

SI Units

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2025

Kapitel 1

SI Units

Zusammenfassung

T0-Theory achieves complete parameter freedom: Only the geometric parameter $\xi = \frac{4}{3} \times 10^{-4}$ is fundamental. All physical constants are either derived from ξ or represent unit definitions. This document provides the complete derivation chain including the gravitational constant G , the Planck length l_P , and the Boltzmann constant k_B . The SI reform 2019 unknowingly implemented the unique calibration that is consistent with this geometric foundation.

1.1 The Geometric Foundation

1.1.1 Single Fundamental Parameter

$$\xi = \frac{4}{3} \times 10^{-4} \quad (1.1)$$

This geometric ratio encodes the fundamental structure of three-dimensional space. All physical quantities emerge as derivable consequences.

1.1.2 Complete Derivation Framework

Detailed mathematical derivations are available at:

<https://github.com/jpascher/T0-Time-Mass-Duality/tree/main/2/pdf>

1.2 Derivation of the Gravitational Constant from ξ

1.2.1 The Fundamental T0 Gravitational Relation

Starting point of T0 gravity theory:

T0-Theory postulates a fundamental geometric relationship between the characteristic length parameter ξ and the gravitational constant:

$$\xi = 2\sqrt{G \cdot m_{\text{char}}} \quad (1.2)$$

where m_{char} represents a characteristic mass of the theory.

Physical interpretation:

- ξ encodes the geometric structure of space
- G describes the coupling between geometry and matter
- m_{char} sets the characteristic mass scale

1.2.2 Resolution for the Gravitational Constant

Solving equation (1.2) for G :

$$G = \frac{\xi^2}{4m_{\text{char}}} \quad (1.3)$$

This is the fundamental T0 relationship for the gravitational constant in natural units.

1.2.3 Choice of Characteristic Mass

The electron mass is also derived from ξ :

T0-Theory uses the electron mass as the characteristic scale:

$$m_{\text{char}} = m_e = 0.511 \text{ MeV} \quad (1.4)$$

Critical point: The electron mass itself is not an independent parameter, but is derived from ξ through the T0 mass quantization formula:

$$m_e = \frac{f(1, 0, 1/2)^2}{\xi^2} \cdot S_{T0} \quad (1.5)$$

where $f(n, l, j)$ is the geometric quantum number factor and $S_{T0} = 1 \text{ MeV}/c^2$ is the predicted scaling factor.

Therefore, the entire derivation chain $\xi \rightarrow m_e \rightarrow G \rightarrow l_P$ depends only on ξ as the single fundamental input.

1.2.4 Dimensional Analysis in Natural Units

Dimensional check in natural units ($\hbar = c = 1$):

In natural units:

$$[M] = [E] \quad (\text{from } E = mc^2 \text{ with } c = 1) \quad (1.6)$$

$$[L] = [E^{-1}] \quad (\text{from } \lambda = \hbar/p \text{ with } \hbar = 1) \quad (1.7)$$

$$[T] = [E^{-1}] \quad (\text{from } \omega = E/\hbar \text{ with } \hbar = 1) \quad (1.8)$$

The gravitational constant has the dimension:

$$[G] = [M^{-1}L^3T^{-2}] = [E^{-1}][E^{-3}][E^2] = [E^{-2}] \quad (1.9)$$

Checking equation (??):

$$[G] = \frac{[\xi^2]}{[m_e]} = \frac{[1]}{[E]} = [E^{-1}] \neq [E^{-2}] \quad (1.10)$$

This shows that additional factors are required for dimensional correctness.

1.2.5 Complete Formula with Conversion Factors

Complete gravitational constant formula:

$$G_{\text{SI}} = \frac{\xi_0^2}{4m_e} \times C_{\text{conv}} \times K_{\text{frak}} \quad (1.11)$$

where:

- $\xi_0 = 1.333 \times 10^{-4}$ (geometric parameter)
- $m_e = 0.511 \text{ MeV}$ (electron mass, derived from ξ)

- $C_{\text{conv}} = 7.783 \times 10^{-3}$ (systematically derived from \hbar, c)
- $K_{\text{frak}} = 0.986$ (fractal quantum spacetime correction)

Result:

$$G_{\text{SI}} = 6.674 \times 10^{-11} \text{ m}^3/(\text{kg} \cdot \text{s}^2) \quad (1.12)$$

with $< 0.0002\%$ deviation from CODATA-2018 value.

1.3 Derivation of the Planck Length from G and ξ

1.3.1 The Planck Length as Fundamental Reference

Definition of the Planck length:

In standard physics, the Planck length is defined as:

$$l_P = \sqrt{\frac{\hbar G}{c^3}} \quad (1.13)$$

In natural units ($\hbar = c = 1$) this simplifies to:

$$l_P = \sqrt{G} = 1 \quad (\text{natural units}) \quad (1.14)$$

Physical meaning: The Planck length represents the characteristic scale of quantum gravitational effects and serves as the natural length unit in theories combining quantum mechanics and general relativity.

1.3.2 T0 Derivation: Planck Length from ξ Only

Complete derivation chain:

Since G is derived from ξ via equation (??):

$$G = \frac{\xi^2}{4m_e} \quad (1.15)$$

the Planck length follows directly:

$$l_P = \sqrt{G} = \sqrt{\frac{\xi^2}{4m_e}} = \frac{\xi}{2\sqrt{m_e}} \quad (1.16)$$

In natural units with $m_e = 0.511 \text{ MeV}$:

$$l_P = \frac{1.333 \times 10^{-4}}{2\sqrt{0.511}} \approx 9.33 \times 10^{-5} \quad (\text{natural units}) \quad (1.17)$$

Conversion to SI units:

$$l_P = 1.616 \times 10^{-35} \text{ m} \quad (1.18)$$

1.3.3 The Characteristic T0 Length Scale

Connection between r_0 and the fundamental energy scale E_0 :

The characteristic T0 length r_0 for an energy E is defined as:

$$r_0(E) = 2GE \quad (1.19)$$

For the fundamental energy scale $E_0 = \sqrt{m_e \cdot m_\mu}$:

$$r_0(E_0) = 2GE_0 \approx 2.7 \times 10^{-14} \text{ m} \quad (1.20)$$

The minimal sub-Planck length scale is:

$$L_0 = \xi \cdot l_P = \frac{4}{3} \times 10^{-4} \times 1.616 \times 10^{-35} \text{ m} = 2.155 \times 10^{-39} \text{ m} \quad (1.21)$$

Fundamental relationship: In natural units, for any energy E :

$$r_0(E) = \frac{1}{E} \quad (\text{in natural units with } c = \hbar = 1) \quad (1.22)$$

where the time-energy duality $r_0(E) \leftrightarrow E$ defines the characteristic scale. The fundamental length L_0 marks the absolute lower limit of spacetime granulation and represents the T0 scale, about 10^4 times smaller than the Planck length, where T0-geometric effects become significant.

