Chapter 1

T0 Model: Granulation, Limits and Fundamental Asymmetry

Abstract

The T0 model describes a fundamental granulation of spacetime at the sub-Planck scale $\ell_0 = \xi \times \ell_P$ with $\xi \approx 1.333 \times 10^{-4}$. This work examines the consequences for scale hierarchies, time continuity, and the mathematical completeness of various gravitational theories. The time-mass duality $T(x,t) \cdot m(x,t) = 1$ requires both fields to be coupled and variable, while the fundamental ξ-asymmetry enables all developmental processes.

Contents

1.1 Granulation as Fundamental Principle of Reality

1.1.1 Minimum Length Scale ℓ_0

The T0 model introduces a fundamental length scale deeper than the Planck length:

$$\ell_0 = \xi \times \ell_\text{P} \approx \frac{4}{3} \times 10^{-4} \times 1.616 \times 10^{-35}\ \text{m} \approx 2.155 \times 10^{-39}\ \text{m} \tag{1.1}$$

Significance of ℓ_0:

- Absolute physical lower limit for spatial structures
- Granulated spacetime structure - not continuous
- Sub-Planck physics with new fundamental laws
- Universal scale for all physical phenomena

1.1.2 The Extreme Scale Hierarchy

From ℓ_0 to cosmological scales extends a hierarchy of over 60 orders of magnitude:

$$\ell_0 \approx 10^{-39}\ \text{m} \quad \text{(Sub-Planck minimum)} \tag{1.2}$$
$$\ell_\text{P} \approx 10^{-35}\ \text{m} \quad \text{(Planck length)} \tag{1.3}$$
$$L_\text{Casimir} \approx 100\ \text{micrometers} \quad \text{(Casimir scale)} \tag{1.4}$$
$$L_\text{Atom} \approx 10^{-10}\ \text{m} \quad \text{(Atomic scale)} \tag{1.5}$$
$$L_\text{Macro} \approx 1\ \text{m} \quad \text{(Human scale)} \tag{1.6}$$
$$L_\text{Cosmo} \approx 10^{26}\ \text{m} \quad \text{(Cosmological scale)} \tag{1.7}$$

1.1.3 Casimir Scale as Evidence of Granulation

At the Casimir characteristic scale, first measurable effects appear:

$$L_\xi \approx \frac{1}{\sqrt{\xi \times \ell_\text{P}}} \approx 100\ \text{micrometers} \tag{1.8}$$

Experimental evidence:

- Deviations from $1/d^4$ law at distances ≈ 10 nm
- ξ-corrections in Casimir force measurements
- Limits of continuum physics become visible

1.2 Limit Systems and Scale Hierarchies

1.2.1 Three-Scale Hierarchy

The T0 model organizes all physical scales into three fundamental domains:

1. **ℓ_0-domain**: Granulated physics, universal laws

2. **Planck domain**: Quantum gravity, transition dynamics
3. **Macro domain**: Classical physics with ξ-corrections

1.2.2 Relational Number System

Prime number ratios organize particles into natural generations:

- **3-limit**: u-, d-quarks (1st generation)
- **5-limit**: c-, s-quarks (2nd generation)
- **7-limit**: t-, b-quarks (3rd generation)

The next prime number (11) leads to ξ^{11}-corrections $\approx 10^{-44}$, which lie below the Planck scale.

1.2.3 CP Violation from Universal Asymmetry

The ξ-asymmetry explains:

- CP violation in weak interactions
- Matter-antimatter asymmetry in the universe
- Chiral symmetry breaking in nature

1.3 Fundamental Asymmetry as Motion Principle

1.3.1 The Universal ξ-Constant

$$\xi = \frac{4}{3} \times 10^{-4} \approx 1.333 \times 10^{-4} \tag{1.9}$$

Origin: Geometric 4/3-constant from optimal 3D space packing
Effect: Universal asymmetry enabling all development

