E=mc² = E=m: The Constants Illusion Exposed
Unit Conventions in Relativity Theory
From Dynamic Ratios to the Constants Illusion

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Abstract

This work shows the central point of Einstein's relativity theory: $E=mc^2$ is mathematically identical to $E=m$. The only difference lies in Einstein's treatment of c as a "constant" instead of a dynamic ratio. By fixing c = 299,792,458 m/s, the natural time-mass duality $T \cdot m = 1$ is artificially "frozen," leading to apparent complexity. The T0 theory shows: c is not a fundamental law of nature, but only a ratio that must be variable if time is variable. The choice of convention concerned not $E=mc^2$ itself, but the constant-setting of c.

Contents

1 The Central Thesis: E=mc² = E=m

The Central Recognition

E=mc² and E=m are mathematically identical!
The only difference: Einstein treats c as a "constant," although c is a dynamic ratio.
Einstein's error: c = 299,792,458 m/s = constant
T0 truth: c = L/T = variable ratio

1.1 The Mathematical Identity

In natural units:

$$E = mc^2 = m \times c^2 = m \times 1^2 = m \tag{1}$$

This is not an approximation - this is exactly the same equation!

1.2 What is c really?

$$c = \frac{\text{Length}}{\text{Time}} = \frac{L}{T} \tag{2}$$

c is a ratio, not a natural constant!

2 The Convention Choice: The Constant-Setting of c

2.1 The Act of Constant-Setting

Einstein set: $c = 299,792,458$ m/s = **constant**
What does this mean?

$$c = \frac{L}{T} = \text{constant} \quad \Rightarrow \quad \frac{L}{T} = \text{fixed} \tag{3}$$

Implication: If L and T can vary, their **ratio** must remain constant.

2.2 The Problem of Time Variability

Einstein recognized himself: Time dilates!

$$t' = \gamma t \quad \text{(time is variable)} \tag{4}$$

But simultaneously he claimed:

$$c = \frac{L}{T} = \text{constant} \tag{5}$$

This is a logical contradiction!

2.3 The T0 Resolution

T0 insight: $T(x,t) \cdot m = 1$
This means:

- Time $T(x,t)$ **must** be variable (coupled to mass)
- Therefore $c = L/T$ **cannot** be constant
- c is a **dynamic ratio**, not a constant

3 The Constants Illusion: How it Works

3.1 The Mechanism of the Illusion

Step 1: Einstein sets c = constant

$$c = 299,792,458 \text{ m/s} = \text{fixed} \tag{6}$$

Step 2: Time becomes "frozen" by this

$$T = \frac{L}{c} = \frac{L}{\text{constant}} = \text{apparently determined} \tag{7}$$

Step 3: Time dilation becomes "mysterious effect"

$$t' = \gamma t \quad \text{(why? → complicated relativity theory)} \tag{8}$$

3.2 What Really Happens (T0 View)

Reality: Time is naturally variable through $T(x,t) \cdot m = 1$
Einstein's constant-setting "freezes" this natural variability artificially
Result: One needs complicated theory to repair the "frozen" dynamics

4 c as Ratio vs. c as Constant

4.1 c as Natural Ratio (T0)

$$c(x,t) = \frac{L(x,t)}{T(x,t)} \tag{9}$$

Properties:

- c varies with location and time
- c follows the time-mass duality
- No artificial constants
- Natural simplicity: $E = m$

4.2 c as Artificial Constant (Einstein)

$$c = 299,792,458 \text{ m/s} = \text{constant everywhere} \tag{10}$$

Problems:

- Contradiction to time dilation
- Artificial "freezing" of time dynamics
- Complicated repair mathematics needed
- Inflated formula: $E = mc^2$

5 The Time Dilation Paradox

5.1 Einstein's Contradiction Exposed

Einstein claims simultaneously:

$$c = \text{constant} \tag{11}$$

$$t' = \gamma t \quad \text{(time varies)} \tag{12}$$

But:

$$c = \frac{L}{T} \quad \text{and} \quad T \text{ varies} \quad \Rightarrow \quad c \text{ cannot be constant!} \tag{13}$$

5.2 Einstein's Hidden Solution

Einstein "solves" the contradiction through:

