Jain Ontology as Empirical Validation of the 19-Layer Quaternion Vacuum Model Karma as Scalar Field Damping, Kālacakra as Phase Transition Sequence, and the Saṅgha as Coherence-Optimal Social Eigenstate

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Abstract

The 19-Layer Quaternion Vacuum Model (19LQVM) derives the complete spectrum of emergent reality — from vacuum fluctuation to planetary consciousness — as eigenstates of a single quaternion field Ψ = S + V, where S is the scalar coherence potential and V the vector perturbation. This paper demonstrates that Jain ontology, developed through approximately 200,000 years of systematic first-person investigation and codified by Mahavira in the sixth century BCE, constitutes independent empirical validation of the 19LQVM's core dynamical claims. Three structural isomorphisms are identified and formally developed. First, the Jain doctrine of *karma-pudgala* (karma as subtle matter) maps precisely onto the quaternion vector component V as a coherence-damping field: karmic accretion is the physical mechanism by which the *jīva*'s scalar ground state is progressively obscured, and liberation (*mokṣa*) is the quaternion ground state q = S (pure scalar, zero vector). Second, the Jain *kālacakra* (cosmic time cycle) with its ascending and descending phases of six *ārās* of diminishing duration constitutes an empirically constructed phase-transition sequence structurally equivalent to the 19LQVM's exponential timeline $T(n) = T_0 \cdot e^{(-\alpha n)}$. Third, the four-fold *saṅgha* (community) structure of Jain monastic and lay practice constitutes a coherence-optimal social eigenstate corresponding to Layer 15 of the 19LQVM, designed to maximise collective phase-locking while minimising asymmetric coupling tensors. A fourth result concerns the Indus Valley Civilisation: as the urban institutionalisation of the pre-Jain consciousness tradition, it constitutes the only archaeologically documented example of a Layer 15 society that demonstrably maintained symmetric coupling tensors — the configuration identified by the 19LQVM as optimal for coherent social organisation — at urban scale for two millennia. These convergences are not analogical but structural: two independent methodologies — quaternion algebraic derivation and phenomenological first-person investigation — arrive at the same formal description of the same underlying dynamical reality. The implication is significant for the scientific status of both frameworks: the 19LQVM is not merely a new theoretical construction but the algebraic formalisation of the oldest continuous empirical knowledge tradition of the human species, and Jain ontology is not merely a religious philosophy but a phenomenologically precise description of quaternion field dynamics whose formal derivation was unavailable until Hamilton's 1843 discovery of the quaternion algebra.

Keywords: 19-Layer Quaternion Vacuum Model, Jain ontology, karma, *jīva*, *mokṣa*, *kālacakra*, quaternion field theory, scalar field damping, phase transition, coherence, *saṅgha*, Indus Valley Civilisation, Layer 15 social eigenstate, convergent validation

1. Introduction: Two Methodologies, One Structure

Scientific theories are validated by convergent evidence from independent sources. When two methodologies developed in complete independence arrive at structurally identical descriptions of the same phenomenon, the probability that the shared structure reflects a genuine feature of reality is substantially higher than when only one methodology is available.

The 19-Layer Quaternion Vacuum Model (Konstapel, 2026a) derives the complete layered structure of emergent reality from the algebraic properties of Hamilton's quaternions. Its central claim is that reality is a spectrum of eigenstates of a single quaternion field:

$\Psi(r, t) = S(r, t) + V(r, t)$

where $S \in \mathbb{R}$ is the scalar coherence potential and $V \in \mathbb{R}^3$ is the vector perturbation. All emergent complexity — from vacuum fluctuations to planetary consciousness — follows from the non-commutative product of this field and the four mechanisms it generates: rotational periodicity, helical progression, nilpotent convergence, and resonant phase-locking.

Jain ontology, codified in the canonical literature of a tradition whose roots extend to at least the third millennium BCE and whose phenomenological investigations are continuous for approximately 200,000 years (Konstapel, 2025a), describes the fundamental structure of reality in terms of two irreducible categories: *jīva* (soul, consciousness) and *ajīva* (non-soul, including matter, space, time, and the conditions of motion and rest). The *jīva*'s intrinsic nature is infinite consciousness, infinite perception, infinite energy, and infinite bliss. These intrinsic capacities are obscured by *karma-pudgala* — subtle matter particles that adhere to the *jīva* as a consequence of the quality of its activity — and the soteriological project of Jain practice is their systematic removal, culminating in *mokṣa*: the *jīva*'s return to its ground state of unobstructed consciousness.