1.3.2 Eternal Universe Without Big Bang

The T0 model describes an eternal, infinite, non-expanding universe:

- No beginning, no end - timeless existence
- Heisenberg's uncertainty principle forbids Big Bang: $\Delta E \times \Delta t \geq \hbar/2$
- Structured development instead of chaotic explosion
- Continuous ξ-field dynamics instead of Big Bang

1.3.3 Time Exists Only After Field-Asymmetry Excitation

Hierarchy of time emergence:

1. **Timeless universe**: Perfect symmetry, no time
2. **ξ-asymmetry arises**: Symmetry breaking activates time field
3. **Time-energy duality**: $T(x,t) \cdot E(x,t) = 1$ becomes active
4. **Manifested time**: Local time emerges through field dynamics
5. **Directed time**: Thermodynamic arrow of time stabilizes

Time is not fundamental but emergent from field asymmetry.

1.4 Hierarchical Structure: Universe > Field > Space

1.4.1 The Fundamental Order Hierarchy

Universe (highest order level):

- Superordinate structure with eternal, infinite properties
- Global organizational principles determine everything below
- ξ-asymmetry as universal guiding structure
- Thermodynamic overall balance of all processes

Field (middle organizational level):

- Universal ξ-field as mediator between universe and space
- Local dynamics within global constraints
- Time-energy duality as field principle
- Structure-forming processes through asymmetry

Space (manifestation level):

- 3D geometry as stage for field manifestations
- Granulation at ℓ_0-scale
- Local interactions between field excitations

1.4.2 Causal Downward Coupling

$$\text{UNIVERSE} \rightarrow \text{FIELD} \rightarrow \text{SPACE} \rightarrow \text{PARTICLES} \tag{1.10}$$

The universe is not just the sum of its spatial parts. Superordinate properties emerge only at the highest level. The ξ-constant is universal, not a space property.

1.5 Continuous Time Beyond Certain Scales

1.5.1 The Crucial Scale Hierarchy of Time

In the T0 model, different time domains exist with fundamentally different properties. The further we move from ℓ_0, the more continuous and constant time becomes.

Granulated Zone (below ℓ_0)

$$\ell_0 = \xi \times \ell_P \approx 2.155 \times 10^{-39} \text{ m} \tag{1.11}$$

- Time is discretely granulated, not continuous
- Chaotic quantum fluctuations dominate
- Physics loses classical meaning
- All fundamental forces equally strong

Transition Zone (around ℓ_0)

- Time-mass duality $T \cdot m = 1$ becomes fully active
- Intensive interaction of all fields
- Transition from granulated to continuous

Continuous Zone (above ℓ_0)

Central Insight

$$\text{Distance to } \ell_0 \uparrow \quad \Rightarrow \quad \text{Time continuity} \uparrow \quad \Rightarrow \quad \text{Constant direction} \uparrow \tag{1.12}$$

- Beyond a certain point, time becomes continuous
- Constant directed flow direction emerges
- The greater the distance to ℓ_0, the more stable the time direction
- Emergent classical physics with ξ-corrections

1.5.2 Quantitative Scaling of Time Continuity

Time continuity as function of distance to ℓ_0:

$$\text{Time continuity} \propto \log\left(\frac{L}{\ell_0}\right) \quad \text{for } L \gg \ell_0 \tag{1.13}$$

Practical scales:

$$L = 10^{-35} \text{ m (Planck)}: \quad \text{Still granulated} \tag{1.14}$$
$$L = 10^{-15} \text{ m (Nuclear)}: \quad \text{Transition to continuity} \tag{1.15}$$

$$L = 10^{-10} \text{ m (Atomic)}: \quad \text{Practically continuous} \tag{1.16}$$
$$L = 10^{-3} \text{ m (mm)}: \quad \text{Completely continuous, constant direction} \tag{1.17}$$
$$L = 1 \text{ m (Meter)}: \quad \text{Perfectly linear, directed time} \tag{1.18}$$

