

# Introduction to the T0-Theory

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[T0-Theory: Fundamental Principles]T0-Theory: Fundamental Principles

## Abstract

This document introduces the fundamental principles of the T0-Theory, a geometric reformulation of physics based on a single universal parameter  $\xi = \frac{4}{3} \times 10^{-4}$ . The theory demonstrates how all fundamental constants and particle masses can be derived from the three-dimensional space geometry. Various interpretive approaches—harmonic, geometric, and field-theoretic—are presented on an equal footing. The fractal structure of quantum spacetime is systematically accounted for by the correction factor = 0.986.

## 1 Introduction to the T0-Theory

### 1.1 Time-Mass Duality

In natural units ( $\hbar = c = 1$ ), the fundamental relation holds:

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

Time and mass are dual to each other: Heavy particles have short characteristic time scales, light particles long ones.

This duality is not merely a mathematical relation but reflects a fundamental property of spacetime. It explains why heavy particles couple more strongly to the temporal structure of spacetime.

### 1.2 The Central Hypothesis

The T0-Theory is based on the revolutionary hypothesis that all physical phenomena can be derived from the geometric structure of three-dimensional space. At its center is a single universal parameter:

## Foundation

### The Fundamental Geometric Parameter:

$$\xi = \frac{4}{3} \times 10^{-4} = 1.333333 \dots \times 10^{-4} \tag{2}$$

This parameter is dimensionless and contains all the information about the physical structure of the universe.

### 1.3 Paradigm Shift Compared to the Standard Model

Aspect	Standard Model	T0-Theory
Free Parameters	> 20	1
Theoretical Basis	Empirical Adjustment	Geometric Derivation
Particle Masses	Arbitrary	Computable from Quantum Numbers
Constants	Experimentally Determined	Geometrically Derived
Unification	Separate Theories	Unified Framework

Table 1: Comparison between Standard Model and T0-Theory

## 2 The Geometric Parameter

### 2.1 Mathematical Structure

The parameter  $\xi$  consists of two fundamental components:

$$\xi = \underbrace{\frac{4}{3}}_{\text{Harmonic-geometric}} \times \underbrace{10^{-4}}_{\text{Scale Hierarchy}} \quad (3)$$

### 2.2 The Harmonic-Geometric Component: $4/3$

#### Alternative

#### Harmonic Interpretation:

The factor  $\frac{4}{3}$  corresponds to the **perfect fourth**, one of the fundamental harmonic intervals:

- **Octave:** 2:1 (always universal)
- **Fifth:** 3:2 (always universal)
- **Fourth:** 4:3 (always universal!)

These ratios are **geometric/mathematical**, not material-dependent. Space itself has a harmonic structure, and  $4/3$  (the fourth) is its fundamental signature.

#### Alternative

#### Geometric Interpretation:

The factor  $\frac{4}{3}$  arises from the tetrahedral packing structure of three-dimensional space:

- **Tetrahedron Volume:**  $V = \frac{\sqrt{2}}{12}a^3$

- **Sphere Volume:**  $V = \frac{4\pi}{3}r^3$
- **Packing Density:**  $\eta = \frac{\pi}{3\sqrt{2}} \approx 0.74$
- **Geometric Ratio:**  $\frac{4}{3}$  from optimal space division

## 2.3 The Scale Hierarchy:

### Foundation

#### Quantum Field Theoretic Derivation of $10^{-4}$ :

The factor  $10^{-4}$  arises from the combination of:

#### 1. Loop Suppression (Quantum Field Theory):

$$\frac{1}{16\pi^3} = 2.01 \times 10^{-3} \quad (4)$$

#### 2. T0-Higgs Parameter:

$$(\lambda_h^{(T0)})^2 \frac{(v^{(T0)})^2}{(m_h^{(T0)})^2} = 0.0647 \quad (5)$$

#### 3. Complete Calculation:

$$2.01 \times 10^{-3} \times 0.0647 = 1.30 \times 10^{-4} \quad (6)$$

Thus: **QFT Loop Suppression** ( $\sim 10^{-3}$ )  $\times$  **T0 Higgs Sector** ( $\sim 10^{-1}$ ) =  $10^{-4}$