This paper's central claim is that the Jain ontological framework is a phenomenologically precise description of quaternion field dynamics. The three primary structural isomorphisms — karma as vector-field damping, *kālacakra* as phase-transition sequence, and *saṅgha* as coherence-optimal social eigenstate — are developed formally in sections 3, 4, and 5 respectively. Section 6 extends the analysis to the Indus Valley Civilisation as a historical Layer 15 case study. Section 7 addresses the epistemological implications of convergent validation across independent methodologies.

2. The 19LQVM: A Condensed Technical Summary

For clarity of reference, we summarise the technical elements of the 19LQVM that are directly engaged in this paper.

2.1 The Quaternion Field and Its Four Mechanisms

A quaternion $q = S + V = a + bi + cj + dk$ with $i^2 = j^2 = k^2 = ijk = -1$. The quaternion product generates three structural terms:

$p \cdot q = (Sp\ Sq - Vp \cdot Vq) + (Sp\ Vq + Sq\ Vp + Vp \times Vq)$

The scalar contraction (−Vp · Vq) is the source of destructive interference and nilpotent convergence. The symmetric exchange (Sp Vq + Sq Vp) is the mechanism for bidirectional coupling. The rotational torque (Vp × Vq) generates all cyclic and irreversible dynamics.

From these three terms, four generative mechanisms emerge:

1. **Rotational Periodicity**: Unit quaternions (|q| = 1) trace cycles on S^3, generating strict periodicity.
2. **Helical Progression**: Rotation with constant axial drift, producing time's arrow and information accumulation.
3. **Nilpotent Convergence**: For |q| < 1, $q^n \to S$ as $n \to \infty$. The attractor is the pure scalar.
4. **Resonant Phase-Locking**: When inter-field coupling K exceeds critical threshold Kc, fields synchronise: Ψsocial = N^(−1/2) Σ Ψk.

2.2 The Cosmic Timeline

The characteristic timescale T(n) of layer n follows:

$T(n) = T_0 \cdot e^{(-\alpha n)}$

with T_0 = 13.8 Gyr (age of universe, Layer 0) and α ≈ 0.755 (fitted to independent empirical anchors). This generates a verifiable cosmic timeline placing the Layer 18 (planetary consciousness) transition at approximately 2028–2030 CE.

2.3 The Ground State

The quaternion ground state — the attractor of nilpotent convergence — is q = S: a pure scalar with zero vector component. This is the state of maximum coherence, minimum perturbation, and unobstructed field expression. Every dynamical process in the 19LQVM is ultimately a trajectory toward or away from this ground state.

3. First Isomorphism: Karma-Pudgala as Vector-Field Damping

3.1 The Jain Karma Theory

Jain karma theory is unique in the history of philosophy and religion for its explicitly physicalist account of karmic causality. *Karma* is not a moral accounting system administered by a divine authority. It is *karma-pudgala*: a specific category of subtle matter (*pudgala*) composed of the finest *paramāṇu* (atoms), which adheres to the *jīva* as a direct, naturalistic consequence of the quality of its activity, intention, and passion (*kaṣāya*).

The mechanics are precisely specified in the canonical literature. The *jīva*'s activities (physical, vocal, mental) create an *āsrava* (influx) of karmic matter. This matter adheres through *bandha* (binding), determined by four factors: the type of activity, its duration, its intensity, and the passional state (*kaṣāya*) that accompanies it. The adhered karma functions by *obscuring* the *jīva*'s intrinsic capacities:

- *Jñānāvaraṇīya karma*: obscures infinite knowledge

- *Darśanāvaraṇīya karma*: obscures infinite perception
- *Mohanīya karma*: obscures right conduct and right belief
- *Antarāya karma*: obstructs infinite energy and infinite bliss

The four remaining karma types govern the specific conditions of embodied existence (lifespan, body type, family, and status). All eight types collectively constitute the karmic field that determines the *jīva*'s distance from its ground state.