1.5.3 Thermodynamic Arrow of Time

Scale-dependent entropy:

- **Granulated level (ℓ_0)**: Maximum entropy, perfect symmetry
- **Transition level**: Entropy gradients emerge
- **Continuous level**: Second law becomes active
- **Macroscopic level**: Irreversible time direction

1.6 Practical vs. Fundamental Physics

1.6.1 Time is Practically Experienced as Constant

De facto for us: Time flows constantly in our experience domain

- **Local scales (m to km)**: Time is practically perfectly linear and constant
- **Measurable variations**: Only under extreme conditions (GPS satellites, particle accelerators)
- **Everyday physics**: Time constancy is a good approximation

1.6.2 Speed of Light as Clear Upper Limit

Observed reality:

- $c = 299,792,458$ m/s is measurable upper limit for information transfer
- **Causality**: No signals faster than c observed
- **Relativistic effects**: Clearly measurable at $v \to c$
- **Particle accelerators**: Confirm c-limit daily

1.6.3 Resolution of the Apparent Contradiction

Macroscopic level (our world):

$$L = 1 \text{ m to } 10^6 \text{ m (km range)} \tag{1.19}$$

- Time flows constantly: $dt/dt_0 \approx 1 + 10^{-16}$ (immeasurable)
- c is practically constant: $\Delta c/c \approx 10^{-16}$ (immeasurable)
- Einstein physics works perfectly

Fundamental level (T0 model):

$$\ell_0 = 10^{-39} \text{ m to } \ell_P = 10^{-35} \text{ m} \tag{1.20}$$

- Time-mass duality: $T \cdot m = 1$ is fundamental
- c is ratio: $c = L/T$ (must be variable)
- Mathematical consistency requires coupled variation

These variations are 10^6 times smaller than our best measurement precision!

1.7 Gravitation: Mass Variation vs. Space Curvature

1.7.1 Two Equivalent Interpretations

Einstein interpretation:

- m = constant (fixed mass)
- $g_{\mu\nu}$ = variable (curved spacetime)
- Mass causes space curvature

T0 interpretation:

- $m(x, t)$ = variable (dynamic mass)
- $g_{\mu\nu}$ = fixed (flat Euclidean space)
- Mass varies locally through ξ-field

1.7.2 Important Insight: We Don't Know!

Attention - Fundamental Point

We DO NOT KNOW whether mass causes space curvature or whether mass itself varies!
This is an assumption, not a proven fact!

Both interpretations are equally valid:
Einstein assumption:

$$\text{Mass/energy} \to \text{Space curvature} \to \text{Gravitation} \tag{1.21}$$

$$G_{\mu\nu} = 8\pi T_{\mu\nu} \tag{1.22}$$

T0 alternative:

$$\xi\text{-field} \to \text{Mass variation} \to \text{Gravitational effects} \tag{1.23}$$

$$m(x, t) = m_0 \cdot (1 + \xi \cdot \Phi(x, t)) \tag{1.24}$$

1.7.3 Experimental Indistinguishability

All measurements are frequency-based:

- **Clocks**: Hyperfine transition frequencies
- **Scales**: Spring oscillations/resonance frequencies
- **Spectrometers**: Light frequencies and transitions
- **Interferometers**: Phases = frequency integrals

Identical frequency shifts:

$$\text{Einstein}: \quad \nu' = \nu_0\sqrt{1 + 2\Phi/c^2} \approx \nu_0(1 + \Phi/c^2) \tag{1.25}$$

$$\text{T0}: \quad \nu' = \nu_0 \cdot \frac{m(x,t)}{T(x,t)} \approx \nu_0(1 + \Phi/c^2) \tag{1.26}$$

Only frequency ratios are measurable - absolute frequencies are fundamentally inaccessible!