## 3 Fractal Spacetime Structure

### 3.1 Quantum Spacetime Effects

The T0-Theory recognizes that spacetime exhibits a fractal structure on Planck scales due to quantum fluctuations:

### Key Result

#### Fractal Spacetime Parameters:

$$= 2.94 \quad (\text{effective fractal dimension}) \quad (7)$$

$$= 1 - \frac{-2}{68} = 1 - \frac{0.94}{68} = 0.986 \quad (8)$$

## Physical Interpretation:

- $< 3$ : Spacetime is “porous” on smallest scales
- $= 0.986 < 1$ : Reduced effective interaction strength
- The constant 68 arises from the tetrahedral symmetry of 3D space
- Quantum fluctuations and vacuum structure effects

### 3.2 Origin of the Constant 68

## Alternative

## Tetrahedron Geometry:

All tetrahedron combinations yield 72:

$$6 \times 12 = 72 \quad (\text{edges} \times \text{rotations}) \quad (9)$$

$$4 \times 18 = 72 \quad (\text{faces} \times 18) \quad (10)$$

$$24 \times 3 = 72 \quad (\text{symmetries} \times \text{dimensions}) \quad (11)$$

The value  $68 = 72 - 4$  accounts for the 4 vertices of the tetrahedron as exceptions.

## 4 Characteristic Energy Scales

### 4.1 The T0 Energy Hierarchy

From the parameter  $\xi$ , natural energy scales emerge:

$$(E_0)_\xi = \frac{1}{\xi} = 7500 \quad (\text{in natural units}) \quad (12)$$

$$(E_0)_{\text{EM}} = 7.398 \text{ MeV} \quad (\text{characteristic EM energy}) \quad (13)$$

$$(E_0)_{\text{char}} = 28.4 \quad (\text{characteristic T0 energy}) \quad (14)$$

### 4.2 The Characteristic Electromagnetic Energy

## Key Result

## Gravitational-Geometric Derivation of $E_0$ :

The characteristic energy follows from the coupling relation:

$$E_0^2 = \frac{4\sqrt{2} \cdot m_\mu}{\xi^4} \quad (15)$$

This yields  $E_0 = 7.398 \text{ MeV}$  as the fundamental electromagnetic energy scale.

## Alternative

### Geometric Mean of Lepton Masses:

Alternatively,  $E_0$  can be defined as the geometric mean:

$$E_0 = \sqrt{m_e \cdot m_\mu} = 7.35 \text{ MeV} \quad (16)$$

The difference from 7.398 MeV ( $< 1\%$ ) is explainable by quantum corrections.

## 5 Dimensional Analytic Foundations

### 5.1 Natural Units

The T0-Theory works in natural units, where:

$$\hbar = c = 1 \quad (\text{convention}) \quad (17)$$

In this system, all quantities have energy dimension or are dimensionless:

$$[M] = [E] \quad (\text{from } E = mc^2 \text{ with } c = 1) \quad (18)$$

$$[L] = [E^{-1}] \quad (\text{from } \lambda = \hbar/p \text{ with } \hbar = 1) \quad (19)$$

$$[T] = [E^{-1}] \quad (\text{from } \omega = E/\hbar \text{ with } \hbar = 1) \quad (20)$$

### 5.2 Conversion Factors

#### Warning

### Critical Importance of Conversion Factors:

For experimental comparison, conversion factors from natural to SI units are essential:

- These are **not** arbitrary but follow from fundamental constants
- They encode the connection between geometric theory and measurable quantities
- Example:  $C_{\text{conv}} = 7.783 \times 10^{-3}$  for the gravitational constant  $G$  in  $\text{m}^3 \text{kg}^{-3} \text{s}^{-2}$

