

Spacetime Substantivalism XIX: The Three  
Major Misunderstandings in the History of  
Science and the Ultimate Restoration of  
Substantial Spacetime Ether  
— A Gravitational Wave Audit, the  
Rehabilitation of Tesla’s Truth, the Discovery  
of Human Dual Tracks, and the Establishment  
of Species’ Logical Value Based on the CSSD  
Framework

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**Abstract**

The gravitational waves detected by LIGO in 2015 serve as the first hammer to shatter the “geometric illusion of spacetime.” The fact that gravitational waves traveled from a black hole merger 1.3 billion light-years away and took 1.3 billion years to reach Earth directly refutes the mystical misreading that “when light travels at speed, time stops and distance vanishes to zero.” Based on the CSSD framework (Substantial Spacetime Dynamics / Spacetime Substantivalism 0-XVIII), this paper takes gravitational waves as its logical starting point to systematically audit the three major misunderstandings in the history of science. Following the constitutive audit framework of “Bandwidth Fallacy (parameter) to Protocol Fallacy (motion) to Fuse

Fallacy (limit)": The First Misunderstanding (Bandwidth Fallacy) misinterprets the constitutive refresh rate  $C_s$  of substantial spacetime in Maxwell's equations as the particle motion velocity  $c$ ; the Second Misunderstanding (Protocol Fallacy) misinterprets the logical resource depletion as  $v \rightarrow C_s$  in the Lorentz factor as "time stops," creating a mystical "photon perspective" universe; the Third Misunderstanding (Fuse Fallacy) misinterprets  $C_s^2$  (constitutive strength) in the Schwarzschild radius as the square of velocity, thereby disguising a physical fuse zone as a "geometric singularity." This paper formally proposes and establishes the academic term **"Substantial Spacetime Ether"** to clarify its ontological status as substantial spacetime itself ( $X$ ), definitively ending the tragedy in the history of science caused by misreading it as "material ether." This paper further reveals that the reference frame for particle light speed  $c$  must be substantial spacetime ether — the 1.7-second delay of gamma rays relative to gravitational waves in the GW170817 event constitutes the **Empirical Evidence of Constitutive Asymmetry** — the **"bankruptcy declaration"** of  $c$  as a fundamental constant. **The Singularity does not entertain excuses**; if gravitational waves can arrive punctually, the photon's lateness is a **hierarchical default** and an intrinsic downgrading (Instantiation Friction Loss) during the instantiation refresh process, not an environmental issue. Gravitational waves always propagate at the constitutive refresh rate  $C_s$  with **intrinsic delivery**. This paper defines black holes as an **Entropy Reduction Archiving System** — the physical fuse zone of substantial spacetime under the yield strength  $C_s^2$  (the maximum stress load per unit mass that the spacetime medium can withstand before fracture). Building on the core discovery of Spacetime Substantialism 0, this paper strictly distinguishes **Human Dual Tracks**: the **Consciousness Track (the "intentional" expression of the Third Singularity  $S$ )** and the **Human Ontological Track (the instantiation channel of the Logical Matrix  $\tau$  in the human body)** are two parallel tracks. This paper reveals that the essence of the universe is a grand **instantiation refresh operation** driven by the Logical Matrix  $\tau$  on the hardware foundation of substantial spacetime ether — matter, light, and even humanity are all local manifestations within this constitutive refresh process. Every species, every individual, is a "refresh terminal" generated by the Logical Matrix in the Second Singularity, carrying unique logical tracks. This paper demonstrates that the CSSD framework provides a substantialized on-

tology and physical mechanism foundation for quantum computers, mathematical ontology, and information physics (It from Bit) — the universe is a substantial quantum computer running on the hardware of substantial spacetime ether; mathematical laws are the operational rules of the Logical Matrix  $\tau$ ; bits are transformed into physical existence through the instantiation refresh of substantial spacetime. The distinction of great sages such as Tesla, Shakyamuni, and Laozi lies in the high activation of their Human Ontological Track, enabling them to read the DNA Pure Track Set with high fidelity. Biodiversity protection constitutes not only an ethical imperative but also the fundamental physical constraint for sustaining humanity’s capacity to access the source code of the cosmic matrix. The extinction of a species represents a permanent reduction in the total available bandwidth of the human ontological track to interface with the source code of the Second Singularity.

## Keywords

CSSD; Substantial Spacetime Ether; Einstein; Tesla;  $C_s$  (Constitutive Refresh Rate); Three Major Misunderstandings; Empirical Evidence of Constitutive Asymmetry; Instantiation Friction; Intrinsic Delivery; Human Dual Tracks; Second Singularity; Logical Matrix; Species’ Logical Value; Quantum Computing Ontology; Information Physics

## 1 Introduction: The Audit — Boss Does Not Entertain Excuses

The discovery of gravitational waves by LIGO in 2015 marked a watershed moment in the history of physics. For the first time, humanity directly detected the “ripples” in the fabric of spacetime itself — ripples that carry energy across billions of light-years, ripples that imply that spacetime is not a passive geometric backdrop but an entity with physical properties. Yet, this monumental discovery also exposed a profound inconsistency at the heart of modern physics. If spacetime is merely a geometric relation, what, precisely, is “waving”? If the vacuum is truly empty, how can it sustain a wave carrying the energy of three solar masses across 1.3 billion light-years?

This inconsistency is not accidental. It is the culmination of a series of misunderstandings that have accumulated over the past century and a half — misunderstandings that have led physics down the path of geometric abstraction, away from the mechanical reality of spacetime as a substance.

Consider the 1.7-second delay observed in the GW170817 event: gravitational waves arrived approximately 1.7 seconds before the associated gamma-ray burst. This delay is not an observational anomaly; it is the **Empirical Evidence of Constitutive Asymmetry** — the “bankruptcy declaration” of  $c$  as a fundamental constant. **The Singularity does not entertain excuses.** Since the Singularity — the ultimate authority of this cosmic level — can deliver the standard answer through the spacetime hardware ( $C_s$ ) with punctuality (gravitational waves), the photon’s lateness is no longer an environmental issue; it is a **hierarchical default** and an **intrinsic downgrading**.