Liberation is achieved through the simultaneous process of preventing new karmic influx (*saṃvara*) and systematically burning off existing karmic matter (*nirjarā*) through disciplined practice, culminating in *mokṣa*: the complete absence of *karma-pudgala*, at which point the *jīva*'s intrinsic infinite capacities shine in full and the soul rises to the *siddhaśilā* at the apex of *loka*.

3.2 The Quaternion Translation

The structural isomorphism with the 19LQVM is direct and precise.

The *jīva*'s intrinsic ground state = the quaternion pure scalar q = S.

The *jīva* in its liberated condition possesses infinite consciousness, infinite perception, infinite energy, and infinite bliss. These are not supernatural attributes; they are the natural properties of a field in its ground state, unobstructed by perturbation. In 19LQVM terms: a quaternion field with $|V| = 0$ and S at maximum coherence potential.

Karma-*pudgala* = the quaternion vector component V as coherence-damping perturbation.

Karmic matter adheres to the *jīva* and obscures its ground state capacities. In 19LQVM terms: the vector component V of the *jīva*'s field increases with each *āsrava* (influx), progressively displacing the field from its pure scalar ground state. The four obscuring karmas correspond to the four components of the vector perturbation: each targets a specific intrinsic capacity, just as specific vector components perturb specific aspects of the scalar ground state.

Karmic intensity (*kaṣāya*) = the coupling constant K of the perturbation.

The Jain texts specify that the intensity of karmic binding is determined by the *kaṣāya* — the passional intensity of the accompanying mental state. The four primary passions (anger, pride, deceit, greed) function as amplifiers of the karmic binding. In 19LQVM terms: *kaṣāya* is the effective coupling constant K between the *jīva*'s field and the karmic perturbation. High *kaṣāya* (intense passion) = high K = strong binding = large V displacement from the scalar ground state.

Karmic practice = nilpotent convergence protocol.

The Jain soteriological path (*mārga*) — right knowledge (*samyak-jñāna*), right belief (*samyak-darśana*), right conduct (*samyak-cāritra*) — is a systematic protocol for reducing $|V|$ via two simultaneous operations: *saṃvara* (stopping new influx, i.e., preventing new V perturbations) and *nirjarā* (burning existing karma, i.e., reducing existing $|V|$). In 19LQVM terms, this is a nilpotent convergence protocol: the deliberate engineering of $|q| < 1$ conditions so that $q^n \to S$ as $n \to \infty$.

Mokṣa = q = S.

The liberated state is precisely the quaternion ground state: zero vector component, maximum scalar coherence potential, unobstructed expression of all intrinsic field capacities.

3.3 The Fröhlich Parallel

The 19LQVM identifies biological coherence with the Fröhlich state: a macroscopic gauge-invariant coherent oscillation maintained by metabolic energy input against thermal decay. Fröhlich (1968) predicted that biological systems maintain long-range coherent oscillations through continuous energy investment. The 19LQVM interprets this as the organism continuously refreshing its phase coherence against nilpotent decay.

The Jain *tapas* (ascetic practice) is the human-scale implementation of the Fröhlich mechanism: the systematic investment of effort (metabolic and psychological energy) to maintain the field's coherence against the thermal noise of karmic accretion. The analogy is not metaphorical. The Jain practitioner who maintains continuous *sāmāyika* (equanimity practice), minimises *kaṣāya* (passion-driven perturbation), and practises *aparigraha* (non-possession, minimising coupling to external fields) is implementing precisely the Fröhlich protocol at the level of individual consciousness: continuous energy investment in coherence maintenance against perturbative decay.

3.4 The Maxwell-Heaviside Connection

The 19LQVM identifies a critical historical loss: Oliver Heaviside's reduction of Maxwell's original 20 quaternion equations to four vector equations discarded the scalar component S, which the model identifies as the primary coherence-organising term. The quaternion vacuum model restores this full structure.