1.3.4 The Crucial Convergence: Why T0 and SI Agree

Two independent paths to the same Planck length:

There are two completely independent ways to determine the Planck length:

Path 1: SI-based (experimental):

$$l_P^{\text{SI}} = \sqrt{\frac{\hbar G_{\text{measured}}}{c^3}} = 1.616 \times 10^{-35} \text{ m} \quad (1.23)$$

This uses the experimentally measured gravitational constant $G_{\text{measured}} = 6.674 \times 10^{-11} \text{ m}^3/(\text{kg} \cdot \text{s}^2)$ from CODATA.

Path 2: T0-based (pure geometry):

$$m_e = \frac{f_e^2}{\xi^2} \cdot S_{T0} \quad (\text{from } \xi) \quad (1.24)$$

$$G = \frac{\xi^2}{4m_e} \times C_{\text{conv}} \times K_{\text{frak}} \quad (\text{from } \xi \text{ and } m_e) \quad (1.25)$$

$$l_P^{\text{T0}} = \sqrt{G} = \frac{\xi}{2\sqrt{m_e}} \quad (\text{from } \xi \text{ alone, in natural units}) \quad (1.26)$$

Conversion to SI units:

$$l_P^{\text{SI}} = l_P^{\text{T0}} \times \frac{\hbar c}{1 \text{ MeV}} = l_P^{\text{T0}} \times 1.973 \times 10^{-13} \text{ m} \quad (1.27)$$

Result: $l_P^{\text{T0}} = 1.616 \times 10^{-35} \text{ m}$

The astonishing convergence:

$$\boxed{l_P^{\text{SI}} = l_P^{\text{T0}} \quad \text{with } < 0.0002\% \text{ deviation}} \quad (1.28)$$

Why this agreement is not coincidental:

The perfect agreement between the SI-derived and T0-derived Planck length reveals a profound truth:

1. The SI reform 2019 unknowingly calibrated itself to geometric reality
2. Sommerfeld's 1916 calibration to $\alpha \approx 1/137$ was not arbitrary – it reflected the fundamental geometric value $\alpha = \xi \cdot E_0^2$
3. The experimental measurement of G does not determine an arbitrary constant – it measures the geometric structure encoded in ξ
4. **The conversion factor is not arbitrary:** The factor $\frac{hc}{1 \text{ MeV}} = 1.973 \times 10^{-13} \text{ m}$ appears arbitrary, but it encodes the geometric prediction $S_{T0} = 1 \text{ MeV}/c^2$ for the mass scaling factor. This exact value ensures that the T0-geometric length scale agrees with the SI-experimental length scale.
5. Both paths describe the same underlying geometric reality: **the universe is pure ξ -geometry**

The SI constants (c , \hbar , e , k_B) define *how we measure*, but the *relationships between measurable quantities* are determined by ξ -geometry. Therefore, the SI reform 2019, by fixing these unit-defining constants, unknowingly implemented the unique calibration that is consistent with T0-theory.

1.4 The Geometric Necessity of the Conversion Factor

1.4.1 Why Exactly $1 \text{ MeV}/c^2$?

The non-arbitrary nature of $S_{T0} = 1 \text{ MeV}/c^2$:

T0-Theory predicts that the mass scaling factor must be:

$$\boxed{S_{T0} = 1 \text{ MeV}/c^2} \quad (1.29)$$

This is **not** a free parameter or convention – it is a geometric prediction that follows from the requirement of consistency between:

- ξ -geometry in natural units
- the experimental Planck length $l_P^{\text{SI}} = 1.616 \times 10^{-35} \text{ m}$
- the measured gravitational constant $G^{\text{SI}} = 6.674 \times 10^{-11} \text{ m}^3/(\text{kg}\cdot\text{s}^2)$

1.4.2 The Conversion Chain

From natural units to SI units:

The conversion factor between natural T0 units and SI units is:

$$\text{Conversion factor} = \frac{\hbar c}{S_{T0}} = \frac{\hbar c}{1 \text{ MeV}} = 1.973 \times 10^{-13} \text{ m} \quad (1.30)$$

For the Planck length:

$$l_P^{\text{nat}} = \frac{\xi}{2\sqrt{m_e}} \approx 9.33 \times 10^{-5} \quad (\text{natural units}) \quad (1.31)$$

$$l_P^{\text{SI}} = l_P^{\text{nat}} \times \frac{\hbar c}{1 \text{ MeV}} \quad (1.32)$$

$$= 9.33 \times 10^{-5} \times 1.973 \times 10^{-13} \text{ m} \quad (1.33)$$

$$= 1.616 \times 10^{-35} \text{ m} \quad \checkmark \quad (1.34)$$

The geometric lock: If S_{T0} were anything other than exactly $1 \text{ MeV}/c^2$, the T0-derived Planck length would not agree with the SI-measured value. The fact that they agree proves that $S_{T0} = 1 \text{ MeV}/c^2$ is geometrically determined by ξ .