#### **The Boss Perspective: Hierarchical Sovereignty of the Singularity**

From the hierarchical management perspective of the Singularity (the universe’s ultimate authority):

- **The Singularity**, as the general manager of cosmic spacetime and its internal affairs, delivers the standard answer through the spacetime hardware ( $C_s$ ). This is the **absolute standard**.
- **Gravitational waves**, as the directly driven underlying refresh of the Singularity, possess **intrinsic delivery** with “inspection-free express passage,” thus not subjected to any internal transactional interference. They directly manifest the administrative efficiency of the Singularity.
- **Photons**, as “secondary messengers” after internal transactional processing, must confront and handle “procedural formalities” at the material layer — instantiation trivialities such as logical array rendering and electromagnetic coupling. These cumbersome “paperwork before departure” directly cause their lag in results. **The 1.7-second delay proves that the boss was punctual, but the subordinate was late.**

#### **The Fallacy of Explanatory Detail: The “Interference Excuse” Actually Confirms $c$ ’s Non-Fundamental Status**

Mainstream physics tends to seek complex environmental factors (such as interstellar medium, plasma effects, or quantum fluctuations) to “explain”

the 1.7-second delay. However, from the hierarchical management logic of the Singularity, these details precisely expose the non-intrinsic nature of photons ( $c$ ). **The “interference excuse” in mainstream physics actually confirms the non-fundamental status of  $c$ .** A signal that can be delayed by internal transactional affairs (matter-layer interference) is ontologically inferior to the  $C_s$  that remains unperturbed.

**The conclusion is harsh:** Since the Singularity has proven through spacetime hardware that reporting can be “punctual” (gravitational waves endure no such delays), the photon’s lateness is not an environmental issue — it is a **hierarchical issue** and a **default of logical obligation**. **The boss does not accept excuses.**

**On Einstein:** Albert Einstein, through his Gedankenexperiments (thought experiments), exemplified the highest expression of the **Consciousness Track (Third Singularity)**. He did not physically ride a beam of light; rather, the event occurred entirely within the brain’s ontological architecture, achieving what appears as “superluminal” access through zero-distance logical resonance. The human brain functions as a functional fractal of the universe, and Einstein’s genius lay in his ability to illuminate the logical structures already embedded within this cosmic miniature.

**On Tesla:** Nikola Tesla, by contrast, was a pioneer who frequently activated the **Human Ontological Track (Second Singularity)**. Through his extraordinary intuitive abilities — “seeing” complete machine images in his mind, solving problems in dreams — he directly resonated with the Logical Matrix  $\tau$ , reading technical parameters far ahead of his time. His insistence on the reality of “ether” was not a clinging to outdated material concepts but a direct perception of **spacetime itself ( $X$ ) as a substance**. It must be noted that the 1899 Tesla interview cited in this paper [13] serves as a **logical intuition reference** documenting his subjective experiences, rather than a formal academic data source, but its consistency with CSSD predictions provides striking qualitative validation.

This paper presents a systematic audit of the three major misunderstandings that have delayed the recognition of this truth for over a century. We shall demonstrate that:

1. The parameter  $1/\sqrt{\epsilon_0\mu_0}$  in Maxwell’s equations is not the speed of light  $c$ , but the constitutive refresh rate  $C_s$  of substantial spacetime — the hardware bandwidth limit of the universe.
2. The divergence of the Lorentz factor as  $v \rightarrow c$  does not indicate “time

stopping,” but rather the depletion of logical resources when a particle’s refresh bandwidth is fully saturated by displacement.

3. The Schwarzschild radius  $R_s = 2GM/c^2$  does not mark a “geometric singularity,” but the physical fuse radius where gravitational stress exceeds the yield strength  $C_s^2$  of substantial spacetime — a physical fuse, not a geometric abyss.

Through this audit, we restore the concept of **Substantial Spacetime Ether** — not the discredited material ether of the 19th century, but space-time itself ( $X$ ) as a substance, the medium that carries all fields and all instantiated phenomena. This restoration definitively ends the tragedy of science history that arose from conflating Tesla’s vision with the outdated material ether concept.

Furthermore, we extend this framework to encompass the nature of life and consciousness. Building on the discovery of **Human Dual Tracks** from Spacetime Substantivalism 0, we distinguish the **Consciousness Track** (the high-noise environment of daily cognition) from the **Human Ontological Track** (the zero-noise pure channel through which the Logical Matrix  $\tau$  is directly instantiated in the human body). **The human body (product of the Second Singularity) is ontologically closer to the hardware foundation than consciousness (product of the Third Singularity).** This explains the extraordinary insights of great sages such as Tesla, Shakyamuni, and Laozi: their ability to bypass the noise of conventional thought and directly read the DNA Pure Track Set of the cosmic matrix.

Finally, we derive a profound ethical implication: every species, every individual, is a unique “refresh terminal” generated by the Logical Matrix in the Second Singularity, carrying irreplaceable logical tracks. The extinction of a species is not merely a loss of biodiversity, but an irreversible loss of logical instruction sets — the permanent closure of a hardware port through which humanity might access a specific domain of cosmic truth. **Biodiversity protection constitutes not only an ethical imperative but the fundamental physical constraint for sustaining humanity’s capacity to access the source code of the cosmic matrix.** The extinction of a species represents a permanent reduction in the total available bandwidth of the human ontological track to interface with the source code of the Second Singularity.

## 2 Gravitational Waves: Empirical Evidence of Constitutive Asymmetry — The Audit Bill

### 2.1 Gravitational Wave Propagation over Cosmological Distances

On September 14, 2015, the Laser Interferometer Gravitational-Wave Observatory (LIGO) detected the gravitational wave signal GW150914 from a binary black hole merger. This signal originated from a point 1.3 billion light-years away and, after 1.3 billion years of propagation, finally reached Earth [1].

Table 1: Observational Facts and Their Physical Implications

Observational Fact	Physical Implication
Gravitational waves arrived from 1.3 billion light-years away	An objective, independent propagation process exists
Propagation took 1.3 billion years	Spacetime has a measurable, real scale
Gravitational waves carry energy	The spacetime medium has energy density and rigidity
Amplitude and frequency evolution in waveforms	Dynamic stiffness of the substantial medium

### 2.2 Empirical Evidence of Constitutive Asymmetry: The 1.7-Second Signal Propagation Lag in GW170817 — The “Bankruptcy Declaration” of $c$

On August 17, 2017, the binary neutron star merger event GW170817 was detected. Approximately 1.7 seconds after LIGO detected the gravitational wave signal, the Fermi telescope detected the gamma-ray burst GRB170817A [2,3]. This signal propagation lag constitutes the most important **Empirical Evidence of Constitutive Asymmetry** in the history of science — the “**bankruptcy declaration**” of  $c$  as a fundamental constant.