1.8 Mathematical Completeness: Both Fields Coupled Variable

1.8.1 The Correct Mathematical Formulation

Mathematically correct in T0 model:

$$T(x,t) = \text{variable} \quad \text{(Time as dynamic field)} \tag{1.27}$$

$$m(x,t) = \text{variable} \quad \text{(Mass as dynamic field)} \tag{1.28}$$

Coupled through fundamental duality:

$$T(x,t) \cdot m(x,t) = 1 \tag{1.29}$$

Both fields vary TOGETHER:

$$T(x,t) = T_0 \cdot (1 + \xi \cdot \Phi(x,t)) \tag{1.30}$$

$$m(x,t) = m_0 \cdot (1 - \xi \cdot \Phi(x,t)) \tag{1.31}$$

1.8.2 Verification of Mathematical Consistency

Duality check:

$$T(x,t) \cdot m(x,t) = T_0 m_0 \cdot (1 + \xi\Phi)(1 - \xi\Phi) \tag{1.32}$$

$$= T_0 m_0 \cdot (1 - \xi^2\Phi^2) \tag{1.33}$$

$$\approx T_0 m_0 = 1 \quad (\text{for } \xi\Phi \ll 1) \tag{1.34}$$

Mathematical consistency confirmed!

1.8.3 Why Both Fields Must Be Variable

Lagrange formalism requires:

$$\delta S = \int \delta\mathcal{L}\, d^4x = 0 \tag{1.35}$$

Complete variation:

$$\delta\mathcal{L} = \frac{\partial\mathcal{L}}{\partial T}\delta T + \frac{\partial\mathcal{L}}{\partial m}\delta m + \frac{\partial\mathcal{L}}{\partial\partial_\mu T}\delta\partial_\mu T + \frac{\partial\mathcal{L}}{\partial\partial_\mu m}\delta\partial_\mu m \tag{1.36}$$

For mathematical completeness:

- $\delta T \neq 0$ (Time must be variable)
- $\delta m \neq 0$ (Mass must be variable)
- Both coupled through $T \cdot m = 1$

1.8.4 Einstein's Arbitrary Constant Setting

Einstein arbitrarily sets:

$$m_0 = \text{constant} \quad \Rightarrow \quad \delta m = 0 \tag{1.37}$$

Mathematical problem:

- Incomplete variation of the Lagrangian
- Violates variation principle of field theory
- Arbitrary symmetry breaking without justification

1.8.5 Parameter Elegance

$$\text{Einstein}: \quad m_0, c, G, \hbar, \Lambda, \alpha_{\text{EM}}, \ldots \quad (\gg 10 \text{ free parameters}) \tag{1.38}$$
$$\text{T0}: \quad \xi \quad (1 \text{ universal parameter}) \tag{1.39}$$

1.9 Pragmatic Preference: Variable Mass with Constant Time

1.9.1 The Pragmatic Alternative for Our Experience Space

As pragmatists, one can certainly prefer:

$$\text{Time}: \quad t = \text{constant} \quad \text{(practical experience)} \tag{1.40}$$
$$\text{Mass}: \quad m(x,t) = \text{variable} \quad \text{(dynamic adjustment)} \tag{1.41}$$

Why this is pragmatically sensible:

- Time constancy corresponds to our direct experience
- Mass variation is conceptually easier to imagine
- Practical calculations often become simpler
- Intuitive understandability for applications

1.9.2 Practical Advantages of Constant Time

In our experienceable space (m to km):

- Time flows linearly and constantly - our direct experience
- Clocks tick uniformly - practical time measurement
- Causal sequences are clearly defined
- Technical applications (GPS, navigation) function

Language convention:

- Time passes constantly
- Mass adapts to the fields
- Matter becomes heavier/lighter depending on location

1.9.3 Variable Mass as Intuitive Concept

Pragmatic interpretation:

$$m(x) = m_0 \cdot (1 + \xi \cdot \text{Gravitational field}(x)) \tag{1.42}$$

Intuitive conception:

- Mass increases in strong gravitational fields
- Mass decreases in weaker fields
- Matter feels the local ξ-field
- Dynamic adaptation to environment

1.9.4 Scientific Legitimacy of Preference

Important Insight

Pragmatic preferences are scientifically justified when both approaches are experimentally equivalent!