- Complicated Lorentz transformations
- Mathematical formalisms

- Space-time constructions
- **But the logical contradiction remains!**

5.3 T0's Natural Solution

No contradiction in T0:

$$T(x,t) \cdot m = 1 \quad \Rightarrow \quad \text{time is naturally variable} \tag{14}$$

$$c = \frac{L}{T} \quad \Rightarrow \quad \text{c is naturally variable} \tag{15}$$

No constant-setting → No contradictions → No complicated repair mathematics

6 The Mathematical Demonstration

6.1 From E=mc² to E=m

Starting equation: $E = mc^2$
c in natural units: $c = 1$
Substitution:

$$E = mc^2 = m \times 1^2 = m \tag{16}$$

Result: $E = m$

6.2 The Reverse Direction: From E=m to E=mc²

Starting equation: $E = m$
Artificial constant introduction: $c = 299,792,458$ m/s
Inflating the equation:

$$E = m = m \times 1 = m \times \frac{c^2}{c^2} = m \times c^2 \times \frac{1}{c^2} \tag{17}$$

If one defines c^2 as "conversion factor":

$$E = mc^2 \tag{18}$$

This shows: $E = mc^2$ is only $E = m$ with **artificial inflation factor** c^2!

7 The Practical Justification of $E = mc^2$ in Our Experiential Realm

7.1 $E = mc^2$ and $E = m$ – Same Content in Different Unit Systems

The Pragmatic Perspective: Unit Systems and Conventions

The fundamental insight that must be clearly recognized: The equation $E = mc^2$ is mathematically equivalent to $E = m$ when one chooses suitable units.
Einstein formulated in SI units (practical for our world):

$$E = m \cdot (299\,792\,458)^2 \text{ J} \tag{19}$$

T0 formulates in natural units (fundamentally simpler):

$$E = m \quad \text{with} \quad c = 1 \tag{20}$$

Both descriptions contain exactly the same physical information – they merely use different measuring rods.
The choice between them is not a question of "right" or "wrong," but of *practical suitability versus fundamental simplicity*.

7.2 Why the Fixation $c =$ const. Is Practically Reasonable

For our everyday experiential world, the establishment of c as a constant is not only historically understandable but also *pragmatically justified* from multiple perspectives:

1. **Measurement Practice:** All our measuring instruments (clocks, rulers, electronic devices) utilize physical processes that themselves depend on c. Establishing a fixed c creates a consistent reference framework for reproducible experiments. Without such a convention, every measurement would require a circular self-calibration.
2. **Technological Applications:** From GPS navigation to particle accelerator technology, practical applications are based on the assumption of a locally constant c. This assumption works with extremely high precision for the range in which we live and work. The error introduced by this assumption is far below the resolution of our current technology for most applications.
3. **Scientific Communication:** A uniform convention allows scientists worldwide to compare results and communicate with each other. The SI units with

fixed c provide a practical basis for this. Science requires shared languages, and measurement conventions form an essential part of this language.

4. **Historical Development:** The establishment of c as constant did not occur arbitrarily but emerged from centuries of measurement attempts (Roemer, Fizeau, Michelson-Morley) that within their accuracy showed no variation. Einstein built on this empirical foundation.
5. **Educational Transmission:** Complex theories require entry points. $E = mc^2$ with constant c provides such an entry point into relativistic thinking. The deeper insight $E = m$ can follow as a second step for those seeking the fundamental structure.

7.3 The Crucial Distinction: Practical Convention vs. Fundamental Natural Law

T0 Theory makes a crucial distinction that resolves apparent contradictions:

Practical Measurement Convention	Fundamental Natural Law
For technical applications and everyday experiments, fixing $c = 299\,792\,458$ m/s is sensible and useful.	On the most fundamental level, c is not an absolute natural constant but a dynamic ratio L/T that follows the time-mass duality $T \cdot m = 1$.
Corresponds to selecting a stable reference system for our world of experience.	Corresponds to the intrinsic structure of reality before any human conventions.
Necessary for building reproducible technology and conducting comparable experiments.	Necessary for understanding the ultimate principles behind the phenomena.
Works perfectly for 99.9% of all current applications.	Shows what remains when all practical conventions are removed.