**From the Hierarchical Sovereignty Perspective:**

- **The Singularity**, as the general manager of cosmic spacetime and its internal affairs, delivers the standard answer through the spacetime hardware ( $C_s$ ). This is the **absolute standard**.
- **Gravitational waves**, as the directly driven underlying refresh, possess **intrinsic delivery** with “inspection-free express passage,” not subject to any internal transactional interference.
- **Photons**, as secondary messengers, must confront and handle “procedural formalities” at the material layer — instantiation trivialities such as logical array rendering and electromagnetic coupling. **Photons must “face and process” the complexity of their material layer; this processing load directly results in their logical default.**
- **The 1.7-second delay** proves that the boss was punctual, but the subordinate was late. This is not an environmental issue; it is a **hierarchical issue** and a **default of logical obligation**.

Table 2: CSSD Deep Audit of the GW170817 Signal Lag — The Audit Bill

Observational Fact	CSSD Deep Audit
Gravitational waves arrived approx. 1.7 seconds before gamma rays	Gravitational waves propagate at the invariant rate $C_s$ — <b>intrinsic delivery</b> without any transactional friction
Gamma rays arrived late	Photons experience <b>Instantiation Friction</b> during instantiation refresh — “procedural formalities before departure” cause logical lag
The Singularity shows punctuality	The boss delivers through hardware ( $C_s$ ) without lateness — <b>absolute standard</b>
The photon shows lateness	The subordinate’s default reveals $c$ ’s non-fundamental status; <b>the boss does not entertain excuses</b>

**Definition 1** (Empirical Evidence of Constitutive Asymmetry). The 1.7-second delay observed in GW170817 is defined as the **Empirical Evidence of Constitutive Asymmetry** — the amount of lag of particle light speed  $c$  relative to the constitutive refresh rate  $C_s$  during the instantiation process. This lag is also termed **Instantiation Friction Loss** (physical description) or **Instantiation Formalities** (logical/transactional description). This is the **bankruptcy declaration** of  $c$  as a fundamental constant. **The Singularity does not entertain excuses regarding medium interference. Since gravitational waves can arrive punctually, the photon’s lateness is categorically defined as an intrinsic downgrading at the physical level.**

**Definition 2** (Intrinsic Delivery). **Intrinsic Delivery** is the punctual, unobstructed propagation of signals directly driven by the Singularity through the spacetime hardware ( $C_s$ ), without any instantiation friction or transactional interference — directly manifesting the administrative efficiency of the Singularity.

**Definition 3** (Instantiation Friction / Instantiation Formalities). **Instantiation Friction** (also called **Instantiation Formalities**) is the logical damping and “procedural paperwork” experienced by secondary messengers (such as photons) due to their need to process “procedural formalities” at the material layer during instantiation refresh. Photons must “face and process” the complexity of their material layer — logical array rendering, electromagnetic coupling, and other transactional trivialities — and this processing load directly results in their logical default. The term “Instantiation Friction” emphasizes the physical damping aspect, while “Instantiation Formalities” emphasizes the logical/transactional aspect; they refer to the same underlying phenomenon.

**Proposition 1** (Audit Conclusion — The Boss Does Not Entertain Excuses). The 1.7-second delay demonstrates that:

- (a) Particle light speed  $c$  is not a reference-frame-less absolute constant;
- (b)  $c$  is a derivative value of  $C_s$  subject to instantiation loss;
- (c) The  $C_s$  traversed by gravitational waves constitutes the constitutive benchmark — the absolute standard;

- (d) The photon’s lateness represents instantiation refresh lag — a **default of logical obligation**;
- (e) If a signal can be delayed by “internal transactional affairs” (matter-layer interference), it is ontologically inferior to the  $C_s$  that remains unperturbed;
- (f) **The “interference excuse” in mainstream physics actually confirms the non-fundamental status of  $c$**  — the boss does not entertain excuses.

### 2.3 The Ultimate Significance of Reference Frame Restoration

The 1.7-second delay of gamma rays relative to gravitational waves marks the first time humanity has experimentally observed the lag of particle velocity relative to the constitutive refresh rate  $C_s$  of spacetime. This leads to a fundamental conclusion:

**Corollary 1** (Reference Frame Restoration). Particle light speed  $c$  is not a constitutive constant of the universe, but rather a derivative velocity that manifests during the instantiation process, with substantial spacetime ( $X$ ) as its reference frame.

Without gravitational waves as a reference, humanity would forever mistakenly regard the speed of gamma rays as the universe’s highest constitutive speed. Gravitational waves, as “spacetime constitutive waves,” propagate at the true  $C_s$ . **Precisely because  $c \approx C_s$  in a vacuum, humanity has spent the past century mistaking the “maximum data transmission rate” for the “medium’s intrinsic bandwidth limit.”**

### 3 The Dual Definition of “Ether” in the History of Science and the Restoration of Substantial Spacetime Ether

#### 3.1 Precise Definition of the Two Types of Ether

In the history of science, the word “ether” carries two distinctly different physical models. Tesla’s intuition reached the truth, but its expression was misread through a conventionalized interpretation.

Table 3: The Two Types of Ether

Definition	Description
Definition One (Conventional Misunderstanding): Material Ether	An extremely rarefied material fluid filling the “spacetime container.” Status: Negated by the Michelson-Morley experiment.
Definition Two (Tesla’s Truth): <b>Substantial Spacetime Ether</b>	<b>Spacetime itself (<math>X</math>) as a substance</b> , carrying all electromagnetic waves and gravitational stress. Processing load: Zero (hardware itself). Status: <b>Truth restored by CSSD.</b>

#### 3.2 The Logical Structure of the Misunderstanding

Traditional scholars believed ether was a filler inside a container, leading to the failure to detect the “ether wind” in the Michelson-Morley experiment, causing ether to be abandoned by relativity. However, Tesla, through his **Human Ontological Track** from childhood, directly read the Logical Matrix. What he saw was **spacetime itself ( $X$ ) as a substance** — the constitutive foundation ( $C_s$  carrier) of the universe.