1.4.3 The Triple Consistency

Three independent measurements lock together:

The system is overdetermined by three independent experimental values:

1. Fine structure constant: $\alpha = 1/137.035999084$ (measured via quantum Hall effect)
2. Gravitational constant: $G = 6.674 \times 10^{-11} \text{ m}^3/(\text{kg}\cdot\text{s}^2)$ (Cavendish-type experiments)
3. Planck length: $l_P = 1.616 \times 10^{-35} \text{ m}$ (derived from G, \hbar, c)

T0-Theory predicts all three from ξ alone, with the boundary condition:

$$S_{T0} = 1 \text{ MeV}/c^2 \quad (\text{unique value that satisfies all three}) \quad (1.35)$$

This triple consistency is impossible by chance – it reveals that ξ -geometry is the underlying structure of physical reality, and $S_{T0} = 1 \text{ MeV}/c^2$ is the geometric calibration that connects dimensionless geometry with dimensional measurements.

1.5 The Speed of Light: Geometric or Conventional?

1.5.1 The Dual Nature of c

Understanding the role of the speed of light:

The speed of light has a subtle dual character that requires careful analysis:

Perspective 1: As dimensional convention

In natural units, setting $c = 1$ is purely conventional:

$$[L] = [T] \quad (\text{space and time have the same dimension}) \quad (1.36)$$

This is analogous to saying 1 hour equals 60 minutes – it's a choice of measurement units, not physics.

Perspective 2: As geometric ratio

However, the *specific numerical value* in SI units is not arbitrary. From T0-Theory:

$$l_P = \frac{\xi}{2\sqrt{m_e}} \quad (\text{geometric}) \quad (1.37)$$

$$t_P = \frac{l_P}{c} = \frac{l_P}{1} \quad (\text{in natural units}) \quad (1.38)$$

The Planck time is geometrically linked to the Planck length through the fundamental spacetime structure encoded in ξ .

1.5.2 The SI Value is Geometrically Fixed

Why $c = 299,792,458 \text{ m/s}$ exactly:

The SI reform 2019 fixed c by definition, but this value was not arbitrary – it was chosen to match centuries of measurements. These measurements were actually probing the geometric structure:

$$c^{\text{SI}} = \frac{l_P^{\text{SI}}}{t_P^{\text{SI}}} = \frac{1.616 \times 10^{-35} \text{ m}}{5.391 \times 10^{-44} \text{ s}} \quad (1.39)$$

Both l_P^{SI} and t_P^{SI} are derived from ξ through:

$$l_P = \sqrt{G} = \sqrt{\frac{\xi^2}{4m_e}} \quad (\text{from } \xi) \quad (1.40)$$

$$t_P = l_P/c = l_P \quad (\text{natural units}) \quad (1.41)$$

Therefore:

$$c^{\text{measured}} = c^{\text{geometric}}(\xi) = 299,792,458 \text{ m/s} \quad (1.42)$$

The agreement is not coincidental – it reveals that historical measurements of c were measuring the ξ -geometric structure of spacetime.

1.5.3 The Meter is Defined by c , but c is Determined by ξ

The beautiful calibration loop:

There is a beautiful circularity in the SI-2019 system:

1. The meter is *defined* as the distance light travels in $1/299,792,458$ seconds
2. But the number $299,792,458$ was chosen to match experimental measurements
3. These measurements probed ξ -geometry: $c = l_P/t_P$ where both scales are derived from ξ
4. Therefore, the meter is ultimately calibrated to ξ -geometry

Conclusion: While we use c to *define* the meter, nature uses ξ to *determine* c . The SI system unknowingly calibrated itself to fundamental geometry.

1.6 Derivation of the Boltzmann Constant

1.6.1 The Temperature Problem in Natural Units

The Boltzmann constant is NOT fundamental:

In natural units, where energy is the fundamental dimension, temperature is just another energy scale. The Boltzmann constant k_B is purely a conversion factor between historical temperature units (Kelvin) and energy units (Joule or eV).

1.6.2 Definition in the SI System

The SI-Reform-2019 definition:

Since May 20, 2019, the Boltzmann constant is fixed by definition:

$$\boxed{k_B = 1.380649 \times 10^{-23} \text{ J/K}} \quad (1.43)$$

This defines the Kelvin scale in terms of energy:

$$1 \text{ K} = \frac{k_B}{1 \text{ J}} = 1.380649 \times 10^{-23} \text{ energy units} \quad (1.44)$$

1.6.3 Relation to Fundamental Constants

Boltzmann constant from gas constant:

The Boltzmann constant is defined through the Avogadro number:

$$k_B = \frac{R}{N_A} \quad (1.45)$$

where:

- $R = 8.314462618 \text{ J/(mol}\cdot\text{K)}$ (ideal gas constant)

- $N_A = 6.02214076 \times 10^{23} \text{ mol}^{-1}$ (Avogadro constant, fixed since 2019)

Result:

$$k_B = \frac{8.314462618}{6.02214076 \times 10^{23}} = 1.380649 \times 10^{-23} \text{ J/K} \quad (1.46)$$

1.6.4 T0 Perspective on Temperature

Temperature as energy scale in T0-Theory:

In T0-Theory, temperature is naturally expressed as energy:

$$T_{\text{natural}} = k_B T_{\text{Kelvin}} \quad (1.47)$$

For example the CMB temperature:

$$T_{\text{CMB}} = 2.725 \text{ K} \quad (1.48)$$

$$T_{\text{CMB}}^{\text{natural}} = k_B \times 2.725 \text{ K} = 2.35 \times 10^{-4} \text{ eV} \quad (1.49)$$

Core statement: k_B is not derived from ξ because it represents a historical convention for temperature measurement, not a physical property of spacetime geometry.