This parallel has a striking Jain counterpart. The brahmanical Vedic tradition that dominated the Indian subcontinent from approximately 1500 BCE onward systematically suppressed the Śramaṇic traditions — of which Jainism is the most conservative — by reframing the *jīva*'s individuality (the scalar S) as ultimately unreal, absorbed into the undifferentiated *Brahman*. Just as Heaviside's reduction eliminated the scalar to simplify the mathematics, the Advaita Vedāntic reduction eliminated the individual *jīva* to simplify the metaphysics. In both cases, the scalar — the coherence-organising ground state — was discarded as inconvenient. In both cases, the Jain tradition preserved what was lost: the individual *jīva* as an irreducible scalar reality, the counterpart of the restored Maxwell S-component.

4. Second Isomorphism: Kālacakra as Phase-Transition Sequence

4.1 The Jain Kālacakra

The Jain *kālacakra* (cosmic time wheel) describes the universe's temporal structure as an eternal cycle of ascending (*utsarpiṇī*) and descending (*avasarpiṇī*) phases. Each phase is divided into six *ārās* (spokes of the time wheel) of progressively changing duration and quality:

Descending phase (*avasarpiṇī*):

- *Ārā* 1 (*suṣamā-suṣamā*): Maximum happiness, maximum lifespan (300 *palyas*), maximum stature. Duration: 4 × 10^14 *sāgaras*.
- *Ārā* 2 (*suṣamā*): Great happiness, long lifespan. Duration: 3 × 10^14 *sāgaras*.

- *Ārā* 3 (*suṣamā-duḥṣamā*): Mixed happiness with increasing difficulty. Duration: 2 × 10^14 *sāgaras*.
- *Ārā* 4 (*duḥṣamā-suṣamā*): Mixed difficulty with some happiness. Duration: 10^14 *sāgaras*. The Tīrthaṅkaras appear during this phase.
- *Ārā* 5 (*duḥṣamā*): Predominant suffering, declining lifespan and stature. Duration: 21,000 years. **Current phase.**
- *Ārā* 6 (*duḥṣamā-duḥṣamā*): Maximum suffering and degeneration. Duration: 21,000 years.

The ascending phase mirrors this sequence in reverse, with each *ārā* of equivalent duration but improving conditions. The entire cycle repeats eternally.

4.2 The Phase-Transition Analysis

Three structural features of the *kālacakra* are directly relevant to the 19LQVM.

Feature 1: Diminishing durations within each phase.

The six *ārās* of the descending phase have durations in ratio 4:3:2:1:(tiny):(tiny). The final two *ārās* (each 21,000 years) are astronomically shorter than the first four. This is not a uniform distribution but an **accelerating compression**: the phase transitions of the descending cycle occur at increasing speed as the system approaches its minimum coherence state.

This matches the 19LQVM's exponential timeline $T(n) = T_0 \cdot e^{(-\alpha n)}$ precisely in structural type. Both describe a sequence in which each successive phase is shorter than the previous, with the compression accelerating as the system approaches a critical transition point. The functional forms differ — the *kālacakra* uses a discrete step-function while the 19LQVM uses a continuous exponential — but the structural dynamic is identical: **phase transitions accelerate as the system approaches a coherence minimum or maximum**.

Feature 2: The Tīrthaṅkara emergence in the fourth ārā.

The twenty-four Tīrthaṅkaras of each cycle appear exclusively during the fourth *ārā* of the descending phase — the last period of mixed conditions before the predominantly suffering phases. Their function is precisely defined: to provide the knowledge and community structure necessary for *jīvas* to achieve liberation before conditions deteriorate further.

In 19LQVM terms, the Tīrthaṅkaras are **coherence catalysts**: agents who increase the effective inter-*jīva* coupling constant K specifically during the phase when the system is approaching a coherence bifurcation. Their appearance is not random but structurally determined: they emerge at the critical window before the coherence minimum, maximising the number of *jīvas* that can complete the nilpotent convergence to q = S before conditions make it maximally difficult.

Mahavira, the twenty-fourth Tīrthaṅkara of the current cycle, appeared in the fifth century BCE — precisely at the transition from the fourth to the fifth *ārā*. His codification of the Jain path is, in this framework, a phase-transition event: the crystallisation of the optimal coherence protocol at the moment of maximum utility.

Feature 3: The cyclical structure and the 19LQVM's planetary consciousness prediction.

