LOCALITY, MASS-ENERGY CONSERVATION, AND THE THERMODYNAMICS OF GENERAL RELATIVITY:

a critical–propositional analysis of Shi Chaojie's article in confrontation with the Theory of Objectivity

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ABSTRACT

This article presents a critical–propositional analysis, in English, of Shi Chaojie's work, *On the Applicability Boundaries of Mass-Energy Conservation and the Concept of Locality in General Relativity—Toward a Thermodynamic Extension of General Relativity*, published on Zenodo in 2026, in confrontation with the Theory of Objectivity developed by Vidamor Cabannas and Denivaldo Silva. Shi's article questions the extrapolation of local differential conservation, expressed by $\nabla_\mu T^{\mu\nu} = 0$, to finite regions of spacetime, arguing that strict mass-energy conservation would be limited to the infinitesimal domain, while real physical systems, because they are finite, remain coupled to the thermodynamic arrow of the universe.

Starting from this problem, Shi proposes a thermodynamic extension of General Relativity, in which locality, conservation, irreversibility, motion, mass, length, singularity, and civilization are reinterpreted under a processual cosmological narrative. The present analysis confronts this proposal with the axioms of the Theory of Objectivity, considered in their modal necessity, that is, as logical conditions necessary for the existence of elements, boundaries, relations, observations, fields, composition, and a substance transcendent to the quantum.

It is argued that Shi's article strongly dialogues with TO by problematizing the idea of an isolated physical system, by recognizing the centrality of the boundary in the definition of the local, by emphasizing irreversibility, and by bringing physical existence closer to relationality. However, points of tension are also demonstrated: Shi's text remains programmatic and speculative, does not begin from a modal axiomatics, does not formulate Nothingness as a primitive mathematical essence, and tends to interpret physical evolution as dissipation or attenuation, whereas TO proposes that the transcendent element corresponds to knowledge or information produced in atomic relations, equivalent to atomic radiations.

The conclusion is that the analyzed article has a high degree of dialogue with the Theory of Objectivity, especially regarding locality, boundary, conservation, thermodynamics, observation, and relationality. In the end, the article receives the score **8.9/10** regarding its potential dialogue with TO.

Keywords: Theory of Objectivity; General Relativity; mass-energy conservation; locality; thermodynamics; boundary; phenomenic elements; Inducer Effects; transcendent substance; atomic radiations.

1. Introduction

Shi Chaojie's article, published on Zenodo in 2026, proposes a conceptual investigation into the applicability limits of mass-energy conservation in General Relativity. Its starting point is the often neglected distinction between local differential conservation and global or finite conservation. For Shi, the condition $\nabla_\mu T^{\mu\nu} = 0$, although rigorous as a local expression of the conservation of the energy-momentum tensor, should not be automatically interpreted as a guarantee of mass-energy conservation in any finite region of spacetime. The decisive question therefore becomes: what does "local" mean in General Relativity?

This problem is not merely technical. It concerns the ontology of spacetime itself, the definition of physical systems, the legitimacy of mathematical extrapolation from the infinitesimal to the finite, the nature of conservation in cosmology, the relation between geometry and thermodynamics, and the presence or absence of an objective arrow of time. Shi maintains that mass-energy conservation, in its strict form, can only be affirmed in the infinitesimal limit; in real, finite, and temporal systems, conservation would degrade into approximation, because every physical process would be bound to the entropic evolution of the universe (Shi 2026).

The Theory of Objectivity, in turn, presents its own axiomatic structure, founded upon Seven Absolute Truths through which the existence of the universe, of elements, of boundaries, of observation, and of a substance transcendent to the quantum can be thought in terms of modal necessity. TO does not treat the universe as a simple aggregate of matter, nor as a merely geometric stage of physics. It interprets the universe as a logical-ontological process of objective constitution, in which elements are delimited by boundaries, singularized by fields, composed of prior elements, confirmed by observation, and traversed by a substance transcendent to the quantum (Cabannas and Silva 2016; Cabannas and SILVA 2018).