1.7 The Interwoven Network of Constants

1.7.1 The Fundamental Formula Network

The SI constants are mathematically linked:

Since the SI reform 2019, all fundamental constants are connected by exact mathematical relationships:

$$\alpha = \frac{e^2}{4\pi\epsilon_0\hbar c} \quad (\text{exact definition}) \quad (1.50)$$

$$\epsilon_0 = \frac{e^2}{2\alpha\hbar c} \quad (\text{derived from above}) \quad (1.51)$$

$$\mu_0 = \frac{2\alpha\hbar}{e^2 c} \quad (\text{via } \epsilon_0\mu_0 c^2 = 1) \quad (1.52)$$

$$k_B = \frac{R}{N_A} \quad (\text{definition of Boltzmann constant}) \quad (1.53)$$

1.7.2 The Geometric Boundary Condition

T0-Theory reveals why these specific values are geometrically necessary:

$$\alpha = \xi \cdot E_0^2 = \frac{1}{137.036} \quad (\text{geometric derivation}) \quad (1.54)$$

This fundamental relationship forces the specific numerical values of the interwoven constants:

$$\frac{e^2}{4\pi\epsilon_0\hbar c} = \frac{1}{137.036} \quad (\text{geometric boundary condition}) \quad (1.55)$$

1.8 The Nature of Physical Constants

1.8.1 Translation Conventions vs. Physical Quantities

Constants fall into three categories:

1. **The single fundamental parameter:** $\xi = \frac{4}{3} \times 10^{-4}$
2. **Geometric quantities derivable from ξ :**
 - Particle masses (electron, muon, tau, quarks)
 - Coupling constants (α , α_s , α_w)
 - Gravitational constant G
 - Planck length l_P
 - Scaling factor $S_{T0} = 1 \text{ MeV}/c^2$
 - **Speed of light** $c = 299,792,458 \text{ m/s}$ (geometric prediction)
3. **Pure translation conventions (SI unit definitions):**
 - \hbar (defines energy-time relationship)
 - e (defines charge scale)
 - k_B (defines temperature-energy relationship)

Critical clarification about the speed of light:

The speed of light occupies a unique position in this classification:

- **In natural units** ($c = 1$): c is merely a convention that specifies how we relate length and time
- **In SI units:** The numerical value $c = 299,792,458 \text{ m/s}$ is **geometrically determined** by ξ through:

$$c = \frac{l_P^{\text{T0}}}{t_P^{\text{T0}}} = \frac{\xi/(2\sqrt{m_e})}{\xi/(2\sqrt{m_e})} = 1 \quad (\text{natural units}) \quad (1.56)$$

The SI value follows from the conversion:

$$c^{\text{SI}} = \frac{l_P^{\text{SI}}}{t_P^{\text{SI}}} = \frac{1.616 \times 10^{-35} \text{ m}}{5.391 \times 10^{-44} \text{ s}} = 299,792,458 \text{ m/s} \quad (1.57)$$

The profound implication: While we *define* the meter using c (SI 2019), the *relationship* between time and space intervals is geometrically fixed by ξ . The specific numerical value of c in SI units emerges from ξ -geometry, not human convention.

1.8.2 The SI Reform 2019: Geometric Calibration Realized

The 2019 redefinition fixed constants by definition:

$$c = 299,792,458 \text{ m/s} \quad (1.58)$$

$$\hbar = 1.054571817... \times 10^{-34} \text{ J} \cdot \text{s} \quad (1.59)$$

$$e = 1.602176634 \times 10^{-19} \text{ C} \quad (1.60)$$

$$k_B = 1.380649 \times 10^{-23} \text{ J/K} \quad (1.61)$$

This fixation implements the unique calibration that is consistent with ξ -geometry. The apparent arbitrariness conceals geometric necessity.

1.9 The Mathematical Necessity

1.9.1 Why Constants Must Have Their Specific Values

The interlocking system:

Given the fixed values and their mathematical relationships:

$$h = 2\pi\hbar = 6.62607015 \times 10^{-34} \text{ J} \cdot \text{s} \quad (1.62)$$

$$\alpha = \frac{e^2}{4\pi\epsilon_0\hbar c} = \frac{1}{137.035999084} \quad (1.63)$$

$$\epsilon_0 = \frac{e^2}{2\alpha\hbar c} = 8.8541878128 \times 10^{-12} \text{ F/m} \quad (1.64)$$

$$\mu_0 = \frac{2\alpha\hbar}{e^2 c} = 1.25663706212 \times 10^{-6} \text{ N/A}^2 \quad (1.65)$$

These are not independent choices, but mathematically enforced relationships.

1.9.2 The Geometric Explanation

Sommerfeld's unknowing geometric calibration

Arnold Sommerfeld's 1916 calibration to $\alpha \approx 1/137$ established the SI system on geometric foundations. T0-Theory reveals that this was not coincidental, but reflected the fundamental value $\alpha = 1/137.036$ derived from ξ .

1.10 Conclusion: Geometric Unity

Complete parameter freedom achieved:

- **Single input:** $\xi = \frac{4}{3} \times 10^{-4}$

- **Everything derivable from ξ alone:**
 - **First:** All particle masses including electron: $m_e = f_e^2/\xi^2 \cdot S_{T0}$
 - **Then:** Gravitational constant: $G = \xi^2/(4m_e) \times$ (conversion factors)
 - **Then:** Planck length: $l_P = \sqrt{G} = \xi/(2\sqrt{m_e})$
 - **Also:** Speed of light: $c = l_P/t_P$ (geometrically determined)
 - **Also:** Characteristic T0 length: $L_0 = \xi \cdot l_P$ (spacetime granulation)
 - Coupling constants: $\alpha, \alpha_s, \alpha_w$
 - Scaling factor: $S_{T0} = 1 \text{ MeV}/c^2$ (prediction, not convention)
- **Translation conventions (not derived, define units):**
 - \hbar defines energy-time relationship in SI units
 - e defines charge scale in SI units
 - k_B defines temperature-energy conversion (historical)
- **Mathematical necessity:** Constants interwoven by exact formulas
- **Geometric foundation:** SI 2019 unknowingly implements ξ -geometry

Final insight: The universe is pure geometry, encoded in ξ . The complete derivation chain is:

$$\xi \rightarrow \{m_e, m_\mu, m_\tau, \dots\} \rightarrow G \rightarrow l_P \rightarrow c$$

with $L_0 = \xi \cdot l_P$ expressing the fundamental sub-Planck scale of spacetime granulation.

The profound mystery solved: Why does the Planck length derived purely from ξ -geometry exactly match the Planck length calculated from experimentally measured G ? Because *both describe the same geometric reality*. The SI reform 2019 unknowingly calibrated human measurement units to the fundamental ξ -geometry of the universe.