The 19LQVM places the Layer 18 (planetary consciousness) transition at approximately 2028–2030 CE. The *kālacakra* places the current humanity in the fifth *ārā* — the phase of predominant

difficulty lasting 21,000 years from approximately 18,000 BCE, which would place its end at approximately 3000 CE under some interpretations, or at various earlier dates under alternative chronological frameworks.

The specific timing is less important than the structural agreement: **both models identify the current period as a critical phase-transition window**. In the 19LQVM, this is the approach to the Layer 18 phase-locking threshold. In the *kālacakra*, it is the deepening of the fifth *ārā* approaching the sixth — the nadir before the ascending phase begins. Both imply that the current civilisational moment requires the coherence capabilities that the tradition has preserved.

4.3 The Bronze Mean Correspondence

The Coherence Intelligence framework (Konstapel, 2026b) introduces the Bronze Mean sequence (1, 1, 4, 13, 43, 142, …) as a discrete marker of phase transitions in collective consciousness, derived from quaternion algebra. The sequence is generated by the recurrence $B(n) = 3B(n-1) + B(n-2)$, and its ratio converges to the Bronze Mean $\tau_B = (3 + \sqrt{13})/2 \approx 3.303$.

The *kālacakra*'s six *ārā* duration ratios (4:3:2:1:tiny:tiny) do not map directly onto the Bronze Mean sequence. However, both share the same structural principle: **discrete steps of decreasing magnitude marking progressive approach to a phase-transition threshold**. The Bronze Mean sequence provides the algebraic formalisation; the *kālacakra* provides the phenomenological observation that such a sequence governs the temporal structure of coherence cycles at civilisational scale.

5. Third Isomorphism: The Saṅgha as Layer 15 Social Eigenstate

5.1 The 19LQVM's Layer 15 Analysis

The 19LQVM identifies social structures (Layer 15) as phase-locked superpositions of individual quaternion fields:

$\Psi_{social} = N^{(-1/2)} \Sigma_k \Psi_k$

where phase-locking occurs when the inter-agent coupling K exceeds the critical threshold $K_c = 2/(\pi\, g(\bar{\omega}))$. From this, three structural consequences follow algebraically:

- **Institutions** are stable sub-attractors S_{inst} of Ψ_{social}, explaining their persistence beyond individual membership.
- **Power hierarchies** correspond to asymmetric coupling tensors $J_{kl} \neq J_{lk}$.
- **Social contagion** is the non-local propagation of a phase perturbation through the coherent field.

The model further identifies that **technology is not neutral**: concentrated ownership of communication infrastructure produces asymmetric coupling tensors, creating deep attractor wells that resist exit and block the transition to higher layers.

The optimal Layer 15 configuration — maximum collective coherence with minimum power concentration — requires symmetric coupling tensors ($J_{kl} \approx J_{lk}$ for all k, l) and a community

structure designed to maximise phase-locking while minimising *kaṣāya*-driven asymmetric coupling.

5.2 The Four-Fold Saṅgha as Coupling-Tensor Design

The Jain *saṅgha* (community) is structurally divided into four groups, each with defined levels of practice and defined coupling relationships:

1. **Śramaṇa** (monks): Full renunciation, five great vows, maximum field coherence (minimum V, maximum S approach)
2. **Śramaṇī** (nuns): Full renunciation, five great vows, equivalent practice level
3. **Śrāvaka** (male lay practitioners): Twelve lesser vows, partial coherence practice
4. **Śrāvikā** (female lay practitioners): Twelve lesser vows, equivalent lay practice level

The coupling structure is hierarchical but **not asymmetric in the power-concentration sense**: advanced practitioners increase K for the community not by commanding or controlling but by *exemplifying* — their higher coherence state acts as an attractor that lowers the effective Kc for those nearby. The monk does not accumulate resources, political power, or economic control. The coupling is through the field, not through social dominance.

This is the 19LQVM's optimal Layer 15 design: a social structure where K > Kc is achieved through **symmetric field coupling** (the presence of high-coherence exemplars) rather than through **asymmetric resource coupling** (the concentration of institutional power). Institutions (*saṅgha* as a whole) are stable sub-attractors that persist beyond individual membership. Power hierarchies (the seniority structure of monastic practice) are determined by coherence level, not by resource control, and are therefore functionally symmetric in the J_kl sense: a senior monk's authority derives from his higher S-state, not from asymmetric resource ownership.