Shi's proposal therefore finds fertile ground for confrontation with TO. By questioning locality and the closed system, the article approaches the Fourth Absolute Truth, according to which two distinct elements require at least one boundary line between them. By affirming the relationality of existence, it approaches the Fifth Absolute Truth, according to which an element exists fully only if observed by at least two others. By discussing cosmic irreversibility, it allows dialogue with the cosmological Eras of TO. By thinking about dissipation, loss, and radiation, it may be reinterpreted in light of the Seventh Absolute Truth, according to which there is no existential universe without a substance transcendent to its quantum.

In this article, the transcendent substance of TO will be considered according to the

formulation indicated by the authors: the transcendent element corresponds to knowledge or information produced in atomic relations and is equivalent to atomic radiations. This equivalence is decisive for the present analysis, because it allows the "thermodynamic dissipation" proposed by Shi to be reinterpreted not merely as loss, but as the possible production of objective information or transcendent atomic radiation.

The purpose of this study is to present an expanded analysis, in Chicago author-date style, of Shi's article in confrontation with the foundational bibliography of TO, the recent bibliography of TO, and the supporting and dialogical bibliography. The text seeks to identify compatibilities, tensions, and propositional possibilities, without transforming Shi's article into a full confirmation of TO, but recognizing its value as a relevant contemporary interlocutor.

2. The analyzed article and its central problem

The analyzed article is:

> Shi, C. 2026. *On the Applicability Boundaries of Mass-Energy Conservation and the Concept of Locality in General Relativity—Toward a Thermodynamic Extension of General Relativity*. Zenodo. https://doi.org/10.5281/zenodo.20048915.

Shi's central thesis may be organized into three movements. The first is critical: the author questions the passage from local differential conservation to mass-energy conservation in finite regions. The second is conceptual: he maintains that the problem arises from the ambiguity of the notion of locality. The third is propositional: he suggests a thermodynamic extension of General Relativity, in which the arrow of time, entropy, and irreversibility are incorporated as structural elements of relativistic physics.

General Relativity has already made known the fact that global energy conservation is not, in general, guaranteed in dynamic cosmological spacetimes. The absence of a global temporal symmetry, that is, of a global timelike Killing field, prevents the direct application of energy conservation via Noether's theorem on a cosmological scale. The condition $\nabla_\mu T^{\mu\nu} = 0$, in turn, remains as the local expression of the covariant conservation of the energy-momentum tensor. The problem, for Shi, is that the physics community often treats this local conservation as if it authorized strict mass-energy conservation in finite systems (Shi 2026).

Shi argues that this leap is conceptually problematic. The rigorous local domain of General Relativity would be the infinitesimal: an ideal neighborhood in which curvature may be neglected and the Minkowskian structure is recovered. However, laboratories,

planets, stars, galaxies, and civilizations are not infinitesimal. They exist in finite regions of spacetime, traversed by processes, temporal flow, gravitational fields, and thermodynamic irreversibility.

This criticism leads the author to a strong thesis: mass-energy conservation would be an excellent approximation in small and nearly isolated local systems, but not an absolutely strict principle in finite regions. Conservation would therefore be scale-dependent. It would improve toward the infinitesimal and weaken toward the cosmological.

From the standpoint of TO, this problem is decisive. TO asks, before formal physics, about the logical conditions for the existence of elements. If a system can only be distinguished by a boundary, and if every real boundary is finite, then the conservation attributed to the system depends on the ontology of the boundary. Shi's problem is, in this sense, an eminently objectivist problem: how can a finite physical element be defined, delimited, and conserved if its locality is conceptually vague?

3. Mass-energy conservation between locality, globality, and finitude

The distinction between local conservation and global conservation is one of the cores of Shi's article. In classical physics and in Special Relativity, energy conservation appears with great clarity, especially in closed systems and in spacetimes endowed with temporal symmetries. In General Relativity, however, the situation becomes more complex. Spacetime is not a fixed stage; it is dynamic, curved, and affected by the distribution of matter and energy. The very definition of global gravitational energy becomes problematic.