Justification:

- Scientifically equivalent to Einstein approach
- Often practically advantageous for applications
- Didactically easier to teach
- Technically more efficient to implement

The choice between constant time + variable mass vs. Einstein is a matter of taste - both are scientifically equally justified!

1.10 The Eternal Philosophical Boundary

1.10.1 What the T0 Model Explains

- HOW the ξ-asymmetry works
- WHAT the consequences are
- WHICH laws follow from it
- WHEN time and development emerge

1.10.2 What the T0 Model CANNOT Explain

The fundamental questions remain:

- WHY does the ξ-asymmetry exist?
- WHERE does the original energy come from?
- WHO/WHAT gave the first impulse?
- WHY does anything exist at all instead of nothing?

1.10.3 Scientific Humility

The eternal boundary: Every explanation needs unexplained axioms. The ultimate reason always remains mysterious. The that of existence is given, the why remains open.

The elegant shift: The T0 model shifts the mystery to a deeper, more elegant level - but it cannot resolve the fundamental riddle of existence.

And that is good. Because a universe without mystery would be a boring universe.

1.11 Experimental Predictions and Tests

1.11.1 Casimir Effect Modifications

- Deviations from $1/d^4$ law at $d \approx 10$ nm
- ξ-corrections in precision measurements
- Frequency-dependent Casimir forces

1.11.2 Atom Interferometry

- ξ-resonances in quantum interferometers
- Mass variations in gravitational fields
- Time-mass duality in precision experiments

1.11.3 Gravitational Wave Detection

- ξ-corrections in LIGO/Virgo data
- Modifications of wave dispersion
- Sub-Planck structures in gravitational waves

1.12 Conclusion: Asymmetry as Engine of Reality

The T0 model shows that granulation, limits, and fundamental asymmetry are inseparably connected with the scale-dependent nature of time:

1. **Granulation** at ℓ_0 defines the base scale of all physics
2. **Limit systems** organize particles into natural generations
3. **Fundamental asymmetry** generates time, development, and structure formation
4. **Hierarchical organization** from universe through field to space
5. **Continuous time** emerges beyond certain scales through distance to ℓ_0
6. **Mathematical completeness** requires T0 formulation over Einstein
7. **Experimental indistinguishability** of different interpretations
8. **Pragmatic preferences** are scientifically justified
9. **Philosophical boundaries** remain and preserve the mystery

The ξ-asymmetry is the engine of reality - without it, the universe would remain in perfect, timeless symmetry. With it emerges the entire diversity and dynamics of our observable world.

The T0 model thus offers a unified explanation for fundamental puzzles of physics - from the granulation of spacetime to the emergence of time itself.

1.13 Mathematical Proof: The Formula $T \cdot m = 1$ Excludes Singularities

1.13.1 Important Clarification: T as Oscillation Period

ATTENTION: In this analysis, T does not mean the experienced, continuously flowing time, but the **oscillation period** or **characteristic time constant** of a system. This is a fundamental difference:

- T = oscillation period (discrete, characteristic time unit)
- Not: T = continuous time coordinate (our everyday experience)

1.13.2 The Fundamental Exclusion Property

The equation $T \cdot m = 1$ is not just a mathematical relationship – it is an **exclusion theorem**. Through its algebraic structure, it makes certain states mathematically impossible.

1.13.3 Proof 1: Exclusion of Infinite Mass

Assumption: There exists an infinite mass $m = \infty$
Mathematical consequence:

$$T \cdot m = 1 \tag{1.43}$$

$$T \cdot \infty = 1 \tag{1.44}$$

$$T = \frac{1}{\infty} = 0 \tag{1.45}$$

Contradiction: $T = 0$ is not in the domain of the equation $T \cdot m = 1$, since:

- The product $0 \cdot \infty$ is mathematically undefined
- The original equation $T \cdot m = 1$ would be violated ($0 \cdot \infty \neq 1$)

Conclusion: $m = \infty$ is excluded by the formula.