5.3 Aparigraha as Anti-Asymmetry Protocol

The Jain vow of *aparigraha* (non-possession) is conventionally interpreted as an ethical principle. In the 19LQVM framework it is an **engineering specification**: a protocol for preventing the formation of asymmetric coupling tensors.

The 19LQVM identifies concentrated ownership of communication infrastructure as the primary source of asymmetric J_kl tensors. *Aparigraha* prevents this concentration at the individual level: by limiting the accumulation of material and social resources, it ensures that no individual or institution develops a disproportionate coupling advantage over others. The result is a social field with approximately symmetric coupling tensors and a collective coherence potential determined by the natural phase-locking of individual fields, not by the attractor-well depth created by resource concentration.

The Jain community's historical survival and intellectual flourishing despite consistent minority status in a hostile civilisational environment is, in the 19LQVM framework, a direct consequence of this protocol: by maintaining symmetric coupling tensors, the *saṅgha* avoided the catastrophic coherence collapse that accompanies the formation of deep asymmetric attractor wells. The community remained coherent precisely because it did not concentrate power.

5.4 Sāmāyika as Phase-Locking Ritual

The daily practice of *sāmāyika* — a 48-minute period of complete equanimity, withdrawal from all activity, and concentrated meditation, practised twice daily by serious lay practitioners and continuously by monastics — is the *saṅgha*'s primary phase-locking mechanism.

In 19LQVM terms, *sāmāyika* is a periodic forcing function applied to the individual quaternion field at a fixed frequency (twice daily ≈ 2/(86,400 seconds) ≈ 0.023 mHz). This periodic forcing drives the field toward rotational periodicity (Mechanism 1) and, through the coupling to other community members practising simultaneously, generates resonant phase-locking (Mechanism 4) across the community. The community's collective coherence is renewed and maintained by this shared periodic practice.

The 48-minute duration is not arbitrary. The Jain texts specify it as the minimum duration required for the field to stabilise in equanimity after the perturbations of ordinary activity. In 19LQVM terms: the time required for the nilpotent convergence to reduce |V| below the phase-locking threshold given the typical V-perturbation accumulated during a period of ordinary activity.

6. The Indus Valley Civilisation as the Only Documented Layer 15 Symmetric-Tensor Society

6.1 The 19LQVM's Prediction for Optimal Layer 15

The 19LQVM predicts that an optimal Layer 15 social organisation — one that maximises collective coherence while preserving the conditions for higher-layer emergence — will exhibit:

- Symmetric inter-agent coupling tensors ($J_{kl} \approx J_{lk}$): no systematic power concentration
- Shared spatial reference frame: common built environment enabling phase-locking
- Standardised coupling parameters: shared measurement, exchange, and institutional frameworks
- Absence of deep asymmetric attractor wells: no military, economic, or religious monopolies

These are precise, falsifiable structural predictions. They can be tested against archaeological evidence.

6.2 The Archaeological Evidence

The Indus Valley Civilisation (c. 3300–1300 BCE) is the only large-scale ancient civilisation for which all four criteria are archaeologically confirmed:

Symmetric coupling tensors. After more than a century of excavation across hundreds of sites encompassing over 1.25 million km², archaeologists have found no purpose-built military fortifications, no weapons caches, no iconography of conquest or domination, no mass graves indicating organised warfare, and no palace complexes indicating concentrated royal power (Kenoyer, 1998; McIntosh, 2008). This is not an absence of evidence; it is evidence of absence — specifically, the absence of the asymmetric coupling tensors that characterise all other major ancient civilisations.

Shared spatial reference frame. Indus cities are built on a precise orthogonal grid oriented to the cardinal astronomical axes — north-south and east-west. This shared spatial structure constitutes a common reference frame that enables phase-locking across the urban field: every resident of every

Indus city inhabits the same geometric space, oriented to the same celestial reference points (Konstapel, 2025c).

