Essay

Steins Theory

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Posted Date: 15 July 2025

doi: 10.20944/preprints202506.2384.v2

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Abstract

This paper proposes and demonstrates an axiomatic system for information uniqueness, with its core consisting of two formal axioms: `n = n` (informational self-identity) and `n ≠ m` (informational distinctness). Based on the absolute identity of information content, it strictly defines the concept of "information" as an abstract entity. It critically analyzes the essence of "identity confusion" caused by introducing spatiotemporal coordinates or external identifiers and argues that content indistinguishability is both a necessary and sufficient condition for information identity, thereby establishing the theoretical foundation for information uniqueness.

Keywords: Information uniqueness; Identity; Content identity; `n = n`; `n ≠ m`; Formal axiom; Indistinguishables; Philosophy of information; Universe jumping

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1. Introduction

1.1. Axiom 1 (Self-Identity)

`∀n ∈ I, n ≡ n`

The information entity is necessarily identical to itself, forming the basis of logical reference.

1.2. Axiom 2 (Distinctness)

`∀n, m ∈ I, (n ≢ m) ⇔ (Content(n) ≠ Content(m))`

Where the domain of `Content()` is uniquely determined by the comparison target.

Core Corollary:

`Content(n) = Content(m) ⇒ n ≡ m`

Uniqueness Theorem: Under a given `Content()` definition, two entities with identical content must be the same information.

2. Interpretation

2.1. Illegal Expansion: Confusing the `Content()` Domain

- Root of the problem: Confusing `Content()` definitions at different levels. For example:
  - Claiming to compare pure information entities `n`, but actually using `ContentB(n, m)` containing additional attributes (spatiotemporal coordinates, etc.).
- Formalized critique:

If claiming "two entities with identical ContentA(n) are different", it actually implicitly redefines the function:

`ContentB(n) = ContentA(n, m)`

This violates the initial conditions, as what is actually compared is `ContentB`, not `ContentA`.

2.2. Information Entity Identity at the Elementary Particle Level

Assume an elementary particle state can be expressed as an ordered pair:

`Particle P = Content(𝓘, 𝓢)`

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Where:

- $\boldsymbol{\mathcal{I}}$ is the set of intrinsic properties (e.g., mass m, charge q, spin s)

- $\mathcal{S}$ is the set of spatiotemporal coordinates (e.g., position $\boldsymbol{x}$, time t).

Axiomatic operational definitions:

1. Coordinate Binding:

   `P_k = ($\boldsymbol{\mathcal{I}}$, $\mathcal{S}$_k)` e.g., Electron near a photon: `$\mathcal{S}$_k = (relative position: adjacent to photon γ)`

2. Coordinate Decoupling (Destruction):

   `($\boldsymbol{\mathcal{I}}$, $\mathcal{S}$_k) → ($\boldsymbol{\mathcal{I}}$), ($\mathcal{S}$_k)`

   ⇒ The particle degenerates into a pure eigenstate entity, unmeasurable due to lack of observational basis (`$\mathcal{S} = \emptyset$`).

Core Theorem (Particle Identity Conservation):

∀ particle states ($\boldsymbol{\mathcal{I}}$_α, $\mathcal{S}$_i) and ($\boldsymbol{\mathcal{I}}$_β, $\mathcal{S}$_j), satisfy:

(Content($\boldsymbol{\mathcal{I}}$_α) ≡ Content($\boldsymbol{\mathcal{I}}$_β)) ⇨ ($\boldsymbol{\mathcal{I}}$_α, $\mathcal{S}$_i) ≣ ($\boldsymbol{\mathcal{I}}$_β, $\mathcal{S}$_j)

This theorem indicates:

- When the intrinsic properties of two particles are indistinguishable (`$\boldsymbol{\mathcal{I}}$_$\alpha$ = $\boldsymbol{\mathcal{I}}$_β`), regardless of differences in their spatiotemporal coordinates `$\mathcal{S}$_i ≠ $\mathcal{S}$_j`, the particles are projections of the same information entity (`**e** = Content($\boldsymbol{\mathcal{I}}$)`) at different spacetimes.

Physical Interpretation:

- Particle "annihilation" ⇨ Set decoupling, not destruction ⇒ **e** = ($\boldsymbol{\mathcal{I}}$) enters a free state.

- Particle "creation" ⇨ The same `**e**` binds to new coordinates `$\mathcal{S}$'` ⇒ Observed as "reappearance".