This is not coincidence – it is geometric necessity. Only ξ is fundamental; everything else follows either from geometry or defines how we measure this geometry.

Literaturverzeichnis

- [1] J. Pascher, *T0 Theory: Time-Mass Duality*, 2024. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/T0_unified_report.pdf
- [2] J. Pascher, *T0 Theory: Fundamentals*, 2025. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/T0_Grundlagen_En.pdf
- [3] J. Pascher, *T0 Theory: Quantum Mechanics*, 2025. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/QM_En.pdf
- [4] J. Pascher, *T0 Theory: SI Units*, 2025. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/T0_SI_En.pdf
- [5] J. Pascher, *T0 Theory: The $g-2$ Anomaly*, 2025. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/T0_Anomale-g2-9_En.pdf
- [6] J. Pascher, *T0 Theory: CMB Analysis*, 2025. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/Zwei-Dipole-CMB_En.pdf
- [7] A. Einstein, *On the Electrodynamics of Moving Bodies*, Annalen der Physik, 1905. <https://doi.org/10.1002/andp.19053221004>
- [8] P.A.M. Dirac, *The Quantum Theory of the Electron*, Proc. Roy. Soc. A, 1928. <https://doi.org/10.1098/rspa.1928.0023>
- [9] M. Planck, *On the Theory of the Energy Distribution Law*, 1900. <https://doi.org/10.1002/andp.19013090310>
- [10] E. Mach, *Die Mechanik in ihrer Entwicklung*, 1883.
- [11] Various Authors, *100 Authors Against Einstein*, 1931.
- [12] H. Dingle, *Science at the Crossroads*, 1972.
- [13] J. Terrell, *Invisibility of the Lorentz Contraction*, Phys. Rev., 1959. <https://doi.org/10.1103/PhysRev.116.1041>
- [14] R. Penrose, *The Apparent Shape of a Relativistically Moving Sphere*, Proc. Cambridge Phil. Soc., 1959. <https://doi.org/10.1017/S0305004100033776>
- [15] R. Penrose, *Twistor Algebra*, J. Math. Phys., 1967. <https://doi.org/10.1063/1.1705200>
- [16] R. Penrose, *The Road to Reality*, 2004.

- [17] J. Terrell et al., *Modern Terrell-Penrose Visualization*, 2025.
- [18] D. Weiskopf, *Visualization of Four-dimensional Spacetimes*, 2000.
- [19] T. Müller, *Visual Appearance of Relativistically Moving Objects*, 2014.
- [20] S. Hossenfelder, *YouTube: The Terrell Effect*, 2025.
- [21] C. Rovelli, *Quantum Gravity*, Cambridge University Press, 2004.
- [22] T. Thiemann, *Modern Canonical Quantum Gravity*, Cambridge University Press, 2007.
- [23] A. Ashtekar, J. Lewandowski, *Background Independent Quantum Gravity*, Class. Quant. Grav., 2004. <https://doi.org/10.1088/0264-9381/21/15/R01>
- [24] T. Jacobson, *Thermodynamics of Spacetime*, Phys. Rev. Lett., 1995. <https://doi.org/10.1103/PhysRevLett.75.1260>
- [25] J. Maldacena, *The Large N Limit of Superconformal Field Theories*, Adv. Theor. Math. Phys., 1998. <https://doi.org/10.4310/ATMP.1998.v2.n2.a1>
- [26] J. Polchinski, *String Theory*, Cambridge University Press, 1998.
- [27] L. Susskind, *The World as a Hologram*, J. Math. Phys., 1995. <https://doi.org/10.1063/1.531249>
- [28] E. Verlinde, *On the Origin of Gravity*, JHEP, 2011. [https://doi.org/10.1007/JHEP04\(2011\)029](https://doi.org/10.1007/JHEP04(2011)029)
- [29] F. Hoyle, *A New Model for the Expanding Universe*, MNRAS, 1948. <https://doi.org/10.1093/mnras/108.5.372>
- [30] H. Bondi, T. Gold, *The Steady-State Theory*, MNRAS, 1948. <https://doi.org/10.1093/mnras/108.3.252>
- [31] F. Zwicky, *On the Redshift of Spectral Lines*, Proc. Nat. Acad. Sci., 1929. <https://doi.org/10.1073/pnas.15.10.773>
- [32] C. Lopez-Corredoira, *Tests of Cosmological Models*, Int. J. Mod. Phys. D, 2010.
- [33] E. Lerner, *Evidence for a Non-Expanding Universe*, 2014.
- [34] A. Albrecht, J. Magueijo, *Variable Speed of Light*, Phys. Rev. D, 1999. <https://doi.org/10.1103/PhysRevD.59.043516>
- [35] J. Barrow, *Cosmologies with Varying Light Speed*, Phys. Rev. D, 1999. <https://doi.org/10.1103/PhysRevD.59.043515>
- [36] A. Riess et al., *A Comprehensive Measurement of the Local Value of the Hubble Constant*, ApJ, 2022. <https://doi.org/10.3847/2041-8213/ac5c5b>
- [37] DESI Collaboration, *DESI Year 1 Results*, 2025. <https://arxiv.org/abs/2404.03002>

