$E=mc^2$ Revisited

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Chapitre 1

$E=mc^2$ Revisited

$E=mc^2 = E=m$: The Constants Illusion Exposed
Why Einstein's c-constant conceals the fundamental error
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Résumé

This work reveals 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. Einstein's error was not $E=mc^2$ itself, but the constant-setting of c.

1.1 The Central Thesis : E=mc² = E=m

The Fundamental 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

1.1.1 The Mathematical Identity

In natural units :

$$E = mc^2 = m \times c^2 = m \times 1^2 = m \tag{1.1}$$

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

1.1.2 What is c really ?

$$c = \frac{\text{Length}}{\text{Time}} = \frac{L}{T} \tag{1.2}$$

c is a ratio, not a natural constant !

1.2 Einstein's Fundamental Error : The Constant-Setting

1.2.1 The Act of Constant-Setting

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

$$c = \frac{L}{T} = \text{constant} \quad \Rightarrow \quad \frac{L}{T} = \text{fixed} \tag{1.3}$$

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

1.2.2 The Problem of Time Variability

Einstein recognized himself : Time dilates !

$$t' = \gamma t \quad \text{(time is variable)} \tag{1.4}$$

But simultaneously he claimed :

$$c = \frac{L}{T} = \text{constant} \tag{1.5}$$

This is a logical contradiction !

1.2.3 The T0 Resolution

T0 insight : $\cdot m = 1$
This means :
— Time **must** be variable (coupled to mass)
— Therefore $c = L/T$ **cannot** be constant
— c is a **dynamic ratio**, not a constant

1.3 The Constants Illusion : How it Works

1.3.1 The Mechanism of the Illusion

Step 1 : Einstein sets c = constant

$$c = 299,792,458 \text{ m/s} = \text{fixed} \tag{1.6}$$

Step 2 : Time becomes "frozen" by this

$$T = \frac{L}{c} = \frac{L}{\text{constant}} = \text{apparently determined} \tag{1.7}$$

Step 3 : Time dilation becomes "mysterious effect"

$$t' = \gamma t \quad (\text{why ?} \rightarrow \text{complicated relativity theory}) \tag{1.8}$$

1.3.2 What Really Happens (T0 View)

Reality : Time is naturally variable through $\cdot m = 1$
Einstein's constant-setting "freezes" this natural variability artificially
Result : One needs complicated theory to repair the "frozen" dynamics

1.4 c as Ratio vs. c as Constant

1.4.1 c as Natural Ratio (T0)

$$c(x,t) = \frac{L(x,t)}{T(x,t)} \tag{1.9}$$

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

1.4.2 c as Artificial Constant (Einstein)

$$c = 299,792,458 \text{ m/s} = \text{constant everywhere} \tag{1.10}$$

Problems :

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

1.5 The Time Dilation Paradox

1.5.1 Einstein's Contradiction Exposed

Einstein claims simultaneously :

$$c = \text{constant} \tag{1.11}$$
$$t' = \gamma t \quad \text{(time varies)} \tag{1.12}$$

But :

$$c = \frac{L}{T} \quad \text{and} \quad T \text{ varies} \quad \Rightarrow \quad c \text{ cannot be constant!} \tag{1.13}$$

1.5.2 Einstein's Hidden Solution

Einstein "solves" the contradiction through :
— Complicated Lorentz transformations
— Mathematical formalisms
— Space-time constructions
— **But the logical contradiction remains!**

1.5.3 T0's Natural Solution

No contradiction in T0 :

$$\cdot m = 1 \quad \Rightarrow \quad \text{time is naturally variable} \tag{1.14}$$

$$c = \frac{L}{T} \quad \Rightarrow \quad \text{c is naturally variable} \tag{1.15}$$

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

1.6 The Mathematical Demonstration

1.6.1 From E=mc² to E=m

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

$$E = mc^2 = m \times 1^2 = m \tag{1.16}$$

Result : $E = m$

1.6.2 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 :

$$E = m = m \times 1 = m \times \frac{c^2}{c^2} = m \times c^2 \times \frac{1}{c^2} \tag{1.17}$$

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

$$E = mc^2 \tag{1.18}$$

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

1.7 The Arbitrariness of Constant Choice : c or Time ?

1.7.1 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 !

1.7.2 Option 1 : Einstein's c-constant

Einstein chose :

$$c = 299,792,458 \text{ m/s} = \text{constant (defined)} \tag{1.19}$$
$$t' = \gamma t \quad \text{(time becomes automatically variable)} \tag{1.20}$$

Language convention :
— "Speed of light is universally constant"
— "Time dilates in strong gravitational fields"
— "Clocks run slower at high velocities"

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

Alternative choice :

$$t = \text{constant (defined)} \tag{1.21}$$
$$c(x,t) = \frac{L(x,t)}{t} = \text{variable} \tag{1.22}$$

Alternative language convention :
— "Time flows equally everywhere"
— "Speed of light varies with location"
— "Light becomes slower in strong gravitational fields"

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 1.1 – Two views, identical physics

1.7.4 Mathematical Equivalence of Both Options

Both descriptions are mathematically identical :

1.7.5 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 !