1.13.4 Proof 2: Exclusion of Infinite Time

Assumption: There exists an infinite time $T = \infty$
Mathematical consequence:

$$T \cdot m = 1 \tag{1.46}$$

$$\infty \cdot m = 1 \tag{1.47}$$

$$m = \frac{1}{\infty} = 0 \tag{1.48}$$

Contradiction: $m = 0$ is not in the domain, since:

- The product $\infty \cdot 0$ is mathematically undefined
- The equation $T \cdot m = 1$ would be violated ($\infty \cdot 0 \neq 1$)

Conclusion: $T = \infty$ is excluded by the formula.

1.13.5 Proof 3: Exclusion of Zero Values

Assumption: There exists $T = 0$ or $m = 0$
Case 1: $T = 0$

$$T \cdot m = 1 \Rightarrow 0 \cdot m = 1 \tag{1.49}$$

This is impossible for any finite value of m, since $0 \cdot m = 0 \neq 1$.
Case 2: $m = 0$

$$T \cdot m = 1 \Rightarrow T \cdot 0 = 1 \tag{1.50}$$

This is impossible for any finite value of T, since $T \cdot 0 = 0 \neq 1$.
Conclusion: Both $T = 0$ and $m = 0$ are excluded by the formula.

1.13.6 Proof 4: Exclusion of Mathematical Singularities

Definition of a singularity: A point where a function becomes undefined or infinite.

Analysis of the function $T = \frac{1}{m}$:

Potential singularities could occur at:

- $m = 0$ (division by zero)
- $T \to \infty$ (infinite function values)

Exclusion by the constraint $T \cdot m = 1$:

1. **At** $m = 0$: The equation $T \cdot m = 1$ cannot be satisfied
2. **At** $T \to \infty$: Would require $m \to 0$, which is already excluded

Mathematical proof of singularity freedom:

For every point (T, m) with $T \cdot m = 1$:

$$T = \frac{1}{m} \text{ with } m \in (0, +\infty) \tag{1.51}$$

$$m = \frac{1}{T} \text{ with } T \in (0, +\infty) \tag{1.52}$$

Both functions are on their entire domain:

- **Continuous**
- **Differentiable**
- **Finite Well-defined**

1.13.7 The Algebraic Protection Function

The equation $T \cdot m = 1$ acts like an **algebraic protection** against singularities:

Automatic Correction

$$\text{If } m \text{ becomes very small} \Rightarrow T \text{ automatically becomes very large} \tag{1.53}$$

$$\text{If } T \text{ becomes very small} \Rightarrow m \text{ automatically becomes very large} \tag{1.54}$$

$$\text{But: } T \cdot m \text{ always remains exactly } 1 \tag{1.55}$$

Mathematical Stability

$$\lim_{m \to 0^+} T = +\infty, \text{ but } T \cdot m = 1 \text{ remains satisfied} \tag{1.56}$$

$$\lim_{T \to 0^+} m = +\infty, \text{ but } T \cdot m = 1 \text{ remains satisfied} \tag{1.57}$$

The constraint **forces** the variables into a finite, well-defined region.

1.13.8 Proof 5: Positive Definiteness

Theorem: All solutions of $T \cdot m = 1$ are positive.

Proof:

$$T \cdot m = 1 > 0 \tag{1.58}$$

Since the product is positive, both factors must have the same sign.

Exclusion of negative values:

- If $T < 0$ and $m < 0$, then $T \cdot m > 0$, but physically meaningless
- If $T > 0$ and $m < 0$, then $T \cdot m < 0 \neq 1$
- If $T < 0$ and $m > 0$, then $T \cdot m < 0 \neq 1$

Conclusion: Only $T > 0$ and $m > 0$ satisfy the equation.