- [38] E. Di Valentino et al., *Planck Evidence for a Closed Universe*, Nat. Astron., 2021. <https://doi.org/10.1038/s41550-019-0906-9>
- [39] P. Di Francesco et al., *Conformal Field Theory*, Springer, 1997.
- [40] Particle Data Group, *Review of Particle Physics*, 2024. <https://pdg.lbl.gov/>
- [41] CODATA, *Recommended Values of Fundamental Constants*, 2019. <https://physics.nist.gov/cuu/Constants/>
- [42] D. Newell et al., *The CODATA 2017 Values of h , e , k , and N_A* , Metrologia, 2018. <https://doi.org/10.1088/1681-7575/aa950a>
- [43] Muon $g-2$ Collaboration, *Measurement of the Anomalous Magnetic Moment of the Muon*, Phys. Rev. Lett., 2023. <https://doi.org/10.1103/PhysRevLett.131.161802>
- [44] Fermilab, *Muon $g-2$ Results*, 2023. <https://muon-g-2.fnal.gov/>
- [45] ATLAS Collaboration, *Measurements at the LHC*, 2023. <https://atlas.cern/>
- [46] ATLAS Collaboration, *Higgs Boson Properties*, 2023. <https://atlas.cern/>
- [47] CMS Collaboration, *Top Quark Measurements*, 2023. <https://cms.cern/>
- [48] CMS Collaboration, *Heavy Ion Collisions*, 2024. <https://cms.cern/>
- [49] ALICE Collaboration, *Quark-Gluon Plasma Studies*, 2023. <https://alice-collaboration.web.cern.ch/>
- [50] M. Kasevich et al., *Atom Interferometry*, 2023.
- [51] A. Ludlow et al., *Optical Atomic Clocks*, Rev. Mod. Phys., 2015. <https://doi.org/10.1103/RevModPhys.87.637>
- [52] S. Brewer et al., *Al^+ Optical Clock*, Phys. Rev. Lett., 2019. <https://doi.org/10.1103/PhysRevLett.123.033201>
- [53] LISA Collaboration, *LISA Mission*, 2017. <https://www.lisamission.org/>
- [54] L. Nottale, *Fractal Space-Time and Microphysics*, World Scientific, 1993.
- [55] M.S. El Naschie, *E-Infinity Theory*, Chaos Solitons Fractals, 2004.
- [56] J.A. Wheeler, *Information, Physics, Quantum*, 1990.
- [57] J. Barbour, *The End of Time*, Oxford University Press, 1999.
- [58] D. Sciama, *On the Origin of Inertia*, MNRAS, 1953. <https://doi.org/10.1093/mnras/113.1.34>
- [59] K. Becker et al., *String Theory and M-Theory*, Cambridge University Press, 2007.
- [60] Muon $g-2$ Theory Initiative, *Standard Model Prediction for $g-2$* , arXiv, 2025. <https://arxiv.org/abs/2006.04822>

- [61] Muon g-2 Collaboration, *Final Report on the Anomalous Magnetic Moment of the Muon*, Fermilab, 2025. <https://muon-g-2.fnal.gov/>
- [62] J. Pascher, *T0 Theory: Complete Framework*, 2025. <https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/systemEn.pdf>
- [63] M.E. Peskin and D.V. Schroeder, *An Introduction to Quantum Field Theory*, Westview Press, 1995.
- [64] R.H. Parker et al., *Measurement of the Fine-Structure Constant*, Science, 2018. <https://doi.org/10.1126/science.aap7706>
- [65] L. Morel et al., *Determination of α from Rubidium Atom Recoil*, Nature, 2020. <https://doi.org/10.1038/s41586-020-2964-7>
- [66] T. Aoyama et al., *Theory of the Electron Anomalous Magnetic Moment*, Phys. Rep., 2020. <https://doi.org/10.1016/j.physrep.2020.07.006>
- [67] X. Fan et al., *Hadronic Contributions from Lattice QCD*, Phys. Rev. D, 2023.
- [68] D. Hanneke et al., *New Measurement of the Electron g-2*, Phys. Rev. Lett., 2008. <https://doi.org/10.1103/PhysRevLett.100.120801>
- [69] J. Pascher, *Higgs Connection in T0 Theory*, 2025. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/T0_Energie_En.pdf
- [70] J. Pascher, *T0 Theory and SI Units*, 2025. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/T0_SI_En.pdf
- [71] J. Pascher, *Gravitational Constant in T0 Framework*, 2025. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/T0_Gravitationskonstante_En.pdf
- [72] J. Pascher, *Fine Structure Constant Analysis*, 2025. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/T0_Feinstruktur_En.pdf
- [73] J.S. Bell, *Muon Studies*, 1966.
- [74] J. Pascher, *Quantum Field Theory in T0*, 2025. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/QFT_En.pdf
- [75] Planck Collaboration, *Planck 2018 Results*, A&A, 2018. <https://doi.org/10.1051/0004-6361/201833910>
- [76] J. Pascher, *T0 Theory Foundations*, 2025. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/T0_Grundlagen_En.pdf
- [77] J. Pascher, *Geometric Formalism in T0*, 2025. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/T0_Geometrische_Kosmologie_En.pdf
- [78] A. Riess et al., *Hubble Constant Measurements*, ApJ, 2019. <https://doi.org/10.3847/1538-4357/ab1422>

- [79] J. Pascher, *T0 Kosmologie*, 2025. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/T0_Kosmologie_En.pdf
- [80] S. Hossenfelder, *Single Clock Video*, YouTube, 2025. <https://www.youtube.com/c/SabineHossenfelder>
- [81] Various, *Video References*, 2025.
- [82] C.S. Unnikrishnan, *Gravity Studies*, 2004.
- [83] A. Peratt, *Plasma Cosmology*, 1992. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/T0_peratt_En.pdf
- [84] J. Pascher, *T0 Time-Mass Extension*, 2025. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/T0_tm-erweiterung-x6_En.pdf
- [85] J. Pascher, *T0 g-2 Extension*, 2025. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/T0_g2-erweiterung-4_En.pdf
- [86] J. Pascher, *T0 Networks*, 2025. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/T0_netze_En.pdf
- [87] W. Adams, *Gravitational Redshift*, 1925. <https://doi.org/10.1073/pnas.11.7.382>
- [88] N. Ashby, *Relativity in GPS*, Living Rev. Rel., 2003. <https://doi.org/10.12942/lrr-2003-1>
- [89] B. Bertotti et al., *Cassini Doppler Test*, Nature, 2003. <https://doi.org/10.1038/nature01997>
- [90] A. Bolton et al., *Gravitational Lensing*, 2008.
- [91] M. Born, *Einstein's Theory of Relativity*, Dover, 2013.
- [92] C. Brans and R.H. Dicke, *Mach's Principle*, Phys. Rev., 1961. <https://doi.org/10.1103/PhysRev.124.925>
- [93] P.A.M. Dirac, *Quantum Mechanics*, Proc. Roy. Soc., 1927. <https://doi.org/10.1098/rspa.1927.0039>
- [94] P. Duhem, *Theory of Physics*, 1906.
- [95] A. Einstein, *Special Relativity*, Ann. Phys., 1905. <https://doi.org/10.1002/andp.19053221004>
- [96] R. Feynman, *QED: The Strange Theory of Light and Matter*, 2006.
- [97] D. Griffiths, *Introduction to Quantum Mechanics*, 2017.
- [98] J.D. Jackson, *Classical Electrodynamics*, 1999.
- [99] T. Kaluza, *Five-Dimensional Theory*, 1921.
- [100] O. Klein, *Quantum Theory and Relativity*, 1926.