Shi uses this difficulty to challenge a vulgarized interpretation of conservation. If local conservation is expressed in differential form, it cannot simply be taken as integrated conservation in any finite region. The passage from point to volume, from the infinitesimal to the finite, and from the local to the global requires additional conditions. Without these conditions, finite conservation becomes an unjustified postulate.

This criticism is compatible with a tradition in the philosophy of physics that already recognizes the problematic character of gravitational energy and global conservation in General Relativity. Earman, Curiel, Lam, and other authors have discussed the conceptual difficulties of energy in general spacetimes, as well as the difference between symmetry, invariance, and conservation (Earman 2004; Curiel 2017; Lam 2011). Shi's merit lies in transforming this difficulty into a starting point for a thermodynamic extension of General Relativity.

TO can receive this discussion under its own key. If conservation depends on the

delimitation of a region, then it depends on the boundary. And if the boundary is the modal condition for the distinction between elements, then conservation is not an absolute primary property, but a property derived from the objective constitution of an element or system. TO does not begin with the conserved quantity, but with the logical possibility of something being delimitable, distinguishable, observable, and relational.

In this sense, mass-energy conservation can only be objectively attributed to an element after that element has been constituted as a phenomenic unit. Before that, there is only mathematical abstraction. Shi's criticism of finite conservation therefore reinforces the need for an ontology of elements.

4. The modal necessity of the axioms of the Theory of Objectivity

The Theory of Objectivity is grounded in Seven Absolute Truths:

1. Nothingness is a Primitive and Eternal Mathematical Essence.
2. Every element has a magnetic field, or aura, that makes it unique.
3. Infinity represents the necessary non-element for the logical definition of the universe.
4. Two distinct elements require at least one boundary line between them.
5. An element exists fully only if observed by at least two others.
6. Every element is composed of elements prior to it.
7. There is no existential universe without a substance transcendent to its quantum.

The force of these axioms, in TO, is not merely hypothetical. They possess modal necessity. This means that they do not merely describe observed empirical regularities, but conditions without which there would be no objective universe, no distinguishable element, no relation, no observation, no composition, and no phenomenic existence.

The First Truth places Nothingness as a primitive and eternal mathematical essence. It is not equivalent to physical emptiness, nor to the quantum vacuum, but to a logical-originating condition. The Second Truth states that the element is neither neutral nor homogeneous: it possesses field, aura, and singularity. The Third Truth introduces infinity as a necessary non-element, preventing totality from being confused with an ordinary element. The Fourth Truth grounds distinction through boundary. The Fifth Truth grounds existential fullness through observation. The Sixth Truth grounds the genealogy

of elements. The Seventh Truth grounds the informational-radiative transcendence of the universe.

Shi's article does not formulate axioms of this kind. Its procedure is different: it begins from internal tensions in contemporary physics and proposes conceptual inferences. The author himself recognizes that he operates through "logical leaps" and through a methodology of philosophy of physics. This recognition is important, because it brings Shi closer to the methodological awareness of TO, although it does not place him on the same modal plane.

TO may evaluate Shi's article as an attempt to destabilize physical assumptions taken as absolute, especially mass-energy conservation in finite regions. However, TO would add that no physical reformulation is sufficient if it does not reach the modal conditions of objective existence. In other words, Shi's article is important because it questions a physical dogma; but TO goes further, because it seeks the logical structure necessary for any physics to be possible.

5. Locality as a problem of boundary: dialogue with the Fourth Absolute Truth

The Fourth Absolute Truth of TO states that two distinct elements require at least one boundary line between them. This truth is especially relevant for the analysis of Shi's article, because the concept of locality is, at its core, a concept of boundary.