## 6 The Universal T0 Formula Structure

### 6.1 Basic Pattern of T0 Relations

All T0 formulas follow the universal pattern:

$$\boxed{\text{Physical Quantity} = f(\xi, \text{Quantum Numbers}) \times \text{Conversion Factor}} \quad (21)$$

where:

- $f(\xi, \text{Quantum Numbers})$  encodes the geometric relation
- Quantum numbers  $(n, l, j)$  determine the specific configuration
- Conversion factors establish the connection to SI units

## 6.2 Examples of the Universal Structure

$$\text{Gravitational Constant: } G = \frac{\xi^2}{4m_e} \times C_{\text{conv}} \times \quad (22)$$

$$\text{Particle Masses: } m_i = \frac{1}{\xi \cdot f(n_i, l_i, j_i)} \times C_{\text{conv}} \quad (23)$$

$$\text{Fine Structure Constant: } \alpha = \xi \times \left( \frac{E_0}{1 \text{ MeV}} \right)^2 \quad (24)$$

# 7 Various Levels of Interpretation

## 7.1 Hierarchy of Levels of Understanding

### Foundation

The T0-Theory can be understood on various levels:

### 1. Phenomenological Level:

- Empirical Observation: One constant explains everything
- Practical Application: Prediction of new values

### 2. Geometric Level:

- Space structure determines physical properties
- Tetrahedral packing as basic principle

### 3. Harmonic Level:

- Spacetime as a harmonic system
- Particles as “tones” in cosmic harmony

### 4. Quantum Field Theoretic Level:

- Loop suppressions and Higgs mechanism
- Fractal corrections as quantum effects

## 7.2 Complementary Perspectives

### Alternative

### Reductionist vs. Holistic Perspective:

#### Reductionist:

- $\xi$  as an empirical parameter that “accidentally” works
- Geometric interpretations as added post hoc

#### Holistic:

- Space-Time-Matter as inseparable unity
- $\xi$  as expression of a deeper cosmic order

## 8 Basic Calculation Methods

### 8.1 Direct Geometric Method

The simplest application of the T0-Theory uses direct geometric relations:

$$\text{Physical Quantity} = \text{Geometric Factor} \times \xi^n \times \text{Normalization} \quad (25)$$

where the exponent  $n$  follows from dimensional analysis and the geometric factor contains rational numbers like  $\frac{4}{3}$ ,  $\frac{16}{5}$ , etc.

### 8.2 Extended Yukawa Method

For particle masses, the Higgs mechanism is additionally considered:

$$m_i = y_i \cdot v \quad (26)$$

where the Yukawa couplings  $y_i$  are geometrically calculated from the T0 structure:

$$y_i = r_i \times \xi^{p_i} \quad (27)$$

The parameters  $r_i$  and  $p_i$  are exact rational numbers that follow from the quantum number assignment of the T0 geometry.

## 9 Philosophical Implications

### 9.1 The Problem of Naturalness

#### Foundation

#### Why is the Universe Mathematically Describable?

The T0-Theory offers a possible answer: The universe is mathematically describable because it is **itself** mathematically structured. The parameter  $\xi$  is not just a description of nature—it **is** nature.

- **Platonic Perspective:** Mathematical structures are fundamental
- **Pythagorean Perspective:** “Everything is number and harmony”
- **Modern Interpretation:** Geometry as the basis of physics

### 9.2 The Anthropic Principle

#### Alternative

#### Weak vs. Strong Anthropic Principle:

#### Weak (observation-dependent):

- We observe  $\xi = \frac{4}{3} \times 10^{-4}$  because only in such a universe can observers exist
- Multiverse with different  $\xi$  values

#### Strong (principled):

- $\xi$  has this value **because** it follows from the logic of spacetime
- Only this value is mathematically consistent

## 10 Experimental Confirmation

### 10.1 Successful Predictions

The T0-Theory has already passed several experimental tests.