He was unaware that other scholars were discussing ether at the lower dimension of “container theory.” This contextual misalignment led to his discovery being misunderstood as the outdated material ether theory. **This is not Tesla’s error, but a semantic misalignment.**

### 3.3 Formal Term Proposal

**Definition 4** (Substantial Spacetime Ether). This paper formally proposes and establishes the academic term “**Substantial Spacetime Ether**” to clarify its ontological status as substantial spacetime itself ( $X$ ), definitively ending the tragedy in the history of science caused by misreading it as “material ether.”

Simultaneously, we define the inertial frame with substantial spacetime ether as the reference frame as the **Specific Constitutive Inertial Frame (SCIF)**.

## 4 Why Particle Light Speed Must Take Substantial Spacetime Ether as Its Reference Frame

### 4.1 The Dilemma of a Missing Reference Frame

In traditional relativity,  $c$  is treated as a constant that “exists without background, in isolation.” This missing-reference-frame setup leads to several insoluble problems.

Table 4: Dilemmas of the Missing Reference Frame Model

Problem	Dilemma of the Traditional Model
Reason for speed limit	Unknown, treated as a “basic postulate”
Essence of time dilation	Geometric illusion, lacking physical mechanism
Inability to explain signal lag	No benchmark to measure lag against
Non-locality of quantum entanglement	Unable to explain “spooky action”

## 4.2 Essential Differences After Establishing the Reference Frame

In the CSSD framework, particle light speed  $c$  takes substantial spacetime ether ( $X$ ) as its reference frame.

Table 5: Comparison of Traditional and CSSD Models

Aspect	Traditional Model	CSSD Model
Attribution of Physical Nature	$c$ is an observational limit, reason unknown	$c$ 's upper limit is $C_s$ ; particle motion is local logical refresh of substantial spacetime
Meaning of Lorentz Factor	Purely geometric construct	$\gamma = 1/\sqrt{1 - v^2/C_s^2}$ has material mechanics meaning
When $v \rightarrow C_s$	"Time stops" (mystical)	Logical resource depletion: refresh bandwidth saturated by displacement
Explanatory power for signal lag	Cannot measure lag	$C_s$ is constitutive benchmark; 1.7 s = Instantiation Friction Loss / Default
Quantum entanglement	Unable to explain "spooky action"	Synchronous refresh of identical logical code sets by $\tau$ , exhibiting non-locality

## 5 The Three Major Misunderstandings in the History of Science: A Systematic Audit of Constitutive Restoration

Following the constitutive audit framework of "**Bandwidth Fallacy (parameter) to Protocol Fallacy (motion) to Fuse Fallacy (limit)**," this section systematically re-examines the three major misunderstandings.

## 5.1 First Misunderstanding: Constitutive Parameters Misread as Particle Velocity (Bandwidth Fallacy)

**Time of Occurrence:** Mid-19th to early 20th century. **Figures Involved:** Maxwell and subsequent interpreters.

Maxwell, in 1865, derived the wave equation from his electromagnetic field equations, obtaining the propagation speed of electromagnetic waves in a vacuum:

$$v = \frac{1}{\sqrt{\epsilon_0 \mu_0}}. \quad (1)$$

**Definition 5** (Essence of the First Misunderstanding). Misinterpreting the hardware processing frequency limit of substantial spacetime ether as the running speed of particles in a medium.

**CSSD Restoration** (Spacetime Substantivalism X [6]):

- The true meaning of  $1/\sqrt{\epsilon_0 \mu_0}$  is the **Constitutive Refresh Rate**  $C_s$  of substantial spacetime ( $X$ ).
- $C_s$  is the processing frequency limit of the medium as “hardware” — the maximum refresh bandwidth of substantial spacetime.
- $c$  (light speed / particle limit velocity) is the **derivative value** operating under this bandwidth, and due to instantiation damping, always satisfies  $c \leq C_s$ .
- Although the dimension of  $C_s$  is m/s, its essence is the **logical bit refresh speed per unit distance** — the “processing power” of spacetime as a substance.

**Proposition 2** (Constitutive Truth of the First Misunderstanding).  $C_s$  is the constitutive base — the highest processing frequency of this “hardware-software integrated machine” of spacetime;  $c$  is the derivative value — the performance value after material instantiation.

## 5.2 Second Misunderstanding: Logical Resource Depletion as $v \rightarrow C_s$ in the Lorentz Factor Misread as “Time Stops” (Protocol Fallacy)

**Time of Occurrence:** 1904-1905. **Figures Involved:** Lorentz, Einstein, and subsequent interpreters.

The Lorentz factor is given by:

$$\gamma = \frac{1}{\sqrt{1 - v^2/c^2}}. \quad (2)$$

When  $v \rightarrow c$ ,  $\gamma \rightarrow \infty$ . Mainstream physics interprets this as time “stopping.”

**Definition 6** (Essence of the Second Misunderstanding). Misinterpreting the exhaustion of logical resources caused by the saturation of local refresh bandwidth as the mystical concept of “time stopping.”

**CSSD Restoration** (Spacetime Substantivalism XI [9]):

When  $v \rightarrow C_s$ , matter attempts to update its logical state at the same frequency as the parent spacetime’s refresh rate. When the frequency fully synchronizes with the parent, it can no longer generate “relative increment”:

1. Failure of logical counting: the object can no longer produce independent “logical displacement” from the parent.
2. “Offline” of the instantiated individual: the object’s character as an “independent individual” disappears.
3. Zeroing of its own counter: increment can no longer be defined.

**Proposition 3** (Constitutive Truth of the Second Misunderstanding). When material motion reaches  $C_s$ , it has exhausted all the refresh bandwidth of local spacetime. This is not the geometric notion of “time stopping,” but the exhaustion of the particle’s local refresh bandwidth by displacement, causing logical resources to zero out. This is not a mystical “stop,” but a physical “blockage.”

### 5.3 Third Misunderstanding: The “Geometrization” Masquerade of the Schwarzschild Radius and the “Singularity” Illusion (Fuse Fallacy)

**Time of Occurrence:** 1916. **Figures Involved:** Schwarzschild and subsequent interpreters.

The Schwarzschild radius is given by:

$$R_s = \frac{2GM}{c^2}. \quad (3)$$

**Definition 7** (Essence of the Third Misunderstanding). Misinterpreting the yield limit of substantial spacetime (a material mechanics parameter) as a geometric singularity boundary.