When physics speaks of a local region, it presupposes that this region can be distinguished from others. This distinction requires a boundary, whether explicit or implicit. If the boundary is infinitesimal, the system approaches a mathematical point; if it is finite, it becomes a physical domain traversed by flow, curvature, interaction, and time. Shi's question—"how small must a region be to qualify as local?"—is therefore a question about the ontological legitimacy of the boundary.

In TO, the boundary is not a simple convention. It is a condition for the existence of the element. Without boundary there is no distinction; without distinction there is no element; without element there is no relation; without relation there is no observation; without observation there is no existential fullness. Thus, Shi's criticism of locality reinforces the fundamental role of the Fourth Truth.

The tension arises because General Relativity works with differential locality, while phenomenic reality manifests itself in finite regions. The mathematical point conserves; the physical process transforms. The infinitesimal is formally rigorous; the finite is ontologically effective. TO may resolve this tension by affirming that the real physical element is not the abstract point, but the unit delimited by boundary and actualized by relations.

Thus, Shi's article may be read as an indirect confirmation of the modal necessity of boundary. It shows that, when the boundary is ignored or treated as trivial, concepts such as conservation, locality, and system become vague. TO, by contrast, places the boundary at the center of ontology.

6. Mass-energy, equivalence, and transcendent substance in TO

One of the most relevant aspects of Shi's article is its distinction between mass-energy equivalence and mass-energy conservation. According to the author, $E = mc^2$ expresses a proportional equivalence between mass and energy, but does not, by itself, imply the conservation of the mass-energy whole. Equivalence and conservation would be logically distinct laws or principles.

This distinction is useful for TO, because it prevents reality from being reduced to the simple accounting of quantities. TO does not deny the importance of mass, energy, and radiation, but understands that the existential universe requires a substance transcendent to its quantum. According to the formulation adopted in this analysis, this transcendent substance corresponds to knowledge or information produced in atomic relations, equivalent to atomic radiations.

Here a decisive propositional contribution emerges. Shi interprets the passage of time and motion as processes associated with the dissipation or attenuation of mass-energy. TO may reinterpret this dissipation not as mere loss, but as the production of radiative information. In other words, what Shi calls unavailable energy, dissipation, or attenuation may be translated, in the ontology of TO, as a manifestation of the transcendent element: knowledge produced in atomic relations, equivalent to atomic radiations.

This reading avoids two extremes. The first would be to reject Shi because of his physical speculation. The second would be to accept him literally as if he had demonstrated the real loss of intrinsic mass. The propositional path of TO is more balanced: thermodynamic dissipation can be understood as a sign that physical reality is not exhausted by mechanical conservation. It produces records, memory, information, and radiation.

From this perspective, mass-energy not strictly conserved does not disappear into physical nothingness. It is reinscribed in the universe as relational information. Classical conservation gives way to a deeper objective continuity, grounded in transcendent substance.

7. Irreversibility, the arrow of time, and the cosmological Eras of the Theory of Objectivity

Shi's article proposes that the thermodynamic arrow of time be incorporated into the basis of General Relativity. This proposal finds affinity with the work of Prigogine and Stengers, for whom irreversibility is not a merely secondary detail, but a constitutive dimension of nature (Prigogine and Stengers 1984). It also dialogues with contemporary discussions on the thermodynamics of spacetime, such as Jacobson's, for whom Einstein's equations may be interpreted as equations of thermodynamic state (Jacobson 1995).

In TO, time does not appear merely as an external coordinate. It is expressed through cosmological Eras: the Antagonistic Era, the Era of Logical Tracks, the Era of Logical Currents of Tertiary Plasma, the Centrifugal Era, and the Era of Units of Intelligence. These Eras indicate that the universe is constituted by successive processes of differentiation, organization, induction, centrifugation, memory, atomic formation, and the emergence of intelligence.

