratum quantum, 2:1 asymmetry, ego-temporality, Quantum Flip, sequential invagination, TOQ, temporal physics.

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