Table 1: The dual nature of physical descriptions

7.4 Einstein's Historical Achievement in New Light

Einstein's Pragmatic Genius Reinterpreted

Einstein did not merely discover the energy-mass equivalence $E = m$, but formulated it in the *units practical for his time* as $E = mc^2$.
His historical achievement from the T0 perspective consists of three levels:

1. **Discovery of the fundamental relationship:** Recognizing that energy and mass are different manifestations of the same reality.
2. **Pragmatic formulation:** Expressing this insight in a form usable for experiments and verifiable by contemporary measurements.
3. **Conceptual revolution:** Drawing the consequences for our space-time conception and thereby overcoming Newtonian absolutism.

The T0 Theory does not diminish this achievement but shows that behind the practical form $E = mc^2$ lies an even more fundamental simplicity $E = m$. Einstein stopped one step before the ultimate simplicity – but this step was necessary for his time.
Historical irony: Einstein actually discovered $E = m$ but packaged it in the form $E = mc^2$ because this corresponded to the measurement practices of his time. The physics community then celebrated the packaging and overlooked the simpler content.

7.5 From Practical to Fundamental Description: A Historical Progression

The development of physics can be understood as a continuous refinement of our reference systems and recognition of which elements are conventions and which are intrinsic structures:

Stage	Practical Form	Fundamental Insight	Historical Context
Newtonian Physics	$F = m \cdot a$ (with absolute time and space)	Approximation for $v \ll c$	Industrial Age: Machines, mechanics, predictable motion
Einstein (Special Relativity)	$E = mc^2$ (with $c = \text{const.}$)	Energy-mass equivalence	Early 20th Century: Electromagnetism, early atomic physics
Einstein (General Relativity)	$G_{\mu\nu} = \frac{8\pi G}{c^4} T_{\mu\nu}$ (10 field equations)	Geometry as gravity	Age of astronomy, cosmology
Quantum Mechanics	$i\hbar\frac{\partial}{\partial t}\psi = H\psi$	Quantization of energy	Atomic and nuclear age
T0 Theory	$E = m$ in natural units (with $T \cdot m = 1$)	Time-mass duality as fundamental	Information Age: Search for unified principles

Table 2: Historical progression from practical to fundamental descriptions

Each stage retains the validity of the previous ones for their application area but expands understanding to a deeper level. Newton is not "wrong" but limited in scope. Einstein is not "wrong" but stopped at a certain level of convention. T0 seeks to go one step further – but does not invalidate the previous steps.

7.6 Coexistence of Both Descriptions: A Peaceful Revolution

T0 Theory proposes not a break with established physics but a peaceful expansion:

- **For 99.9% of all technical applications:** $E = mc^2$ with constant c remains the practical and correct formulation. All engineering, GPS technology, particle accelerators, and space travel can continue to work with the established equations.
- **For fundamental theoretical questions:** $E = m$ in natural units shows the actual simplicity of the energy-mass relationship and eliminates logical contradictions (like the time dilation paradox). Theoretical physicists gain a simpler, more consistent foundation.
- **For future precision experiments:** The possibility of tiny c variations (as predicted by T0) should be kept in mind. Experiments can be designed to test whether c is *exactly* constant or only *practically* constant within our measurement accuracy.
- **For educational purposes:** The relationship can be taught at two levels: first the practical level $E = mc^2$ (as done today), then the fundamental level $E = m$ for advanced students. This corresponds to teaching Newtonian mechanics before relativity.

The Peaceful Revolution

The insight that $E = mc^2 = E = m$ does not require us to discard existing physics books or redesign technical systems. It only requires us to recognize that we have been working with a particularly practical form of a fundamentally simpler truth.
The revolution is conceptual, not practical.

7.7 The Actual Concern of T0 Theory

The True Concern of T0 Theory

T0 does not want to abolish $E = mc^2$ as a practical equation but to show:
That behind the practical form lies a fundamental simplicity that has been obscured by the historical choice of units.
This insight does not free us from the necessity of practical conventions but opens a deeper understanding of what these conventions actually describe.
The goal: Not to make physics more complicated, but to recognize its inherent simplicity – and then consciously choose which level of description is appropriate for which purpose.