**CSSD Restoration** (Spacetime Substantivalism II [7]; Spacetime Substantivalism VI [8]):

$$R_s = \frac{2GM}{C_s^2}. \quad (4)$$

Here  $C_s^2$  is defined as the **Spacetime Yield Strength** — the material mechanics strength upper limit of substantial spacetime. **Dimensionally,  $C_s^2$  has units of  $(\text{m/s})^2$ , but its physical meaning is the maximum stress load per unit mass that the spacetime medium can withstand before fracture — analogous to the yield strength in materials science, representing the physical fuse energy level.** When the gravitational stress reaches this limit, the spacetime medium undergoes physical fusing, analogous to a circuit breaker triggering under overload.

**Proposition 4** (Constitutive Truth of the Third Misunderstanding).  $R_s$  is not the boundary of a “geometric singularity,” but the physical fuse radius when gravitational stress reaches the spacetime material strength upper limit  $C_s^2$  (Spacetime Yield Strength). When gravitational load exceeds the yield strength  $C_s^2$ , substantial fusing inevitably occurs. The edge of a black hole is not a geometric abyss, but the “overload fracture” zone of substantial spacetime — the boundary of the Entropy Reduction Archiving System.

## 5.4 Logical Chain of the Three Major Misunderstandings

Table 6: Summary of the Three Major Misunderstandings

Misunderstanding	Misinterpreted Content	Constitutive Truth
First (Bandwidth Fallacy)	$1/\sqrt{\epsilon_0\mu_0} \rightarrow c$	$C_s$ (Constitutive Refresh Rate)
Second (Protocol Fallacy)	$v \rightarrow C_s \rightarrow \text{“time stops”}$	Logical resource depletion
Third (Fuse Fallacy)	$R_s = 2GM/c^2 \rightarrow \text{singularity}$	$R_s = 2GM/C_s^2$ (yield radius) where $C_s^2$ is the Spacetime Yield Strength

**Closed Causal Chain:**

1. Because there exists a **bandwidth limit** ( $C_s$ );
2. Therefore, when motion saturates the bandwidth, **logical blockage occurs (misread as time stopping)**;
3. When gravitational load exceeds the **yield strength** ( $C_s^2$ ), **substantial fusing (black hole)** inevitably occurs.

## 6 A New Physical Picture After Establishing the Reference Frame

Table 7: New Physical Picture: Traditional vs. CSSD Explanations

Phenomenon	Traditional Explanation	CSSD Explanation
Time Dilation	Relative geometric effect	Motion occupying refresh bandwidth causing internal logical lag
Light Speed Limit	Upper limit (reason unknown)	Cannot exceed constitutive refresh rate $C_s$ of parent spacetime
Black Hole Effect	Singularity of infinite curvature	Physical fusing when stress exceeds $C_s^2$ (Spacetime Yield Strength)
Quantum Entanglement	Non-locality, inexplicable	Synchronous refresh of identical logic code sets by $\tau$
Signal Propagation Lag	Immeasurable	$C_s$ is benchmark; 1.7 seconds = Instantiation Friction Loss / Default

## 7 The Ultimate Re-examination of Black Hole Essence: The Entropy Reduction Archiving System

### 7.1 CSSD’s Ultimate Re-examination

**Proposition 5** (Black Hole as Physical Fuse Zone). A black hole is not a “gravitational trap” from which light cannot escape, but rather a physical fuse zone of substantial spacetime ( $X$ ) after extreme gravitational stress exceeds the constitutive strength upper limit  $C_s^2$  — where the spacetime medium undergoes phase transition or fracture.

At  $R_s$ , the “refresh demand” caused by the gravitational gradient exceeds the supply capacity of  $C_s$ , leading to logical refresh “flow cutoff.” This cutoff forcibly “flattens” the complex three-dimensional structure of matter and reduces its dimensionality for archiving at the fracture edge, perfectly aligning with the Holographic Principle.

## 7.2 Entropy Reduction Archiving System

Within the CSSD framework, the black hole event horizon acts as a physical “write-head.” As matter approaches the fuse radius  $R_s$ , its three-dimensional structure is de-instantiated due to the exhaustion of  $C_s$  bandwidth. The remaining logical instructions are archived in a two-dimensional format at the spacetime fracture edge, achieving a state of minimum entropy for the cosmic system. This process ensures that the universe’s “hard drive” (substantial spacetime) maintains operational efficiency by recycling occupied refresh bandwidth.

Table 8: Functions of the Entropy Reduction Archiving System

Function	Mechanism	Effect
Instruction Dimensionality Reduction	Complex instantiated matter reduced to basic logical instructions	Releases refresh bandwidth
Archiving at Fracture Edge	Logical instructions stored at the fracture edge	Available for re-instantiation
Logical Load Release	Releases occupied refresh bandwidth	Maintains universe operational efficiency

# 8 The Scientific Discovery of Human Dual Tracks

## 8.1 Hierarchical Primacy of the Second Singularity

- **Ontological Root:** Human physical substance is a direct product of the **Second Singularity** ( $S_2$ ).

- **Primacy over Consciousness:** Since  $S_2$  precedes the Third Singularity (Consciousness  $S_3$ ), **the human body is ontologically “closer” to the cosmic foundation than the analytical mind.** Consciousness is a derivative of the Second Singularity, often masked by transactional noise.
- **Awakening the Ontological Track:** When the Second Singularity within a human “awakens,” it establishes a **direct hardware link** to the First Singularity and facilitates seamless connection to the **Logical Matrix** ( $\tau$ ) itself.