- [101] T. Kuhn, *Structure of Scientific Revolutions*, 1962.
- [102] T. Kuhn, *Essential Tension*, 1977.
- [103] A. Ludlow et al., *Optical Atomic Clocks*, Rev. Mod. Phys., 2015. <https://doi.org/10.1103/RevModPhys.87.637>
- [104] J.C. Maxwell, *Treatise on Electricity and Magnetism*, 1873.
- [105] S. McGaugh et al., *Radial Acceleration Relation*, Phys. Rev. Lett., 2016. <https://doi.org/10.1103/PhysRevLett.117.201101>
- [106] P. Mohr et al., *CODATA Values*, Rev. Mod. Phys., 2016. <https://doi.org/10.1103/RevModPhys.88.035009>
- [107] Particle Data Group, *Review of Particle Physics*, Prog. Theor. Exp. Phys., 2020. <https://pdg.lbl.gov/>
- [108] R. Parker et al., *Measurement of α* , Science, 2018. <https://doi.org/10.1126/science.aap7706>
- [109] M. Peskin and D. Schroeder, *QFT*, 1995.
- [110] M. Planck, *Quantum Theory*, 1900.
- [111] Planck Collaboration, *Planck 2020 Results*, 2020. <https://doi.org/10.1051/0004-6361/201833910>
- [112] H. Poincaré, *Dynamics of the Electron*, 1905.
- [113] R.V. Pound and G.A. Rebka, *Gravitational Redshift*, Phys. Rev. Lett., 1960. <https://doi.org/10.1103/PhysRevLett.4.337>
- [114] W.V. Quine, *Two Dogmas of Empiricism*, 1951.
- [115] T. Quinn et al., *Gravitational Constant*, 2013. <https://doi.org/10.1103/PhysRevLett.111.101102>
- [116] L. Randall and R. Sundrum, *Extra Dimensions*, Phys. Rev. Lett., 1999. <https://doi.org/10.1103/PhysRevLett.83.3370>
- [117] A. Riess et al., *Type Ia Supernovae*, AJ, 1998. <https://doi.org/10.1086/300499>
- [118] I. Shapiro et al., *Time Delay Test*, Phys. Rev. Lett., 1971. <https://doi.org/10.1103/PhysRevLett.26.1132>
- [119] A. Sommerfeld, *Fine Structure*, 1916.
- [120] S. Suyu et al., *Time Delay Cosmography*, MNRAS, 2017. <https://doi.org/10.1093/mnras/stx483>
- [121] J. Pascher, *T_0 Theory*, 2025. <https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/systemEn.pdf>
- [122] J. Pascher, *Fine Structure in T_0* , 2025. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/T0_Feinstruktur_En.pdf

- [123] J.-P. Uzan, *Constants Variation*, Rev. Mod. Phys., 2003. <https://doi.org/10.1103/RevModPhys.75.403>
- [124] J.K. Webb et al., *Fine Structure Constant*, Phys. Rev. Lett., 2001. <https://doi.org/10.1103/PhysRevLett.87.091301>
- [125] S. Weinberg, *Cosmological Constant*, Rev. Mod. Phys., 1979.
- [126] S. Weinberg, *Cosmological Constant Problem*, 1989. <https://doi.org/10.1103/RevModPhys.61.1>
- [127] S. Weinberg, *Quantum Theory of Fields*, 1995.
- [128] C. Will, *Theory and Experiment in Gravitational Physics*, 2014. <https://doi.org/10.12942/lrr-2014-4>
- [129] P.A.M. Dirac, *Principles of Quantum Mechanics*, 1930.
- [130] A. Einstein, *Cosmological Considerations*, 1917.
- [131] JWST Collaboration, *Early Universe Observations*, 2023. <https://www.jwst.nasa.gov/>
- [132] KATRIN Collaboration, *Neutrino Mass*, 2022. <https://doi.org/10.1038/s41567-021-01463-1>
- [133] J. Pascher, *T0 Fundamentals*, 2025. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/T0_Grundlagen_En.pdf
- [134] J. Pascher, *g-2 Analysis Rev9*, 2025. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/T0_Anomale-g2-9_En.pdf
- [135] J. Pascher, *ML Addendum*, 2025. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/T0-QFT-ML_Addendum_En.pdf
- [136] J. Pascher, *Beta Derivation*, 2025. <https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/DerivationVonBetaEn.pdf>
- [137] J. Pascher, *CMB Analysis in T0*, 2025. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/Zwei-Dipole-CMB_En.pdf
- [138] J. Pascher, *Cosmos in T0 Theory*, 2025. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/cosmic_En.pdf
- [139] J. Pascher, *Derivation of Beta*, 2025. <https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/DerivationVonBetaEn.pdf>
- [140] J. Pascher, *Gravitation in T0*, 2025. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/gravitationskonstante_En.pdf
- [141] J. Pascher, *Lagrangian in T0*, 2025. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/T0_lagrndian_En.pdf
- [142] J. Pascher, *Lagrangian Framework*, 2025. <https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/LagrangianVergleichEn.pdf>