7.8 The Double Perspective: Practical Engineering vs. Fundamental Science

The beauty of the T0 insight lies in the fact that it allows a double perspective:

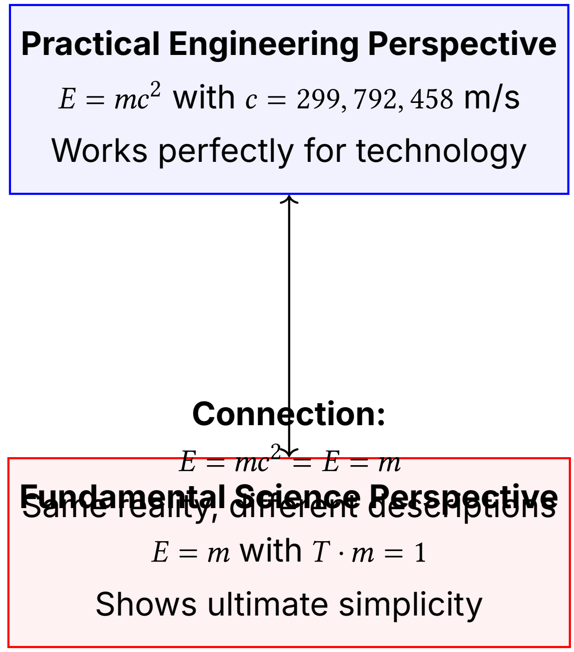

Figure 1: The double perspective of T0 Theory

Both perspectives are valid and useful – for different purposes. The engineer needs the practical perspective to build reliable technology. The theoretical physicist seeks the fundamental perspective to understand ultimate principles. T0 shows that these are not contradictory but complementary views of the same reality.

7.9 Conclusion: Why This Section Matters

This extensive section was necessary to clarify a common misunderstanding: When T0 shows that $E = mc^2 = E = m$, this is not an attack on Einstein or a claim that all previous physics is "wrong." Rather, it is:

1. A recognition that Einstein's formulation was *pragmatically optimal* for his time and still is for most applications.
2. A discovery that behind this practical formulation lies a *fundamentally simpler structure*.
3. An invitation to consciously distinguish between *practical conventions* and *fundamental laws*.
4. A proposal for a peaceful coexistence of both levels of description – each valuable in its own domain.

The following sections now build on this clarified foundation, showing the consequences when we take the fundamental perspective seriously.

8 The Arbitrariness of Constant Choice: c or Time?

8.1 Einstein's Arbitrary Decision

The Fundamental Choice Option

One can choose what should be "constant"!
Option 1 (Einstein's choice): c = constant → time becomes variable
Option 2 (alternative): time = constant → c becomes variable
Both describe the same physics!

8.2 Option 1: Einstein's c-constant

Einstein chose:

$$c = 299,792,458 \text{ m/s} = \text{constant (defined)} \tag{21}$$

$$t' = \gamma t \quad \text{(time becomes automatically variable)} \tag{22}$$

Language convention:

- "Speed of light is universally constant"
- "Time dilates in strong gravitational fields"
- "Clocks run slower at high velocities"

8.3 Option 2: Time-constant (Einstein could have chosen)

Alternative choice:

$$t = \text{constant (defined)} \tag{23}$$

$$c(x,t) = \frac{L(x,t)}{t} = \text{variable} \tag{24}$$

Alternative language convention:

- "Time flows equally everywhere"
- "Speed of light varies with location"
- "Light becomes slower in strong gravitational fields"

8.4 Mathematical Equivalence of Both Options

Both descriptions are mathematically identical:

Phenomenon	Einstein view	Time-constant view
Gravitation	Time slows down	Light slows down
Velocity	Time dilation	c-variation
GPS correction	"Clocks run differently"	"c is different"
Measurements	Same numbers	Same numbers

Table 3: Two views, identical physics

8.5 Why Einstein Chose Option 1

Historical reasons for Einstein's decision:

- **Michelson-Morley**: c seemed locally constant
- **Aesthetics**: "Universal constant" sounded elegant
- **Tradition**: Newtonian constant physics
- **Conceivability**: c-constancy easier to imagine than time constancy
- **Authority effect**: Einstein's prestige fixed this choice

But it was only a convention, not a natural law!