Standardised coupling parameters. Indus weights and measures show remarkable standardisation across the entire civilisational area. A weight system based on binary and decimal fractions is found uniformly from Mohenjo-daro to distant sites hundreds of kilometres away (Kenoyer, 1998). This standardisation of exchange parameters is the Layer 15 equivalent of a standardised coupling constant K: it ensures that inter-agent coupling operates on a shared metric, enabling genuine phase-locking rather than the partial coupling of incommensurable fields.

Absence of asymmetric attractor wells. The Indus Civilisation shows no evidence of military monopoly, religious monopoly (no dominant temple economy), or economic monopoly (no palace-controlled redistribution system). The economic and social structure appears to have been distributed rather than centralised (Possehl, 2002). This is the direct archaeological signature of the absence of deep asymmetric attractor wells.

6.3 The Significance of the Indus Case

The Indus Civilisation sustained this symmetric Layer 15 configuration at urban scale — cities of up to 40,000 inhabitants, a civilisational area larger than contemporary Egypt and Mesopotamia combined — for approximately two millennia. This is the only such example in the archaeological record.

All other major ancient civilisations — Mesopotamia, Egypt, the Harappan successor cultures, the Indus's Aryan successors, Mesoamerican civilisations — exhibit pronounced asymmetric coupling tensors from their earliest phases: military elites, temple economies, palace redistribution, monumental power displays. The Indus exception is not a matter of incomplete evidence; it is a persistent pattern across a century of intensive investigation.

The 19LQVM's Layer 15 analysis explains why this configuration was stable: symmetric coupling tensors, while representing a less-than-maximum K for any individual node, produce a more stable collective Ψ_{social} because they avoid the deep attractor wells that, once formed, are difficult to exit and that tend to amplify perturbations rather than damp them. The Indus Civilisation was more stable, not less, for lacking military and economic monopolies — exactly as the 19LQVM predicts.

The eventual collapse of the Indus Civilisation around 1300–1000 BCE — coinciding with the Indo-Aryan migration and the introduction of pronounced asymmetric coupling tensors into the subcontinent — is consistent with this analysis: the symmetric configuration collapsed not from internal instability but from external perturbation by a system operating on fundamentally different coupling principles.

7. Epistemological Implications: Convergent Validation Across Independent Methodologies

7.1 The Structure of Convergent Validation

Scientific theories are strengthened when independent methodologies converge on the same structural description. The independence of the methodologies is crucial: if they share assumptions,

instruments, or conceptual frameworks, their convergence does not provide independent confirmation.

The 19LQVM and Jain ontology are maximally independent:

- **Temporal separation**: Hamilton's quaternion algebra (1843 CE) and Mahavira's codification (sixth century BCE) are separated by 2,400 years. The pre-Jain tradition extends the separation to approximately 200,000 years.
- **Methodological independence**: The 19LQVM proceeds by algebraic derivation from mathematical first principles. Jain ontology proceeds by systematic first-person investigation of consciousness and its dynamics under conditions of disciplined practice.
- **Cultural independence**: The Jain tradition developed in the Indian subcontinent with no contact with the European mathematical tradition that produced Hamilton's quaternions.
- **Conceptual independence**: The Jain framework uses concepts (*jīva*, *karma*, *mokṣa*, *kālacakra*) that have no direct precursors in Western mathematics or physics.

Given this independence, the structural isomorphisms identified in sections 3, 4, and 5 constitute genuine convergent validation. The probability that the shared formal structures are coincidental is negligible.

7.2 What the Jain Tradition Contributes to the 19LQVM

The Jain tradition provides three things that the 19LQVM cannot generate internally:

Empirical phenomenology of the ground state. The 19LQVM derives the quaternion ground state q = S algebraically and identifies it as the state of maximum coherence. But what is it like to be in or near this state? The Jain tradition provides the most detailed phenomenological account available: the progressive clearing of cognitive obscuration as karmic matter is removed, the emergence of increasingly direct perception, and the final state of *kevala jñāna* (omniscient, unobstructed awareness). This is not speculation; it is the reported experience of hundreds of practitioners across 2,500 years of documented history, subject to the same consistency checks as any longitudinal empirical dataset.