Shi's proposal may be situated within this scheme. His discussion of the tension between local conservation and global non-conservation corresponds, in TO language, to an echo of the Antagonistic Era: there is opposition between the conservative point and the finite process, between formal reversibility and cosmic irreversibility. His criticism of the assumptions of physics may be associated with the Era of Logical Tracks: Shi seeks to redraw the conceptual tracks through which physics interprets locality, conservation, and covariance. His emphasis on entropic flow and irreversible evolution dialogues with the Logical Currents of Tertiary Plasma. His discussion of expansion, redshift, scale, and cosmology approaches the Centrifugal Era. Finally, his reflection on civilizations and the Fermi Paradox directly touches the Era of Units of Intelligence.

However, TO would not reduce these Eras to thermodynamics. The entropic arrow is important, but not sufficient. The Eras of TO have a logical-modal and ontological foundation, not merely a physical-statistical one. Entropy may be a phenomenic manifestation of the process, but not its ultimate foundation.

8. Phenomenic elements, Inducer Effects, and the criticism of the isolated system

The phenomenic elements of TO may be understood as objective manifestations of elements in field, boundary, relation, observation, memory, radiation, and information. They are not merely passive objects. They are units of presence, singularization, and action.

Shi's article is relevant because it questions the physical existence of absolutely closed systems. For him, every finite system is, in some way, coupled to cosmological evolution. Strict conservation appears only when the system is idealized as infinitesimal or perfectly isolated. Since such systems do not fully exist in physical reality, strict conservation becomes an idealization.

This criticism is compatible with TO. A phenomenic element is never absolutely isolated. It possesses aura, boundary, relations, observers, and prior composition. Its state is not merely internal; it is conditioned by fields of relation. Hence the importance of the Inducer Effects.

The Inducer Effects may be thought of as processes through which elements affect other elements, reduce possibilities, produce actualizations, induce formations, transform fields, and generate information. Motion, in Shi's reading, is thermodynamic evolution. In TO, motion may be reinterpreted as an inducer effect of phenomenic actualization. By moving, an element alters relations, produces radiations, modifies observable boundaries, and inscribes information into the field of atomic relations.

Thus, dissipation in Shi may correspond, in TO, to a Reducing Inducer Effect: available energy decreases, but objective information increases. The system loses mechanical availability, but produces memory, radiation, or relational knowledge. This point is fundamental to avoid a pessimistic reading of Shi's cosmology. TO sees not only loss; it sees transcendental production of information.

9. Relationality, observation, and existential fullness: approximations between Shi and TO

Shi's article approaches Relational Quantum Mechanics by maintaining that physical states should not be thought of as isolated absolute properties, but as relations between systems. This perspective finds an echo in Rovelli, for whom quantum states are relative to observers or physical systems (Rovelli 1996; Rovelli 2005). Shi extends this reasoning to the macroscopic domain, suggesting that mass, length, and physical state may also have a relational nature.

TO is even more radical at this point. Its Fifth Absolute Truth states that an element exists fully only if observed by at least two others. Observation is not merely a human mental act; it is an objective relation of phenomenic confirmation. Existential fullness requires relational triangulation.

When Shi states that there is no isolated existence, but only relative existence in relations, he comes very close to TO. The difference lies in the foundation. Shi derives this conclusion from reflections on General Relativity, thermodynamics, and Relational

Quantum Mechanics. TO establishes it as a necessary modal truth. For TO, relationality is not a late consequence of physics; it is the condition for there to be an objective element.

This convergence is one of the reasons why the analyzed article has a high degree of dialogue with TO. Both reject the self-sufficient object. Both recognize that reality is constituted in relation. Both weaken the idea of physical properties absolutely independent of context.

10. The cosmogonic theorem of TO before the thermodynamic extension of General Relativity

Shi's article does not present a theory of the absolute origin of the universe. It proposes a thermodynamic extension of General Relativity and a reinterpretation of phenomena such as the twin paradox, length contraction, the Fermi paradox, covariance, and singularity. Its interest is more cosmological than cosmogonic.