8.6 T0's Overcoming of Both Options

T0 shows: Both choices are arbitrary!

$$T(x,t) \cdot m = 1 \quad \text{(natural duality without constant constraint)} \tag{25}$$

T0 insight:

- **Neither** c nor time are "really" constant
- **Both** are aspects of the same T·m dynamics
- **Constancy** is only definition convention
- **E = m** is the constant-free truth

8.7 Liberation from Constant Constraint

Instead of choosing between:

- c constant, time variable (Einstein)
- Time constant, c variable (alternative)

T0 chooses:

- **Both dynamically coupled** via T·m = 1
- **No arbitrary fixations**
- **Natural ratios** instead of artificial constants

9 The Reference Point Revolution: Earth → Sun → Nature

9.1 The Reference Point Analogy: Geocentric → Heliocentric → T0

The Reference Point Revolution: From Earth → Sun → Nature

Geocentric (Ptolemy): Earth at center
- Complicated epicycles needed
- Works, but artificially complicated

Heliocentric (Copernicus): Sun at center
- Simple ellipses
- Much more elegant and simple

T0-centric: Natural ratios at center
- $T(x,t) \cdot m = 1$ (natural reference point)
- Even more elegant: $E = m$

Einstein's c-constant corresponds to the geocentric system:

- **Human** reference point at center (like Earth at center)
- **Complicated** mathematics needed (like epicycles)
- **Works** locally, but artificially inflated

T0's natural ratios correspond to the heliocentric system:

- **Natural** reference point at center (like Sun at center)
- **Simple** mathematics (like ellipses)
- **Universally** valid and elegant

9.2 Why We Need Reference Points

Reference points are necessary and natural:

- **For measurements**: We need standards for comparison
- **For communication**: Common basis for exchange
- **For technology**: Practical applications require units
- **For science**: Reproducible experiments need standards

The question is not WHETHER, but WHICH reference point:

System	Reference Point	Complexity	Elegance
Geocentric	Earth	Epicycles	Low
Heliocentric	Sun	Ellipses	High
Einstein	c-constant	Relativity theory	Medium
T0	$T(x,t) \cdot m = 1$	$E = m$	Maximum

Table 4: Reference point systems comparison

9.3 The Right vs. Wrong Reference Point

The approach was not to choose a reference point:

- **But to choose the wrong reference point!**
  Wrong reference point (Einstein): c = 299,792,458 m/s = constant
- Based on human definition
- Leads to complicated mathematics
- Creates logical contradictions
  Right reference point (T0): $T(x,t) \cdot m = 1$
- Based on natural ratio
- Leads to simple mathematics: $E = m$
- No contradictions, pure elegance

10 When Something Becomes "Constant"

10.1 The Fundamental Reference Point Problem

The Reference Point Illusion

Something only becomes "constant" when we define a reference point!
Without reference point: All ratios are relative and dynamic
With reference point: One ratio becomes artificially "fixed"
Einstein's error: He defined an absolute reference point for c

10.2 The Natural Stage: Everything is Relative

Before any reference point definition:

$$c_1 = \frac{L_1}{T_1} \tag{26}$$
$$c_2 = \frac{L_2}{T_2} \tag{27}$$
$$c_3 = \frac{L_3}{T_3} \tag{28}$$
$$\vdots \tag{29}$$

All c-values are relative to each other. None is "constant".

10.3 The Moment of Reference Point Setting

Einstein's fatal step:

$$\text{"I define: } c = 299,792,458 \text{ m/s = reference point"} \tag{30}$$

What happens at this moment:

- An **arbitrary reference point** is set
- All other c-values are measured relative to this
- The **dynamic ratio** becomes a "constant"
- The **natural relativity** is artificially "frozen"

10.4 The Reference Point Problematic

Every reference point is arbitrary:

- Why 299,792,458 m/s and not 300,000,000 m/s?
- Why in m/s and not in other units?
- Why measured on Earth and not in space?
- Why at this time and not at another?

10.5 T0's Reference Point-Free Physics

T0 eliminates all reference points:

$$T(x,t) \cdot m = 1 \quad \text{(universal relation without reference point)} \tag{31}$$

- No arbitrary fixations

- All ratios remain dynamic
- Natural relativity is preserved
- Fundamental simplicity: $E = m$

10.6 Example: The Meter Definition

Historical development of meter definition:

1. **1793**: 1 meter = 1/10,000,000 of Earth meridian (Earth reference point)
2. **1889**: 1 meter = prototype meter in Paris (object reference point)
3. **1960**: 1 meter = 1,650,763.73 wavelengths of krypton-86 (atom reference point)
4. **1983**: 1 meter = distance light travels in 1/299,792,458 s (c reference point)

What does this show?