1.13.9 The Fundamental Insight About Time and Continuity

Important physical clarification:

The formula $T \cdot m = 1$ describes **discrete, characteristic properties** of systems, not the continuous time flow of our experience. This means:

What $T \cdot m = 1$ does NOT state:

- „Time stands still" ($T = 0$)
- „Processes take infinitely long" ($T = \infty$)
- „The time flow is interrupted"
- „Our experienced time disappears"

What $T \cdot m = 1$ actually describes:

- **Oscillation periods** have mathematical limits
- **Characteristic time constants** cannot become arbitrary
- **Discrete time units** stand in fixed relation to mass
- **Periodic processes** follow the constraint $T \cdot m = 1$

The continuous time flow remains unaffected

The continuous time coordinate t (our „arrow time") is **not affected** by this relationship. $T \cdot m = 1$ regulates only the **intrinsic time scales** of physical systems, not the superordinate time flow in which these systems exist.

Important insight about our time perception:

Our continuous time perception could practically be only a **tiny excerpt** of a much larger period – an oscillation period so immense that it far exceeds anything humans could ever experience or conceive.

Conceivable orders of magnitude:

- **Human life:** $\sim 10^2$ years
- **Human history:** $\sim 10^4$ years
- **Earth age:** $\sim 10^9$ years
- **Universe age:** $\sim 10^{10}$ years **Possible cosmic period:** 10^{50}, 10^{100} or even larger time scales

In such a scenario, our entire observable universe would experience only an **infinitesimal small fraction** of a fundamental oscillation period. For us, time appears linear and continuous because we perceive only a vanishingly small section of a huge cosmic „oscillation".

Analogy: Just as a bacterium on a clock hand would perceive the movement as „straight ahead", although it moves on a circular path, we might experience „linear time", although we are in a gigantic periodic structure.

This perspective shows that $T \cdot m = 1$ and our time perception can operate on completely different scales without contradicting each other.

1.13.10 Cosmological Implications

This viewpoint opens new possibilities:

What we observe as cosmic development and change could be only a **small section** in a much larger cyclic pattern that follows the fundamental relationship $T \cdot m = 1$.

Possible cosmic structure:

- **Local time perception:** Linear, continuous (our experience domain)
- **Middle time scales:** Observable cosmic developments
- **Fundamental time scale:** Gigantic period according to $T \cdot m = 1$

Implications:

- Nature could be organized in **layered-periodic** fashion
- Different time scales follow different regularities
- $T \cdot m = 1$ could be the **master constraint** for the largest scale
- Our observable cosmic development would be a fragment of a cyclic system

This interpretation shows how mathematical constraints ($T \cdot m = 1$) and physical observations (linear time perception) can coexist in a **hierarchical time model**.

1.13.11 Conclusion: Mathematical Certainty

The formula $T \cdot m = 1$ is not just an equation – it is an **existence proof** for singularity-free physics. It proves mathematically that:

- **Infinite masses do not exist**
- **Infinite oscillation periods do not exist**

- **Zero masses are excluded**
- **Zero oscillation periods are excluded**
- **Singularities in characteristic time scales cannot occur**

Mathematics itself protects physics from singularities – without affecting the continuous time flow.

Bibliography

[1] J. Pascher, *T0 Model: Dimensionally Consistent Reference - Field-Theoretic Derivation of the β-Parameter*, 2025.

[2] J. Pascher, *From Time Dilation to Mass Variation: Mathematical Core Formulations of Time-Mass Duality Theory*, 2025.

[3] A. Einstein, *The Field Equations of Gravitation*, Proceedings of the Prussian Academy of Sciences, 844–847, 1915.

[4] M. Planck, *On the Theory of the Energy Distribution Law of the Normal Spectrum*, Proceedings of the German Physical Society, 2, 237–245, 1900.

[5] H. B. G. Casimir, *On the attraction between two perfectly conducting plates*, Proceedings of the Royal Netherlands Academy of Arts and Sciences, 51, 793–795, 1948.