1.7.6 T0's Overcoming of Both Options

T0 shows : Both choices are arbitrary !

$$\cdot m = 1 \quad \text{(natural duality without constant constraint)} \tag{1.23}$$

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

1.7.7 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

1.8 The Reference Point Revolution : Earth → Sun → Nature

1.8.1 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
- $\cdot m = 1$ (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

1.8.2 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	$\cdot m = 1$	$E = m$	Maximum

TABLE 1.2 – Reference point systems comparison

1.8.3 The Right vs. Wrong Reference Point

Einstein's error 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) : $\cdot m = 1$
— Based on natural ratio
— Leads to simple mathematics : $E = m$
— No contradictions, pure elegance

1.9 When Something Becomes "Constant"

1.9.1 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"
Einstein's error : He defined an absolute reference point for c

1.9.2 The Natural Stage : Everything is Relative

Before any reference point definition :

$$c_1 = \frac{L_1}{T_1} \tag{1.24}$$

$$c_2 = \frac{L_2}{T_2} \tag{1.25}$$

$$c_3 = \frac{L_3}{T_3} \tag{1.26}$$

$$\vdots \tag{1.27}$$

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

1.9.3 The Moment of Reference Point Setting

Einstein's fatal step :

$$\text{"I define : } c = 299,792,458 \text{ m/s} = \text{reference point"} \tag{1.28}$$

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"

1.9.4 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 ?

1.9.5 T0's Reference Point-Free Physics

T0 eliminates all reference points :

$$\cdot m = 1 \quad \text{(universal relation without reference point)} \tag{1.29}$$

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

1.9.6 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 !

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

In 1983 humans defined :

$$1 \text{ meter} = \frac{1}{299,792,458} \times c \times 1 \text{ second} \tag{1.30}$$

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

$$c = \frac{299,792,458 \text{ meters}}{1 \text{ second}} = 299,792,458 \text{ m/s} \tag{1.31}$$

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

1.9.8 T0's Resolution of the Reference Point Illusion

T0 recognizes :
— **Definition ≠ natural law**
— **Measurement reference point ≠ physical constant**
— **Practical agreement ≠ fundamental truth**
T0 solution :

$$\text{For measurements :} \quad \text{Use practical reference points} \tag{1.32}$$
$$\text{For natural laws :} \quad \text{Use reference point-free relations} \tag{1.33}$$

1.10 Why c-Constancy is Not Provable

1.10.1 The Fundamental Measurement Problem

To measure c, we need :

$$c = \frac{L}{T} \tag{1.34}$$

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 !**

1.10.2 The Gauge Definition Problem

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

$$c = 299,792,458 \text{ m/s} \quad \text{(not measured, but defined !)} \tag{1.35}$$

One cannot "prove" what one has defined !

1.10.3 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 !

1.10.4 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 !

1.10.5 T0 Prediction for Precise Measurements

T0 predicts : At highest precision one will find :

$$c(x,t) = c_0 \left(1 + \xi \times \frac{(x,t) - _0}{_0}\right) \tag{1.36}$$

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

1.11 Ontological Consideration : Calculations as Constructs

1.11.1 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

1.11.2 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

1.11.3 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 !

1.11.4 Why T0 is Still "Better"

Not because of "absolute truth," but because of :
1. Simplicity (Occam's Razor) :
— E = m is simpler than E = 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

1.11.5 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 !

1.11.6 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".

1.11.7 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**
Einstein's error 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.

1.12 The Practical Consequences

1.12.1 Why E=mc² "Works"

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

1.12.2 When E=mc² Fails

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

1.12.3 T0's Universal Validity

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

1.13 The Correction of Physics History

1.13.1 Einstein's True Achievement

Einstein's actual discovery was :

$$E = m \quad \text{(in natural form)} \tag{1.37}$$

His error was :

$$E = mc^2 \quad \text{(with artificial constant inflation)} \tag{1.38}$$

1.13.2 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.

1.14 The T0 Perspective : c as Living Ratio

1.14.1 c as Expression of Time-Mass Duality

In T0 theory :

$$c(x,t) = f\left(\frac{L(x,t)}{(x,t)}\right) = f\left(\frac{L(x,t)\cdot m(x,t)}{1}\right) \tag{1.39}$$

since $\cdot m = 1$.
c becomes an expression of the fundamental time-mass duality !

1.14.2 The Dynamic Speed of Light

T0 prediction :

$$c(x,t) = c_0\sqrt{1+\xi\frac{m(x,t)-m_0}{m_0}} \tag{1.40}$$

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

1.15 Experimental Tests of c-Variability

1.15.1 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

1.15.2 Expected Results

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 1.3 – Predicted c-variations

1.16 Conclusions

1.16.1 The Central Recognition

The Fundamental Truth

$E=mc^2 = E=m$
Einstein's "constant" c is in truth a variable ratio.
The constant-setting was Einstein's fundamental error.
T0 corrects this error by returning to natural variability.

1.16.2 Physics After the Constants Illusion

The future of physics :
— No artificial constants
— Dynamic ratios everywhere
— Living, variable natural laws
— Fundamental simplicity : $E = m$

1.16.3 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 !

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