## 10.2 Testable Predictions

### Key Result

The theory makes specific, falsifiable predictions:

1. Neutrino Mass:  $m_\nu = 4,54$  meV (geometric prediction)
2. Tau Anomaly:  $\Delta a_\tau = 7,1 \times 10^{-9}$  (not yet measurable)
3. Modified Gravity at Characteristic T0 Length Scales
4. Alternative Cosmological Parameters without Dark Energy

## 11 Summary and Outlook

### 11.1 The Central Insights

#### Foundation

#### Fundamental T0 Principles:

1. **Geometric Unity:** One parameter  $\xi = \frac{4}{3} \times 10^{-4}$  determines all physics
2. **Fractal Structure:** Quantum spacetime with  $D_f = 2.94$  and  $K_{\text{frak}} = 0.986$
3. **Harmonic Order:**  $4/3$  as fundamental harmonic ratio
4. **Hierarchical Scales:** From Planck to cosmological dimensions
5. **Experimental Testability:** Concrete, falsifiable predictions

### 11.2 The Next Steps

This first document of the T0 Series has established the fundamental principles. The following documents will deepen these foundations in specific applications.

## 12 Structure of the T0 Document Series

This foundational document forms the starting point for a systematic presentation of the T0-Theory. The following documents deepen specific aspects:

- **T0\_FineStructure\_En.tex:** Mathematical Derivation of the Fine Structure Constant
- **T0\_GravitationalConstant\_En.tex:** Detailed Calculation of Gravity
- **T0\_ParticleMasses\_En.tex:** Systematic Mass Calculation of All Fermions
- **T0\_Neutrinos\_En.tex:** Special Treatment of Neutrino Physics

- **T0\_AnomalousMagneticMoments\_En.tex**: Solution to the Muon g-2 Anomaly
- **T0\_Cosmology\_En.tex**: Cosmological Applications of the T0-Theory
- **T0\_QM-QFT-RT\_En.tex**: Complete Quantum Field Theory in the T0 Framework with Quantum Mechanics and Quantum Computing Applications

Each document builds on the principles established here and demonstrates their application in a specific area of physics.

## 13 References

### 13.1 Fundamental T0 Documents

1. Pascher, J. (2025). *T0-Theory: Derivation of the Gravitational Constant*. Technical Documentation.
2. Pascher, J. (2025). *T0-Model: Parameter-Free Particle Mass Calculation with Fractal Corrections*. Scientific Treatise.
3. Pascher, J. (2025). *T0-Model: Unified Neutrino Formula Structure*. Special Analysis.

### 13.2 Related Works

1. Einstein, A. (1915). *The Field Equations of Gravitation*. Proceedings of the Royal Prussian Academy of Sciences.
2. Planck, M. (1900). *On the Theory of the Law of Energy Distribution in the Normal Spectrum*. Proceedings of the German Physical Society.
3. Wheeler, J.A. (1989). *Information, Physics, Quantum: The Search for Links*. Proceedings of the 3rd International Symposium on Foundations of Quantum Mechanics.

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*This document is part of the new T0 Series  
and replaces the older, inconsistent presentations*

**T0-Theory:                      Time-Mass                      Duality                      Framework**

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## References

- [1] J. Pascher, *T0 Theory: Time-Mass Duality*, 2024.
- [2] J. Pascher, *T0 Theory: Fundamentals*, 2025.