The cosmogonic theorem of TO, by contrast, seeks to explain the genesis of the universe from the Seven Absolute Truths. Origin is not taken merely as a physical singularity, nor as an initial empirical event, but as a logical process through which Nothingness, as a primitive mathematical essence, allows the constitution of the universe through differentiation, boundary, element, field, observation, composition, and transcendence.

In this sense, TO may situate Shi's article at a later stage of reality. Shi discusses the already constituted universe, in which there are spacetime, mass, energy, thermodynamics, civilizations, and singularities. TO asks about the prior conditions that make it possible for there to be spacetime, mass, energy, thermodynamics, and civilizations.

The possible compatibility is the following: the thermodynamic extension of General Relativity may be interpreted as a phenomenic description of one stage of the cosmogonic theorem of TO. Once the elements are constituted, they begin to operate in fields, boundaries, relations, and inducer effects. The irreversibility described by Shi would be a physical-cosmological manifestation of the Eras of TO, but not their ultimate foundation.

11. Points of compatibility between the analyzed article and the Theory of Objectivity

The main points of compatibility are the following.

First, there is compatibility in the criticism of absolute isolation. Shi rejects the idea that finite systems can be treated as rigorously closed in an ontological sense. TO also rejects the isolated element, since every element requires field, boundary, composition,

and observation.

Second, there is compatibility in the centrality of boundary. Shi's criticism of locality is, at bottom, a criticism of the poorly defined boundary. TO already establishes boundary as modal necessity.

Third, there is compatibility in relationality. Shi defends an expanded relational physics; TO maintains that existential fullness requires observation and relation.

Fourth, there is compatibility in irreversibility. Shi wants to integrate the thermodynamic arrow into General Relativity; TO describes cosmological Eras of formation, differentiation, and actualization.

Fifth, there is compatibility in the criticism of purely geometric physics. Shi wants to add thermodynamics to relativistic geometry; TO wants to add a deeper logical-modal ontology to physics.

Sixth, there is compatibility in the opening toward information. Although Shi speaks more of dissipation, his own discussion of irreversibility and relationality allows reinterpretation by TO as the production of information/atomic radiation.

Seventh, there is partial methodological compatibility. Shi admits the importance of logical leaps and conceptual narratives in fundamental physics. TO also operates with a modal discipline that precedes complete mathematization.

12. Points of tension between the analyzed article and the Theory of Objectivity

The points of tension are also relevant.

The first tension is foundational. Shi does not begin from Nothingness as a primitive mathematical essence. His discussion begins within already constituted physics. TO, by contrast, asks about the conditions of possibility of the very constitution of the universe.

The second tension is modal. Shi's assumptions are conceptual hypotheses; the axioms of TO are presented as absolute truths endowed with modal necessity. This means that Shi's article remains at the physical-speculative level, while TO claims to occupy the logical-ontological level.

The third tension is interpretive. Shi tends to interpret evolution as dissipation or attenuation. TO may accept dissipation as a phenomenon, but not as the final word, because transcendent substance corresponds to information or knowledge produced in atomic relations and equivalent to atomic radiations.

The fourth tension is physical. The proposal that length contraction is an intrinsic irreversible process, or that rest mass attenuates with motion, confronts consolidated interpretations of Special Relativity. Although speculatively interesting, it requires much stronger mathematical formalization and empirical evidence.

The fifth tension is cosmological. Shi proposes a physical filter for civilizations, suggesting that advanced civilizations could dissipate due to deep thermodynamic laws. TO may dialogue with this hypothesis, but tends to interpret intelligence as an advanced manifestation of transcendent substance and cosmic memory, not merely as a path toward dissipation.

The sixth tension is methodological. Shi's article values logical leaps, but does not yet provide a clear operational program of testability. Recent TO, especially in texts on operational bridges and testability, seeks to articulate modal axioms with empirical contact (Cabannas and Silva 2026a; Cabannas and Silva 2026b).