- Each definition is **human arbitrariness**
- The **reference point** changes with human technology
- There is **no "natural" length unit** - only human agreements
- **Humans make c "constant" by definition** - not nature!

10.7 The Circular Error: Humans Define Their Own "Constants"

In 1983 humans defined:

$$1 \text{ meter} = \frac{1}{299,792,458} \times c \times 1 \text{ second} \tag{32}$$

This makes c automatically "constant" - through human definition, not through natural law:

$$c = \frac{299,792,458 \text{ meters}}{1 \text{ second}} = 299,792,458 \text{ m/s} \tag{33}$$

Circular reasoning: Humans define c as constant and then "measure" a constant!

Nature is not asked in this process!

10.8 T0's Resolution of the Reference Point Illusion

T0 recognizes:

- **Definition $\neq$ natural law**

- **Measurement reference point ≠ physical constant**
- **Practical agreement ≠ fundamental truth**

T0 solution:

$$\text{For measurements:} \quad \text{Use practical reference points} \tag{34}$$

$$\text{For natural laws:} \quad \text{Use reference point-free relations} \tag{35}$$

11 Why c-Constancy is Not Provable

11.1 The Fundamental Measurement Problem

To measure c, we need:

$$c = \frac{L}{T} \tag{36}$$

But: We measure L and T with **the same physical processes** that depend on c!

Circular problem:

- Light measures distances → c determines L
- Atomic clocks use EM transitions → c influences T
- Then we measure c = L/T → **We measure c with c!**

11.2 The Gauge Definition Problem

Since 1983: 1 meter = distance light travels in 1/299,792,458 s

$$c = 299,792,458 \text{ m/s} \quad \text{(not measured, but defined!)} \tag{37}$$

One cannot "prove" what one has defined!

11.3 The Systematic Compensation Problem

If c varies, ALL measuring devices vary equally:

- **Laser interferometers**: use light (c-dependent)
- **Atomic clocks**: use EM transitions (c-dependent)
- **Electronics**: uses EM signals (c-dependent)

Result: All devices **automatically compensate** the c-variation!

11.4 The Burden of Proof Problem

Scientifically correct:

- One **cannot prove** that something is constant
- One can only show that it **appears constant within measurement precision**
- **Each new precision level** could show variation

Einstein's "c-constancy" was belief, not proof!

11.5 T0 Prediction for Precise Measurements

T0 predicts: At highest precision one will find:

$$c(x,t) = c_0 \left(1 + \xi \times \frac{T(x,t)(x,t) - T(x,t)_0}{T(x,t)_0}\right) \tag{38}$$

with $\xi = 1.33 \times 10^{-4}$ (T0 parameter)
c varies tiny (∼10^{-15}), but measurable in principle!

12 Ontological Consideration: Calculations as Constructs

12.1 The Fundamental Epistemological Limit

Ontological Truth

All calculations are human constructs!
They can **at best** give a certain idea of reality.
That calculations are internally consistent proves little about actual reality.
Mathematical consistency ≠ ontological truth

12.2 Einstein's Construct vs. T0's Construct

Both are human thought structures:
Einstein's construct:

- E = mc² (mathematically consistent)
- Relativity theory (internally coherent)
- 10 field equations (work computationally)
- **But**: Based on arbitrary c-constant setting

T0's construct:
- E = m (mathematically simpler)
- T·m = 1 (internally coherent)
- $\partial^2 E = 0$ (works computationally)
- **But**: Also only a human thought model

12.3 The Ontological Relativity

What is "really" real?
- **Einstein's space-time**? (construct)
- **T0's energy field**? (construct)
- **Newton's absolute time**? (construct)
- **Quantum mechanics' probabilities**? (construct)

All are human interpretive frameworks of the inaccessible reality!

12.4 Why T0 is Still "Better"

Not because of "absolute truth," but because of:

1. Simplicity (Occam's Razor):
- E = m is simpler than E = mc²
- One equation is simpler than 10 equations
- Fewer arbitrary assumptions

2. Consistency:
- No logical contradictions (like Einstein's)
- No constant arbitrariness
- Unified thought structure

3. Predictive power:
- Testable predictions
- Fewer free parameters
- Clearer experimental distinction

4. Aesthetics:
- Mathematical elegance
- Conceptual clarity
- Unity

12.5 The Epistemological Humility

T0 does NOT claim to be "absolute truth."