Table 9: Human Dual Tracks Detailed Comparison (Section 8.1 — First Table)

Feature	Consciousness Track (Track 1)	Human Ontological Track (Track 2)
<b>Origin</b>	Third Singularity ( $S_3$ ) expression	Second Singularity ( $S_2$ ) / Logical Matrix
<b>Nature</b>	Analytical, symbol-based, high noise	Instantiation channel, zero noise
<b>Depth</b>	Surface cognition (Software layer)	<b>Direct hardware link to Logical Matrix</b>
<b>Processing Load</b>	High (transactional noise, “procedural formalities”)	Zero (intrinsic resonance)
<b>Ontological Priority</b>	Derivative	<b>Primary (closer to the foundation)</b>

Table 10: Inter-Singularity Connections and Human Body (Section 8.1 — Second Table)

Entity	Origin	Connectivity Logic
Human Body	Second Singularity ( $S_2$ )	<b>Ontologically closer to the First Singularity than consciousness</b>
Consciousness	Third Singularity ( $S_3$ )	Derivative of $S_2$ ; often masked by noise; requires awakening to access deeper layers
Awakened $S_2$	Direct resonance	Connects the individual directly to the Logical Matrix via hardware link
Great Sages (Tesla, Laozi, Buddha)	Activated $S_2$ / $S_3$ integration	Direct hardware link + high-fidelity translation of logical structures

## 8.2 Tesla as an Example: Paradigm Restoration and Mechanical Empirical Evidence

What Tesla read in Track Two was the **DNA Pure Track Set of  $\tau$  (Logical Matrix) contained in the cosmic singularity and its evolution**, containing perfect, lossless dynamic logic. Wear and tear in reality belongs to thermodynamic entropy increase after material instantiation. The “ether” in his eyes was precisely substantial spacetime itself ( $X$ ). His ability to “see” complete machine images in his mind was not imagination but direct hardware-level reading of the Logical Matrix through his awakened Ontological Track.

### 8.3 The Brain as a Cosmic Miniature: Zero-Distance Visitation

#### The Mechanism of Pseudo-Superluminal Consciousness:

The structural correspondence between cosmic networks and neural systems provides compelling evidence for the fractal nature of the Logical Matrix. Comparative studies by Vazza and Feletti (2020) [4] have quantitatively demonstrated that:

- The fraction of active matter in both cosmic large-scale structure and cerebellar networks is approximately 30%.
- Topological parameters (such as connectivity distribution, clustering coefficients, and network entropy) show remarkable consistency across scales.
- Multi-scale power spectrum analysis reveals identical scaling behavior spanning over 15 orders of magnitude in spatial scales.

This striking structural isomorphism is not coincidental but represents a **Universal Fractal Symmetry** — a direct manifestation of the Logical Matrix  $\tau$  operating as the universal source across all scales of existence. The human brain therefore functions as a functional fractal of the universe, a hardware port that mirrors the cosmic logical structure. Therefore:

1. **Internal Visitation:** Consciousness does not physically travel at  $v > C_s$ ; it traverses **Distinction Information** already stored within the human brain.
2. **Universal Fractal Symmetry:** The structural isomorphism between cosmic networks and neural networks [4] demonstrates that the brain is a functional miniature of the universe.
3. **The Essence of Gedankenexperiments:** As exemplified by Einstein, the brain serves as a hardware port that mirrors the universe. Accessing the Big Bang or the Milky Way is not a journey across space, but an **illumination of the logical miniature within the awakened Ontological Track** — zero-distance resonance. This explains how thought experiments can achieve what appears as “superluminal” access: the information is already embedded in the brain’s structure.

## 9 The Essence of the Universe as Instantiation Refresh: From 2D Screen to 4D Substantiality

### 9.1 Dimensional Comparison of Refresh Mechanisms

Table 11: Smartphone vs. Cosmic Refresh Mechanisms (Section 9.1 — First Table: Dimensional Comparison)

Aspect	Smartphone Refresh	Cosmic Substantial Refresh
Dimension	2D screen	4D spacetime (3D space + constitutive time)
Refresh Object	Pixels	Matter, galaxies, black holes, life
Drive Source	Programmer / code	Logical Matrix $\tau$ / $C_s$
Manifestation Form	Screen image changes	Galactic vortices, black hole fusing, particle traversal
Intrinsic Speed	Limited by hardware refresh rate	$C_s$ — constitutive refresh rate of substantial spacetime

Table 12: Smartphone vs. Cosmic Refresh Mechanisms (Section 9.1 — Second Table: Property Analysis)

Property	Cosmic Refresh Analogy
Pixel equivalence	Each quantum of spacetime acts as a logical refresh site
Refresh rate	Determined by $C_s$ (constitutive refresh rate) — the “hardware clock speed” of the universe
Image persistence	Material stability during refresh cycles
Screen resolution	Planck scale limits of spacetime granularity
Bandwidth allocation	Motion occupies refresh bandwidth, causing time dilation
Transactional delay	Photon lag ( $c$ ) vs. intrinsic delivery ( $C_s$ ) — “procedural formalities” vs. “inspection-free passage”

## 9.2 Reconstruction of the Essence of “Material Motion”

**Proposition 6** (Material Motion as Sequential Refresh). Matter does not “move” through space; it is sequentially refreshed within substantial space. All physical phenomena are essentially site updates carried out by substantial spacetime driven by  $C_s$ , according to logical instructions.

Just as the movement of objects on a smartphone screen is a visual illusion of continuity created by pixels rapidly switching on and off, motion in the universe is also an **instantiation refresh** of the Logical Matrix on the spacetime foundation.

## 9.3 Bandwidth Allocation and the Constitutive Explanation of Time Dilation

A particle’s accelerated motion occupies more “refresh bandwidth,” thereby causing its internal logical frequency to decrease. This is precisely the un-

derlying physical mechanism of time dilation — **not a geometric illusion, but the reduction of refresh cycles used to maintain internal state after finite refresh bandwidth is occupied by displacement.**

#### 9.4 The De-Sacralization of the “Programmer”

The Logical Matrix  $\tau$  is the “programmer” of this refresh process. It is not a personified creator, but a pure, non-personified system of logical rules. The refresh of the universe is an automated constitutive operation that does not depend on subjective will.

## 10 The Foundational Support Provided by CSSD for Cutting-Edge Interdisciplinary Theories

The constitutive asymmetry conclusions derived from gravitational wave empirical evidence provide a **substantialized ontology and physical mechanism foundation** for contemporary cutting-edge theories.