- [3] J. Pascher, *T0 Theory: Quantum Mechanics*, 2025.
- [4] J. Pascher, *T0 Theory: SI Units*, 2025.
- [5] J. Pascher, *T0 Theory: The  $g-2$  Anomaly*, 2025.
- [6] J. Pascher, *T0 Theory: CMB Analysis*, 2025.
- [7] A. Einstein, *On the Electrodynamics of Moving Bodies*, Annalen der Physik, 1905.
- [8] P.A.M. Dirac, *The Quantum Theory of the Electron*, Proc. Roy. Soc. A, 1928.
- [9] M. Planck, *On the Theory of the Energy Distribution Law*, 1900.
- [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.
- [14] R. Penrose, *The Apparent Shape of a Relativistically Moving Sphere*, Proc. Cambridge Phil. Soc., 1959.
- [15] R. Penrose, *Twistor Algebra*, J. Math. Phys., 1967.
- [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.
- [24] T. Jacobson, *Thermodynamics of Spacetime*, Phys. Rev. Lett., 1995.
- [25] J. Maldacena, *The Large  $N$  Limit of Superconformal Field Theories*, Adv. Theor. Math. Phys., 1998.
- [26] J. Polchinski, *String Theory*, Cambridge University Press, 1998.
- [27] L. Susskind, *The World as a Hologram*, J. Math. Phys., 1995.
- [28] E. Verlinde, *On the Origin of Gravity*, JHEP, 2011.
- [29] F. Hoyle, *A New Model for the Expanding Universe*, MNRAS, 1948.

- 
- [30] H. Bondi, T. Gold, *The Steady-State Theory*, MNRAS, 1948.
- [31] F. Zwicky, *On the Redshift of Spectral Lines*, Proc. Nat. Acad. Sci., 1929.
- [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.
- [35] J. Barrow, *Cosmologies with Varying Light Speed*, Phys. Rev. D, 1999.
- [36] A. Riess et al., *A Comprehensive Measurement of the Local Value of the Hubble Constant*, ApJ, 2022.
- [37] DESI Collaboration, *DESI Year 1 Results*, 2025.
- [38] E. Di Valentino et al., *Planck Evidence for a Closed Universe*, Nat. Astron., 2021.
- [39] P. Di Francesco et al., *Conformal Field Theory*, Springer, 1997.
- [40] Particle Data Group, *Review of Particle Physics*, 2024.
- [41] CODATA, *Recommended Values of Fundamental Constants*, 2019.
- [42] D. Newell et al., *The CODATA 2017 Values of  $h$ ,  $e$ ,  $k$ , and  $N_A$* , Metrologia, 2018.
- [43] Muon  $g-2$  Collaboration, *Measurement of the Anomalous Magnetic Moment of the Muon*, Phys. Rev. Lett., 2023.
- [44] Fermilab, *Muon  $g-2$  Results*, 2023.
- [45] ATLAS Collaboration, *Measurements at the LHC*, 2023.
- [46] ATLAS Collaboration, *Higgs Boson Properties*, 2023.
- [47] CMS Collaboration, *Top Quark Measurements*, 2023.
- [48] CMS Collaboration, *Heavy Ion Collisions*, 2024.
- [49] ALICE Collaboration, *Quark-Gluon Plasma Studies*, 2023.
- [50] M. Kasevich et al., *Atom Interferometry*, 2023.
- [51] A. Ludlow et al., *Optical Atomic Clocks*, Rev. Mod. Phys., 2015.
- [52] S. Brewer et al.,  *$Al^+$  Optical Clock*, Phys. Rev. Lett., 2019.
- [53] LISA Collaboration, *LISA Mission*, 2017.
- [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.
- [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.
- [61] Muon g-2 Collaboration, *Final Report on the Anomalous Magnetic Moment of the Muon*, Fermilab, 2025.
- [62] J. Pascher, *T0 Theory: Complete Framework*, viXra, 2025.
- [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.
- [65] L. Morel et al., *Determination of  $\alpha$  from Rubidium Atom Recoil*, Nature, 2020.
- [66] T. Aoyama et al., *Theory of the Electron Anomalous Magnetic Moment*, Phys. Rep., 2020.
- [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.
- [69] J. Pascher, *Higgs Connection in T0 Theory*, 2025.
- [70] J. Pascher, *T0 Theory and SI Units*, 2025.
- [71] J. Pascher, *Gravitational Constant in T0 Framework*, 2025.
- [72] J. Pascher, *Fine Structure Constant Analysis*, 2025.
- [73] J.S. Bell, *Muon Studies*, 1966.
- [74] J. Pascher, *Quantum Field Theory in T0*, 2025.
- [75] Planck Collaboration, *Planck 2018 Results*, A&A, 2018.
- [76] J. Pascher, *T0 Theory Foundations*, 2025.
- [77] J. Pascher, *Geometric Formalism in T0*, 2025.
- [78] A. Riess et al., *Hubble Constant Measurements*, ApJ, 2019.
- [79] J. Pascher, *T0 Kosmologie*, 2025.
- [80] S. Hossenfelder, *Single Clock Video*, YouTube, 2025.
- [81] Various, *Video References*, 2025.
- [82] C.S. Unnikrishnan, *Gravity Studies*, 2004.
- [83] A. Peratt, *Plasma Cosmology*, 1992.
- [84] J. Pascher, *T0 Time-Mass Extension*, 2025.