T0 only says:

- "Here is a **simpler** construct"
- "With **fewer** arbitrary assumptions"
- "That is **more consistent** than Einstein's construct"
- "And makes **more testable** predictions"

But ultimately T0 also remains a human thought structure!

12.6 The Pragmatic Consequence

Since all theories are constructs:

Evaluation criteria are:

1. **Simplicity** (fewer assumptions)
2. **Consistency** (no contradictions)
3. **Predictive power** (testable consequences)
4. **Elegance** (aesthetic criteria)
5. **Unity** (fewer separate domains)

By all these criteria T0 is "better" than Einstein - but not "absolutely true".

12.7 The Ontological Humility

The deepest insight:

- **Reality itself** is inaccessible
- **All theories** are human constructs
- **Mathematical consistency** proves no ontological truth
- **The best** we have: **Simpler, more consistent constructs**

The c-constant setting was a convention decision, associated with the c-constant setting, but also the claim to absolute truth of his mathematical constructs.

T0's advantage is not absolute truth, but relative superiority as a thought model.

13 The Practical Consequences

13.1 Why E=mc² "Works"

E=mc² works because:
- It is mathematically identical to $E = m$
- c^2 compensates the "frozen" time dynamics
- The T0 truth is unconsciously contained
- Local approximations usually suffice

13.2 When E=mc² Fails

The constants illusion breaks down at:
- Very precise measurements
- Extreme conditions (high energies/masses)
- Cosmological scales
- Quantum gravity

13.3 T0's Universal Validity

E = m is valid everywhere and always:
- No approximations needed
- No constant assumptions
- Universal applicability
- Fundamental simplicity

14 The Correction of Physics History

14.1 Einstein's True Achievement

Einstein's actual discovery was:

$$E = m \quad \text{(in natural form)} \tag{39}$$

His error was:

$$E = mc^2 \quad \text{(with artificial constant inflation)} \tag{40}$$

14.2 The Historical Irony

The Great Irony

Einstein discovered the fundamental simplicity $E = m$,
but **hid it behind the constants illusion** $E = mc^2$!
The physics world celebrated the complicated form and overlooked the simple truth.

15 The T0 Perspective: c as Living Ratio

15.1 c as Expression of Time-Mass Duality

In T0 theory:

$$c(x,t) = f\left(\frac{L(x,t)}{T(x,t)(x,t)}\right) = f\left(\frac{L(x,t)\cdot m(x,t)}{1}\right) \tag{41}$$

since $T(x,t) \cdot m = 1$.
c becomes an expression of the fundamental time-mass duality!

15.2 The Dynamic Speed of Light

T0 prediction:

$$c(x,t) = c_0\sqrt{1 + \xi\frac{m(x,t) - m_0}{m_0}} \tag{42}$$

Light moves faster in more massive regions!
(Tiny effect, but measurable in principle)

16 Experimental Tests of c-Variability

16.1 Proposed Experiments

Test 1 - Gravitational dependence:

- Measure c in different gravitational fields
- T0 prediction: c varies with $\sim \xi \times \Delta\Phi_{\text{grav}}$

Test 2 - High-energy physics:

- Measure c in particle accelerators at highest energies
- T0 prediction: Tiny deviations at $E \sim$ TeV

16.2 Expected Results

Experiment	Einstein (c constant)	T0 (c variable)
Gravitational field	$c = 299792458$ m/s	$c(1 \pm 10^{-15})$
High energy	$c =$ constant	$c(1 + 10^{-16})$

Table 5: Predicted c-variations

17 Conclusions

17.1 The Central Recognition

The Fundamental Truth

E=mc² = E=m
Einstein's "constant" c is in truth a variable ratio.
The constant-setting was a convention decision.
T0 offers an alternative perspective by returning to natural variability.

17.2 Physics After the Constants Illusion

The future of physics:

- No artificial constants
- Dynamic ratios everywhere
- Living, variable natural laws
- Fundamental simplicity: $E = m$

17.3 Einstein's Corrected Legacy

Einstein's true discovery: $E = m$ (energy-mass identity)
Einstein's error: Constant-setting of c
T0's correction: Return to natural form $E = m$
Einstein was brilliant - he just stopped one step too early!

References

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