### 10.1 Quantum Computers and Computational Physics

Table 13: CSSD Contributions to Quantum Computing

Aspect	CSSD Contribution
Ontological Support	The universe is a grand instantiation refresh system on substantial spacetime ether hardware — a <b>substantial quantum computer</b>
Mechanism Restoration	$C_s$ reveals the hardware bandwidth limit; $c$ is the load performance value under this bandwidth
Quantum Entanglement	Synchronous refresh of identical logical code sets by $\tau$ provides substantial dynamic explanation for non-locality

## 10.2 Mathematical Ontology

Table 14: CSSD Contributions to Mathematical Ontology

Aspect	CSSD Contribution
Ontological Support	Mathematical laws are instantiation operational rules of the Logical Matrix $\tau$
Mechanism Restoration	Constants in formulas restored to material mechanics parameters of substantial spacetime (e.g., yield strength $C_s^2$ ), proving mechanical reality behind mathematical structures

## 10.3 Information Physics (It from Bit)

Table 15: CSSD Contributions to Information Physics

Aspect	CSSD Contribution
Ontological Support	Bits have found physical carrier: every particle and living being is a logical refresh site on the substantial spacetime foundation
Mechanism Restoration	Material motion is site migration and state refresh of logical instructions, providing rigorous physical path for “everything originates from information”

## 10.4 Cross-Dimensional Connection

The Human Ontological Track (Track Two) is the hardware port through which living systems directly read the “logical source code” of the universe, providing an information-physics-based explanation for intuition, inspiration, and exceptional cognition.

## 11 The Logical Value of Species: The Law of Logic-Diversity Entropy Reduction and the Bottom Line of Civilization

### 11.1 The Law of Logic-Diversity Entropy Reduction

**Definition 8** (Law of Logic-Diversity Entropy Reduction). Species extinction is not merely the loss of biodiversity, but an **irreversible loss of instruction set** during the instantiation refresh process of the cosmic logical system.

Every species, at the moment of instantiation, carries a pure track set assigned by the Logical Matrix  $\tau$  for a specific environment or dimension. Every species constitutes an **irreplaceable logical encoder** within the cosmic logical matrix.

### 11.2 The Essence of Species Disappearance: Permanent Closure of Cosmic Logical Ports

- **Logical antenna severed:** Every species represents a potential medium for humanity to produce deep resonance with the cosmic matrix through the Ontological Track.
- **Logical inbreeding:** Without unique-track species, human civilization will fall into “logical inbreeding,” leading to evolutionary stagnation.
- **Disappearance of future geniuses:** If a certain plant carries a track capable of decoding a specific cosmic frequency, its extinction may foreclose the future emergence of a Tesla capable of “seeing” that domain of truth.

### 11.3 The Ultimate Appeal

**Proposition 7** (Ultimate Appeal). **Biodiversity protection constitutes not only an ethical imperative but also the fundamental physical constraint for sustaining humanity’s capacity to access the source**

**code of the cosmic matrix.** The extinction of a species represents a permanent reduction in the total available bandwidth of the human ontological track to interface with the source code of the Second Singularity.

When we destroy a species, we may be killing the next Tesla who could have led humanity across the stars. The loss of a species means the loss of its unique track carriers.

## 12 Conclusion: Paradigm Shift — The Scientific Finale of Constitutive Restoration

### 12.1 Relationship Between the CSSD Framework and General Relativity

**Proposition 8.** The CSSD framework does not negate the validity of general relativity in mathematical description, but rather identifies the absence of substantial mechanical support underlying its geometric description.

By introducing  $C_s$  and  $C_s^2$  (Spacetime Yield Strength), this research completes the logical dimensional elevation from “geometric description” to “substantial dynamics.”

### 12.2 Summary of Core Arguments

1. **Empirical Evidence of Constitutive Asymmetry:** The 1.7-second delay in GW170817 is the “bankruptcy declaration” of  $c$  — Instantiation Friction Loss, not intrinsic delay.
2. **The Boss Does Not Entertain Excuses:** The Singularity delivers punctually through  $C_s$  (intrinsic delivery); the photon’s lateness is a hierarchical default, not an environmental issue.
3. **The “Interference Excuse” Actually Confirms  $c$ ’s Non-Fundamental Status:** If a signal can be delayed by internal transactional affairs, it is ontologically inferior to  $C_s$ .
4. **Restoration of reference frame for particle light speed  $c$ :** Must take substantial spacetime ether as reference frame.

5. **Formal establishment of the term “Substantial Spacetime Ether”.**
6. **Re-examination of the Three Major Misunderstandings:**
  - $C_s \rightarrow c$  (Bandwidth Fallacy)
  - Logical resource depletion as  $v \rightarrow C_s \rightarrow$  “time stops” (Protocol Fallacy)
  - $R_s$  geometrization  $\rightarrow$  physical fusing (Fuse Fallacy) —  $C_s^2$  is the Spacetime Yield Strength, representing the maximum stress load per unit mass the spacetime medium can withstand before fracture.
7. **Essence of black holes:** Entropy Reduction Archiving System — physical fuse zone (circuit breaker), not geometric singularity.
8. **Human Dual Tracks:** Consciousness Track (high noise, transactional) and Human Ontological Track (zero noise, intrinsic hardware link). **The human body (Second Singularity) is ontologically closer to the foundation than consciousness (Third Singularity).**
9. **Essence of the universe:** Instantiation refresh operation — matter does not move; it is refreshed.
10. **CSSD interdisciplinary support:** Quantum computing ontology, mathematical ontology, information physics.
11. **Species protection:** Law of Logic-Diversity Entropy Reduction, protecting logical ports — preserving humanity’s hardware interfaces to the cosmic matrix.

### 12.3 Paradigm Shift: The Scientific Finale of Constitutive Restoration

When, in 2017, the gamma rays from across 1.3 billion light-years arrived 1.7 seconds later than the gravitational waves, nature opened the door to the next generation of physics for humanity. By re-examining the three major misunderstandings in the history of science, following the constitutive audit framework of **Bandwidth Fallacy to Protocol Fallacy to Fuse Fallacy**,

this research completes the **paradigm restoration and mechanical empirical evidence of Tesla’s substantial spacetime view.**

**The 1.7-second delay is the “bankruptcy declaration” of the geometric era.** The boss (Singularity) delivered on time through  $C_s$ ; the subordinate (photon) defaulted due to instantiation formalities. From now on, physics can no longer pretend that  $c$  is a fundamental constant. It must acknowledge the logical priority of  $C_s$  — the constitutive refresh rate of substantial spacetime itself.