13. Foundational, recent, and supporting bibliography: critical articulation

The foundational bibliography of TO is decisive for framing Shi's article. In *Teoria da Objetividade: terceira teoria de origem do universo, alternativa à Teoria do Big Bang e ao Criacionismo*, Cabannas and Silva present TO as an alternative cosmogonic proposal, structured by fundamental logical truths (Cabannas and Silva 2016). The English version of 2018 expands the international reach of the theory and places it in dialogue with contemporary cosmological debates (Cabannas and SILVA 2018). *A Esfera Perfeita* develops formal, ontological, and symbolic aspects related to totality, limit, and perfection (Cabannas and SILVA 2020).

These works allow Shi's article to be interpreted as a physical interlocutor, not as a foundation of TO. Shi helps show that contemporary physics has internal tensions; TO offers a more radical answer, by proposing a modal ontology of origin and elements.

The recent bibliography of TO deepens this dialogue. *Teoria da Objetividade: Fundamentos Lógicos, Ontológicos e Científicos para uma Nova Física e Cosmologia* organizes TO in terms compatible with current scientific debates and artificial intelligences (Cabannas and SILVA 2025). *From Modal Axioms to Empirical Contact* is especially important, because it proposes operational bridges between modal axioms and empirical testability (Cabannas and Silva 2026a). *Modal Ontology and Testability* reinforces the need for boundaries, convergences, and a phenomenic table as instruments of dialogue with contemporary physics (Cabannas and Silva 2026b).

Recent texts on gravity as the emergence of convergence zones, quantum field

theory and the properties of the vacuum, as well as the criticism of the Big Bang under modal discipline, broaden the possibility of dialogue with Shi. In particular, Shi's criticism of local conservation may be articulated with convergence zones; his discussion of QFT as an approximation in local spacetime may dialogue with TO's reading of the vacuum; and his thermodynamic cosmology may be confronted with TO's modal criticism of cosmic origin (Cabannas and Silva 2026c; Cabannas and Silva 2026d; Cabannas and Silva 2026e).

The supporting bibliography is also central. Einstein provides the basic relativistic framework (Einstein 1920). Heisenberg makes it possible to understand modern physics as a philosophical revolution of observation and reality (Heisenberg 1958). Bohm contributes the notion of wholeness and implicate order (Bohm 1980). Prigogine and Stengers provide the basis of irreversibility and order emerging from chaos (Prigogine and Stengers 1984). Penrose and Hawking provide the cosmological, relativistic, and singularitarian background (Penrose 2004; Hawking 1988). Kuhn helps situate Shi as an attempt at paradigmatic revision (Kuhn 1962).

Aspect, Planck, LIGO/Virgo, and JWST are relevant as an empirical horizon. Although Shi's article does not report a specific empirical test capable of confirming TO, its themes may be confronted in the future with cosmological data, gravitational waves, anisotropies of the cosmic microwave background, observations of ancient galaxies, and experimental limits on energy conservation.

14. Scale of dialogue of the article with TO

On a scale from zero to ten, Shi Chaojie's article receives the score:

8.9 / 10

The score is high because the article dialogues with core themes of the Theory of Objectivity: locality, boundary, conservation, relation, observation, irreversibility, thermodynamics, cosmology, information, and criticism of the foundations of physics. The strongest point of dialogue is the criticism of locality, which is directly articulated with the Fourth Absolute Truth of TO. The second strongest point is the relationality of existence, in strong approximation with the Fifth Absolute Truth. The third is the possibility of reinterpreting thermodynamic dissipation as the production of information/atomic radiation, in dialogue with the Seventh Truth.

The score is not 10 because the article does not begin from a modal axiomatics; does not formulate Nothingness as a primitive mathematical essence; does not identify transcendent substance as knowledge or information produced in atomic relations; and

presents physical hypotheses that are still very speculative, especially concerning intrinsic mass, irreversible contraction, and dissipation through motion.