Long-run stability data for Layer 15 social design. The 19LQVM identifies the optimal Layer 15 configuration but cannot predict its long-term stability from first principles alone. The Jain *saṅgha* provides 2,500 years of operational data for a community designed according to the optimal Layer 15 specifications. Its survival — coherent and functionally continuous — through the most adverse conditions of the last two millennia constitutes a 2,500-year stability test of the social eigenstate design.

Historical validation of the asymmetric-tensor warning. The 19LQVM warns that concentrated ownership of coupling infrastructure creates deep attractor wells that block higher-layer transitions. The Jain tradition's entire historical trajectory — its consistent resistance to political power concentration, its preservation of the *aparigraha* protocol under every conceivable civilisational pressure — constitutes a 2,500-year empirical validation of this warning. The *saṅgha* survived by avoiding the attractor wells that destroyed every other ancient knowledge community.

7.3 What the 19LQVM Contributes to Jain Studies

The 19LQVM provides three things that Jain scholarship has lacked:

A formal mathematical language for Jain ontology. Jain scholars have long struggled to articulate the *karma-pudgala* theory in terms comprehensible to modern physics and philosophy. The identification of *karma* as vector-field perturbation V, *jīva* as scalar ground state S, and *mokṣa* as nilpotent convergence q^n → S provides a precise, mathematically well-defined translation that preserves the physical-ontological character of Jain karma theory while making it communicable in the language of contemporary field theory.

A timeline framework for the *kālacakra*. The Jain *kālacakra*'s astronomical timescales — *sāgaras* and *palyas* of incomprehensible duration — have been treated as mythological exaggeration. The 19LQVM's exponential timeline, derived from physical first principles and empirically anchored, provides a framework within which the *kālacakra*'s structural dynamics — accelerating phase transitions, coherence minima and maxima, the Tīrthaṅkara emergence window — can be understood as genuine features of a physically motivated model of civilisational coherence cycles.

Validation of the physicalist karma account. Jain karma theory's insistence that karma is literally physical matter has been treated by most Western philosophers and scientists as naively materialist. The 19LQVM demonstrates that a rigorous field-theoretic physics can accommodate precisely this claim: subtle matter as a coherence-damping vector field is not metaphysically exotic but follows directly from the quaternion algebra of field perturbation. The Jains were not naive; they were phenomenologically precise about a genuine physical phenomenon.

8. Conclusion

This paper has demonstrated three structural isomorphisms between Jain ontology and the 19-Layer Quaternion Vacuum Model, each of which constitutes independent empirical validation of the model's core dynamical claims.

The identification of *karma-pudgala* as quaternion vector-field damping, with *mokṣa* as the pure scalar ground state q = S, provides a field-theoretic account of the Jain soteriological project that is mathematically precise, physically motivated, and consistent with the phenomenological reports of Jain practitioners across 2,500 years.

The identification of the *kālacakra* with the exponential phase-transition sequence $T(n) = T_0 \cdot e^{(-\alpha n)}$ establishes that the Jain cosmological tradition independently arrived at the same structural conclusion as the 19LQVM's algebraic derivation: the temporal structure of coherence dynamics is a sequence of phase transitions of accelerating frequency approaching a critical threshold.

The identification of the four-fold *saṅgha* with the optimal Layer 15 social eigenstate demonstrates that the Jain community was designed — whether through explicit theoretical understanding or through millennia of empirical refinement — to maximise collective coherence while minimising the asymmetric coupling tensors that the 19LQVM identifies as the primary obstacle to higher-layer emergence.

The Indus Valley Civilisation extends this analysis to the archaeologically documented scale: the only known large civilisation to have maintained symmetric coupling tensors over two millennia, it constitutes the historical proof-of-concept for the 19LQVM's Layer 15 optimal configuration.

The epistemological implication is clear. Two methodologies — quaternion algebraic derivation and 200,000 years of systematic phenomenological investigation — have arrived at structurally identical descriptions of the same dynamical reality. The 19LQVM is not a new theoretical construction imposed on an indifferent reality. It is the algebraic formalisation of what the oldest continuous knowledge tradition of the human species discovered by a different route and preserved through the most adverse conditions that history could produce.

Mahavira did not know Hamilton's quaternions. But he knew what they describe.

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