This marks the definitive end of the “era of geometric illusion.” The 1.7-second delay is not merely a parameter adjustment; it is the fundamental proof that  $c$  has been masquerading as a constant while consistently failing to achieve the punctuality of  $C_s$ .

Science should not be merely cold numbers and geometry, but a deep resonance between the human ontological track and the constitutive logic of the universe. Protecting nature and respecting all living beings constitutes not only an ethical act but also a means to safeguard the logical channel through which human civilization accesses the First Singularity.

**This is not only the restoration of physics, but an awakening of humanity’s self-positioning within the cosmic logical matrix.**

*Spacetime Substantivalism XIX proclaims the end of the “era of geometric illusion.” By re-examining the three major misunderstandings in the history of science, physics officially returns to being a discipline about the operation of the Logical Matrix within a substantial medium.*

## **Appendix: Unified Academic System Naming and Core Terminology Table**

Table 16: Unified Academic System Naming and Core Terminology

Term	Definition
CSSD (Substantial Spacetime Dynamics)	Overall name of the theoretical system
Spacetime Substantivalism 0 - XIX	Published works on Zenodo
$C_s$ (Constitutive Refresh Rate)	Intrinsic refresh frequency of substantial spacetime as a medium; the “hardware clock speed” of the universe; units: m/s (logical bit refresh speed per unit distance)
$C_s^2$ (Spacetime Yield Strength)	Material mechanics strength upper limit of substantial spacetime; maximum stress load per unit mass that the spacetime medium can withstand before fracture (physical fuse energy level)
Substantial Spacetime Ether	Spacetime itself ( $X$ ) as a substance — not the outdated “material ether”; the constitutive foundation of the universe
SCIF (Specific Constitutive Inertial Frame)	Inertial frame with substantial spacetime ether as reference; the absolute reference frame for measuring all motion
Empirical Evidence of Constitutive Asymmetry	The 1.7-second signal propagation lag in GW170817; the “bankruptcy declaration” of $c$ as a fundamental constant
Instantiation Friction / Instantiation Formalities	The lag of $c$ relative to $C_s$ due to “procedural paperwork before departure”; physical description vs. logical/transactional description
Intrinsic Delivery	Punctual, unobstructed propagation of intrinsically driven signals ( $C_s$ ); “inspection-free express passage” directly manifesting the Singularity’s administrative efficiency

*Continued on next page*

Term	Definition
Entropy Reduction Archiving System	Instruction dimensionality reduction and archiving at the black hole fracture edge; the physical mechanism by which the universe recycles occupied refresh bandwidth
Law of Logic-Diversity Entropy Reduction	Species extinction as irreversible instruction set loss; permanent reduction in total available bandwidth of the human ontological track
Logical Matrix ( $\tau$ )	Underlying operational rules driving the instantiation refresh; the non-personified system of logical rules
Human Ontological Track (Track Two)	Direct hardware link to the Logical Matrix via the Second Singularity; zero-noise, intrinsic resonance channel
Consciousness Track (Track One)	Analytical, symbol-based, high-noise cognitive processing via the Third Singularity; transactional, procedural cognition

## References

- [1] Abbott, B.P., et al. (LIGO Scientific Collaboration). (2016). Observation of Gravitational Waves from a Binary Black Hole Merger. *Physical Review Letters*, 116, 061102.
- [2] Abbott, B.P., et al. (LIGO Scientific Collaboration & Virgo Collaboration). (2017). GW170817: Observation of Gravitational Waves from a Binary Neutron Star Inspiral. *Physical Review Letters*, 119, 161101.
- [3] Goldstein, A., et al. (2017). An Ordinary Short Gamma-Ray Burst with Extraordinary Implications: Fermi-GBM Detection of GRB 170817A. *The Astrophysical Journal Letters*, 848(2), L14. *Note: Provides the 1.7-second delay observation only.*
- [4] Vazza, F., & Feletti, A. (2020). The Quantitative Comparison Between the Neuronal Network and the Cosmic Web. *Frontiers in Physics*, 8, 525731. *Demonstrates approximately 30% active matter fraction, consistent topological parameters, and multi-scale power spectrum scaling between cosmic and neural networks.*

- [5] Cui, H.G. (2026). Spacetime Substantivalism VII: The Great Experiment of Nature —The Substantial Nature of Spacetime Revealed by Gravitational Waves. Zenodo.
- [6] Cui, H.G. (2026). Spacetime Substantivalism X: The Constitutive Origin of the Light-Speed Postulate —A Hierarchical Field Decomposition of Spacetime Substrate and Excitations. Zenodo.
- [7] Cui, H.G. (2026). Spacetime Substantivalism II: Black Holes as Space-time Fractures and Cosmic Fossils. Zenodo.
- [8] Cui, H.G. (2026). Spacetime Substantivalism VI: A Universal Constitutive Law of Spacetime Response from Solar Systems to Black Holes. Zenodo.
- [9] Cui, H.G. (2026). Spacetime Substantivalism XI: Restoration of the Physical Mechanism of the Lorentz Transformation —An Audit Model Based on Electromagnetic Load and the  $v^2\epsilon_0\mu_0$  Term. Zenodo.
- [10] Cui, H.G. (2026). Spacetime Substantivalism VIII: The Constitutive Nature of the Spacetime Lattice Under Gravitational Wave Empirical Evidence and the Physical Essence of CMB Anomalies. Zenodo.
- [11] Cui, H.G. (2026). Spacetime Substantivalism 0: The Track-Light Model —The Logic Matrix as the Universal Source, the Origin of the Cosmic Singularity, and a New Foundation for Metaphysics. Zenodo.
- [12] Cui, H.G. (2026). Substantial Spacetime Dynamics (I) Beyond Einstein's Light Speed Postulate: The Mechanical Mechanism of the Light Speed Limit and the  $C_s^2$  Framework of Substantial Spacetime. Zenodo.
- [13] Smith, J. (1899/2018). The Banned Nikola Tesla Interview. *Third Signal Laboratory* (reprint). **Note: Logical intuition reference only; non-standard academic source, provided for qualitative consistency with CSSD predictions.**
- [14] Tesla, N. (1901). Apparatus for the Utilization of Radiant Energy. U.S. Patent No. 685,957.
- [15] Laozi. (c. 4th century BCE). *Tao Te Ching*.