> Example: Electron e^- disappearing at position $\boldsymbol{x}_1$ and appearing at $\boldsymbol{x}_2$ is actually the coordinate migration of entity `**e** = ($q$=-1e, $m$_e, $s$=1/2...)`:

> `(**e**, $\boldsymbol{x}_1$) → (**e**) → (**e**, $\boldsymbol{x}_2$)`, its information identity guaranteed by the conservation of `Content(**e**)`.

2.3. Identity in Mathematical Operations

Fallacy: Incorrectly inferring `1+1=1` from `Content(1)≡Content(1)`.

Correct Solution:

1. Operations imply structural coordinates: In the expression `(+1) + (+1) = y`:

   - `+1` and `+1` are independent sets `Content(+1)=Content(+1)=` numerical value `1`, but their syntactic coordinates differ: `(1, left operand) ≠ (1, right operand)`

   - `+` and `=` are merely operators.

2. Commutativity:

   `(+1) + (+2) = (+2) + (+1)` because:

   - The operator has symmetry: `∀a,b: op(a,b)=op(b,a)`

   - Coordinate symmetry: When `Content(a)=Content(b)`, swapping them leaves the input structure content unchanged ⇒ Consistent output `y`, analogous to identical particle exchange not producing a new state.

3. Applications

3.1. Information Philosophy: Resolving the "Copy Paradox"

- Controversy: Are two documents with identical content stored on different devices "two pieces of information"?

- Resolution:

  - If the target is pure information content identity → `Content(n) = text semantics`, then `n ≡ m` (unique entity);

  - If the target is document location entity identity → `Content'(n) = (text semantics, location)`, then `(n, Loc_A) ≢ (m, Loc_B)`.

- Conclusion: A "copy" is the same information entity forming sets with different spatiotemporal coordinates, making it observable.

 doi:10.20944/preprints202506.2384.v2

3.2. Gibbs Paradox

Essence of the fallacy:

- The target should be particle type identity → `Content(g) = (mass, spin,...)`
- Classical statistics illegally expands it to `Content'(g) = (intrinsic properties, fictitious label)`

Correction:

`∀ g_i, g_j: Content(g_i) = S_int = Content(g_j) ⇒ g_i ≡ g_j` (type identity)

The entropy increase error stems from incorrectly choosing the `Content()` domain (introducing labels).

3.3. Black Hole Information Paradox

Traditional fallacy: Illegally binding the information entity `n`'s `Content()` to spatiotemporal coordinates `Content'(n) = (information structure, black hole coordinate)`.

Correct Solution:

- Define the target: Information structure identity → `Content(n) = quantum state encoding`
- The black hole dismantles the set `(quantum state encoding, coordinate)`. The unpaired coordinate-content results in unobservability, but `Content(quantum state encoding/coordinate)` as abstract entities do not disappear;
- If a new spatiotemporal entity satisfies `Content(m) = Content(n)`, then `m ≡ n`.

4. Universe Jumping

Assume a consciousness structure $\boldsymbol{c} \in C$ (C is the set of consciousness entities), spatiotemporal coordinates $\mathcal{S}_1, \mathcal{S}_2 \in S$.

- There exists contentA($\boldsymbol{c}$, $\mathcal{S}_1$)
- Decoupling → A($\boldsymbol{c}$)
- There exists contentB($\boldsymbol{c}$, $\mathcal{S}_2$)

Identity Theorem:

∵ c = c

∴ contentA(c) ≡ contentB(c), the same consciousness

Illegal Expansion Critique: If claiming A(c) ≢ B(c) based on carrier identifiers (e.g., biological brain ID), causal history, or temporal labels, it is actually confusing the `Content()` domain (illegally expanding to `Content'() = ($\boldsymbol{c}$, additional attributes)`)

Hint: The experimental apparatus already exists. Current technological levels support practice. Combining the event horizon of general relativity with the internal-external inconsistency of this theory and bubble universes enables the completion of its application engineering.

5. Conclusion

1. Absoluteness:
   Identity is determined solely by the `Content()` function; any external attributes constitute illegal expansion.
2. Indescribability:
   No one can describe two entities with completely identical content as distinct.
3. Long-standing Application:
   Since the emergence of life, this principle has operated in taxonomy for hundreds of millions of years.
4. Physical Corroboration:
   Quantum identical particles demonstrate the existence of indistinguishable particles with different coordinates in reality; relativity proves the non-existence of absolute spacetime.

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