$E=mc^2 = E=m$: Two Equivalent Perspectives Unit Conventions in Relativity Theory

From SI Units to Natural Units

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Abstract

This work examines the equivalence 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. Both perspectives are valid in their respective contexts. See also document 134.

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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.
The SI convention: c = 299,792,458 m/s = constant
T0 perspective: 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 Choice of Unit System

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 apparent difference!

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"

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

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 difference through:

- Complicated Lorentz transformations
- Mathematical formalisms
- Space-time constructions
- **But the apparent difference remains!**

5.3 T0's Natural Solution

No difference 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 differences → 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 Arbitrariness of Constant Choice: c or Time?

7.1 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!

7.2 Option 1: Einstein's c-constant

Einstein chose:

$$c = 299,792,458 \text{ m/s} = \text{constant (defined)} \tag{19}$$

$$t' = \gamma t \quad \text{(time becomes automatically variable)} \tag{20}$$

Language convention:

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

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

Alternative choice:

$$t = \text{constant (defined)} \tag{21}$$

$$c(x,t) = \frac{L(x,t)}{t} = \text{variable} \tag{22}$$

Alternative language convention:

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

7.4 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 1: Two views, identical physics

7.5 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!

7.6 T0's Overcoming of Both Options

T0 shows: Both choices are arbitrary!

$$T(x,t) \cdot m = 1 \quad \text{(natural duality without constant constraint)} \tag{23}$$

T0 insight:

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

7.7 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

8 The Reference Point Revolution: Earth → Sun → Nature

8.1 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

8.2 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 2: Reference point systems comparison

8.3 The Right vs. Wrong Reference Point

The SI convention 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 apparent differences

Right reference point (T0): $T(x,t) \cdot m = 1$

- Based on natural ratio
- Leads to simple mathematics: $E = m$
- No differences, pure elegance

9 When Something Becomes "Constant"

9.1 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"
The SI convention: He defined an absolute reference point for c

9.2 The Natural Stage: Everything is Relative

Before any reference point definition:

$$c_1 = \frac{L_1}{T_1} \tag{24}$$

$$c_2 = \frac{L_2}{T_2} \tag{25}$$

$$c_3 = \frac{L_3}{T_3} \tag{26}$$

$$\vdots \tag{27}$$

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

9.3 The Moment of Reference Point Setting

Einstein's fatal step:

$$\text{"I define: } c = 299,792,458 \text{ m/s} = \text{reference point"} \tag{28}$$

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"

9.4 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?

9.5 T0's Reference Point-Free Physics

T0 eliminates all reference points:

$$T(x,t) \cdot m = 1 \quad \text{(universal relation without reference point)} \tag{29}$$

- No arbitrary fixations
- All ratios remain dynamic
- Natural relativity is preserved
- Fundamental simplicity: $E = m$

9.6 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!

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

In 1983 humans defined:

$$1 \text{ meter} = \frac{1}{299,792,458} \times c \times 1 \text{ second} \tag{30}$$

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

$$c = \frac{299,792,458 \text{ meters}}{1 \text{ second}} = 299,792,458 \text{ m/s} \tag{31}$$

Circular reasoning: Humans define c as constant and then "measure" a constant!
Nature is not asked in this process!

9.8 T0's Resolution of the Reference Point Illusion

T0 recognizes:

- **Definition $\neq$ natural law**
- **Measurement reference point $\neq$ physical constant**
- **Practical agreement $\neq$ fundamental truth**

T0 solution:

$$\text{For measurements:} \quad \text{Use practical reference points} \tag{32}$$

$$\text{For natural laws:} \quad \text{Use reference point-free relations} \tag{33}$$

10 Why c-Constancy is Not Provable

10.1 The Fundamental Measurement Problem

To measure c, we need:

$$c = \frac{L}{T} \tag{34}$$

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!**

10.2 The Gauge Definition Problem

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

$$c = 299,792,458 \text{ m/s} \quad \text{(not measured, but defined!)} \tag{35}$$

One cannot "prove" what one has defined!

10.3 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!

10.4 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!

10.5 T0 Prediction for Precise Measurements

T0 predicts: At highest precision one will find:

$$c(x,t) = c_0 \left(1 + \xi \times \frac{T(x,t)(x,t) - T(x,t)_0}{T(x,t)_0}\right) \tag{36}$$

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

11 Ontological Consideration: Calculations as Constructs

11.1 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 $\neq$ ontological truth

11.2 Einstein's Construct vs. T0's Construct

Both are human thought structures:
Einstein's construct:

- $E = mc^2$ (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)
- $T \cdot m = 1$ (internally coherent)
- $\partial^2 E = 0$ (works computationally)
- **But**: Also only a human thought model

11.3 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!

11.4 Why T0 is Still "Better"

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

1. Simplicity (Occam's Razor):

- $E = m$ is simpler than $E = mc^2$
- One equation is simpler than 10 equations
- Fewer arbitrary assumptions

2. Consistency:

- No apparent differences (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

11.5 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!

11.6 The Pragmatic Consequence

Since all theories are constructs:
Evaluation criteria are:

1. **Simplicity** (fewer assumptions)
2. **Consistency** (no differences)
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".

11.7 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 SI convention was not only 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.

12 The Practical Consequences

12.1 Why E=mc² "Works"

E=mc² works because:

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

12.2 When E=mc² Fails

The unit convention breaks down at:

- Very precise measurements
- Extreme conditions (high energies/masses)
- Cosmological scales
- Quantum gravity

12.3 T0's Universal Validity

E = m is valid everywhere and always:

- No approximations needed
- No constant assumptions
- Universal applicability
- Fundamental simplicity

13 The Correction of Physics History

13.1 Einstein's True Achievement

Einstein's actual discovery was:

$$E = m \quad \text{(in natural form)} \tag{37}$$

The historical choice was:

$$E = mc^2 \quad \text{(with artificial constant inflation)} \tag{38}$$

13.2 The Historical Irony

The Great Irony

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

14 The T0 Perspective: c as Living Ratio

14.1 c as Expression of Time-Mass Duality

In T0 theory:

$$c(x,t) = f\left(\frac{L(x,t)}{T(x,t)(x,t)}\right) = f\left(\frac{L(x,t)\cdot m(x,t)}{1}\right) \tag{39}$$

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

14.2 The Dynamic Speed of Light

T0 prediction:

$$c(x,t) = c_0\sqrt{1+\xi\frac{m(x,t)-m_0}{m_0}} \tag{40}$$

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

15 Experimental Tests of c-Variability

15.1 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 - Cosmological variation:

- Measure c over cosmological time periods
- T0 prediction: c changes with universe expansion

Test 3 - High-energy physics:

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

Experiment	Einstein (c constant)	T0 (c variable)
Gravitational field	$c = 299792458$ m/s	$c(1 \pm 10^{-15})$
Cosmological time	$c =$ constant	$c(1 + 10^{-12} \times t)$
High energy	$c =$ constant	$c(1 + 10^{-16})$

Table 3: Predicted c-variations

15.2 Expected Results

16 Conclusions

16.1 The Central Recognition

The Fundamental Truth

E=mc² = E=m
Einstein's "constant" c is in truth a variable ratio.
The constant-setting was The historical unit choice.
T0 extends this perspective by returning to natural variability.

16.2 Physics After the Constants Illusion

The future of physics:

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

16.3 Einstein's Corrected Legacy

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

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