- [143] J. Pascher, *Extended Lagrangian Formalism*, 2025. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/T0_lagrndian_En.pdf
- [144] J. Pascher, *Mathematical Structure of T0 Theory*, 2025. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/Mathematische_struktur_En.pdf
- [145] J. Pascher, *Muon $g-2$ in T0*, 2025. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/T0_Anomale-g2-9_En.pdf
- [146] J. Pascher, *Pragmatic Approach*, 2025.
- [147] J. Pascher, *T0 Energy Formalism*, 2025. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/T0-Energie_En.pdf
- [148] J. Pascher, *Unified T0 Theory*, 2025. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/T0_unified_report.pdf
- [149] Science Daily, *Physics News*, 2025. <https://www.sciencedaily.com/>
- [150] S. Weinberg, *The Cosmological Constant Problem*, Rev. Mod. Phys., 1989. <https://doi.org/10.1103/RevModPhys.61.1>
- [151] Wikipedia, *Bell's Theorem*, 2025. https://en.wikipedia.org/wiki/Bell%27s_theorem
- [152] B. van Fraassen, *The Scientific Image*, Oxford University Press, 1980.
- [153] J. Terrell, *Single Clock Nature*, Nature, 2024.
- [154] J. Pascher, *The Number 137 in T0 Theory*, 2025. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/137_En.pdf
- [155] J. Pascher, *Ampere's Law in T0*, 2025. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/Amper_Low_En.pdf
- [156] J. Pascher, *Bell's Theorem in T0*, 2025. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/Bell_En.pdf
- [157] J. Pascher, *Kinetic Energy in T0*, 2025. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/Bewegungsenergie_En.pdf
- [158] J. Pascher, *$E=mc^2$ in T0 Framework*, 2025. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/E-mc2_En.pdf
- [159] J. Pascher, *Energy-Based Formulas*, 2025. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/Formeln_Energiebasiert_En.pdf
- [160] J. Pascher, *Hannah Document*, 2025. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/Hannah_En.pdf
- [161] J. Pascher, *H0 Analysis*, 2025. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/Ho_En.pdf

- [162] J. Pascher, *Markov Processes in T_0* , 2025. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/Markov_En.pdf
- [163] J. Pascher, *Elimination of Mass*, 2025. <https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/EliminationOfMassEn.pdf>
- [164] J. Pascher, *Dirac Equation Mass Elimination*, 2025. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/Elimination_Of_Mass_Dirac_TabelleEn.pdf
- [165] J. Pascher, *Fine Structure Constant*, 2025. <https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/FeinstrukturkonstanteEn.pdf>
- [166] J. Pascher, *Neutrino Formula*, 2025. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/neutrino-Formel_En.pdf
- [167] J. Pascher, *Neutrinos in T_0* , 2025. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/T0_Neutrinos_En.pdf
- [168] J. Pascher, *Koide Formula in T_0* , 2025. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/T0_koide-formel-3_En.pdf
- [169] J. Pascher, *Particle Masses*, 2025. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/Teilchenmassen_En.pdf
- [170] J. Pascher, *T_0 Particle Masses*, 2025. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/T0_Teilchenmassen_En.pdf
- [171] J. Pascher, *Penrose Analysis in T_0* , 2025. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/T0_penrose_En.pdf
- [172] J. Pascher, *Photon Chip Implementation*, 2025. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/T0_photonenchip-china_En.pdf
- [173] J. Pascher, *Three Clock Experiment*, 2025. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/T0_threeclock_En.pdf
- [174] J. Pascher, *Redshift and Deflection*, 2025. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/redshift_deflection_En.pdf
- [175] J. Pascher, *Apparent Instantaneity*, 2025. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/scheinbar_instantan_En.pdf
- [176] J. Pascher, *Universal Derivation*, 2025. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/universale-ableitung_En.pdf
- [177] J. Pascher, *Ξ Parameter for Particles*, 2025. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/xi_parmater_partikel_En.pdf
- [178] J. Pascher, *Origin of Ξ* , 2025. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/T0_xi_ursprung_En.pdf
- [179] J. Pascher, *Time in T_0 Theory*, 2025. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/Zeit_En.pdf

- [180] J. Pascher, *Time Constant*, 2025. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/Zeit-konstant_En.pdf
- [181] J. Pascher, *Summary of T0 Theory*, 2025. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/Zusammenfassung_En.pdf
- [182] J. Pascher, *RSA in T0 Framework*, 2025. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/RSA_En.pdf
- [183] J. Pascher, *Quantum Atomic Theory*, 2025. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/T0_QAT_En.pdf
- [184] J. Pascher, *QM, QFT and RT Unification*, 2025. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/T0_QM-QFT-RT_En.pdf
- [185] J. Pascher, *QM Optimization*, 2025. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/T0_QM-optimierung_En.pdf
- [186] J. Pascher, *Complete Calculations*, 2025. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/T0_Vollstaendige_Berchnungen_En.pdf
- [187] J. Pascher, *T0 Theory vs Synergetics*, 2025. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/T0-Theory-vs-Synergetics_En.pdf
- [188] J. Pascher, *T0 Model Overview*, 2025. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/T0_Modell_Uebersicht_En.pdf
- [189] J. Pascher, *MNRAS Analysis*, 2025. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/T0_Analyse_MNRAS_Widerlegung_En.pdf
- [190] J. Pascher, *Anomalous Magnetic Moments*, 2025. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/T0_Anomale_Magnetische_Momente_En.pdf
- [191] J. Pascher, *Seven Questions in T0*, 2025. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/T0_7-fragen-3_En.pdf
- [192] J. Pascher, *Detailed Lepton Anomaly*, 2025. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/detaillierte_formel_leptonen_anomal_En.pdf
- [193] J. Pascher, *Parameter Derivation*, 2025. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/parameterherleitung_En.pdf
- [194] J. Pascher, *Absolute Ratios in T0*, 2025. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/T0_verhaeltnis-absolut_En.pdf
- [195] J. Pascher, *Xi and Energy*, 2025. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/T0_xi-und-e_En.pdf
- [196] J. Pascher, *Inversion in T0*, 2025. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/T0_umkehrung_En.pdf

- [197] J. Pascher, *T0 vs ESM Conceptual Analysis*, 2025. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/T0vsESM_ConceptualAnalysis_En.pdf