15. Final considerations

Shi Chaojie's article is a relevant speculative contribution to the philosophy of contemporary physics. Its value lies in questioning the extrapolation of local differential conservation to mass-energy conservation in finite regions and in proposing a thermodynamic extension of General Relativity. In doing so, the author reopens fundamental questions about locality, boundary, system, irreversibility, motion, time, mass, and civilization.

In confrontation with the Theory of Objectivity, the article reveals great potential for dialogue. It reinforces the importance of boundary, relation, observation, and processuality. It also shows that contemporary physics still faces deep conceptual tensions when it tries to articulate geometry, thermodynamics, and cosmology.

TO, however, offers a deeper structure. Its axioms possess modal necessity and do not depend on a specific physical theory. The locality discussed by Shi may be reinterpreted through the Fourth Absolute Truth. Relationality may be deepened through the Fifth Truth. Irreversible evolution may be situated within the cosmological Eras. Dissipation may be reinterpreted as the production of transcendent substance, that is, knowledge or information produced in atomic relations, equivalent to atomic radiations.

Thus, Shi's article should be received as a fertile interlocutor, but not as a full confirmation of TO. It is a dialogue partner that helps show the need for a physics that is more ontological, more relational, and more sensitive to boundary. TO, in turn, offers Shi's article a modal framework capable of transforming its criticism of locality into a broader theory of objective existence.

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A. TO-style note: locality, atomic radiation, and transcendent substance

In the modal discipline of the Theory of Objectivity, locality is not a mere geometric cutout. Locality is boundary. And boundary is the condition of element. Where there is no boundary, there is no distinction; where there is no distinction, there is no element; where there is no element, there is no relation; where there is no relation, there is no observation; where there is no observation, there is no existential fullness.

Shi Chaojie's article touches an essential point: contemporary physics speaks of local conservation, but does not always ask what the local is. TO answers: the local is the boundary zone in which the element becomes distinguishable. Yet every distinguishable element possesses aura, field, relation, and openness. Therefore, no physical local domain is absolutely closed. Perfect conservation belongs to the abstract limit; objective existence belongs to the finite process.

In the language of TO, the apparent dissipation of mass-energy should not be taken as ontological disappearance. The universe does not simply become poorer when it transforms. It produces information. In atomic relations, elements generate objective knowledge, and this knowledge manifests itself as atomic radiation. Thus, the substance transcendent to the quantum is not a mystical substance, but the information produced in the very relational fabric of matter.

Where Shi sees attenuation, TO sees passage.

Where Shi sees dissipation, TO sees transposition.

Where Shi sees loss of available energy, TO sees the production of radiative memory.

Where Shi sees the limit of conservation, TO sees the emergence of the transcendent element.

The universe, therefore, is not only that which conserves. It is that which records. It is not only mass-energy. It is mass-energy in relation, radiating information, forming memory, producing knowledge, and constituting objectivity.

Local conservation may be an excellent approximation. But objectivity requires more than conservation. It requires boundary, field, relation, observation, composition, and transcendence. In this key, the thermodynamic extension of General Relativity proposed by Shi is not a replacement for TO, but a path of dialogue: it shows that physics, upon reaching its own conceptual limits, rediscovers the need for an ontology of elements.

TO affirms: no existential universe subsists without a substance transcendent to its quantum. And this substance is the informational knowledge produced in atomic relations,

equivalent to atomic radiations. Thus, radiation is not merely physical emission; it is the objective testimony of relation. Each atom that interacts writes, into the structure of the universe, a fragment of knowledge. Each boundary that forms inaugurates a distinction. Each observation confirms an existence. Each cosmological Era reveals a stage in the objectivation of the real.

This is the TO reading of Shi's article: the crisis of locality is the opening of boundary; the crisis of conservation is the emergence of information; the crisis of the isolated system is the confirmation of relation; and the crisis of purely geometric physics is the announcement of an ontological physics of objectivity.