- [85] J. Pascher, *T0 g-2 Extension*, 2025.
- [86] J. Pascher, *T0 Networks*, 2025.
- [87] W. Adams, *Gravitational Redshift*, 1925.
- [88] N. Ashby, *Relativity in GPS*, Living Rev. Rel., 2003.
- [89] B. Bertotti et al., *Cassini Doppler Test*, Nature, 2003.
- [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.
- [93] P.A.M. Dirac, *Quantum Mechanics*, Proc. Roy. Soc., 1927.
- [94] P. Duhem, *Theory of Physics*, 1906.
- [95] A. Einstein, *Special Relativity*, Ann. Phys., 1905.
- [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.
- [104] J.C. Maxwell, *Treatise on Electricity and Magnetism*, 1873.
- [105] S. McGaugh et al., *Radial Acceleration Relation*, Phys. Rev. Lett., 2016.
- [106] P. Mohr et al., *CODATA Values*, Rev. Mod. Phys., 2016.
- [107] Particle Data Group, *Review of Particle Physics*, Prog. Theor. Exp. Phys., 2020.
- [108] R. Parker et al., *Measurement of  $\alpha$* , Science, 2018.
- [109] M. Peskin and D. Schroeder, *QFT*, 1995.
- [110] M. Planck, *Quantum Theory*, 1900.
- [111] Planck Collaboration, *Planck 2020 Results*, 2020.
- [112] H. Poincaré, *Dynamics of the Electron*, 1905.
- [113] R.V. Pound and G.A. Rebka, *Gravitational Redshift*, Phys. Rev. Lett., 1960.

- [114] W.V. Quine, *Two Dogmas of Empiricism*, 1951.
- [115] T. Quinn et al., *Gravitational Constant*, 2013.
- [116] L. Randall and R. Sundrum, *Extra Dimensions*, Phys. Rev. Lett., 1999.
- [117] A. Riess et al., *Type Ia Supernovae*, AJ, 1998.
- [118] I. Shapiro et al., *Time Delay Test*, Phys. Rev. Lett., 1971.
- [119] A. Sommerfeld, *Fine Structure*, 1916.
- [120] S. Suyu et al., *Time Delay Cosmography*, MNRAS, 2017.
- [121] J. Pascher, *T0 Theory*, 2025.
- [122] J. Pascher, *Fine Structure in T0*, 2025.
- [123] J.-P. Uzan, *Constants Variation*, Rev. Mod. Phys., 2003.
- [124] J.K. Webb et al., *Fine Structure Constant*, Phys. Rev. Lett., 2001.
- [125] S. Weinberg, *Cosmological Constant*, Rev. Mod. Phys., 1979.
- [126] S. Weinberg, *Cosmological Constant Problem*, 1989.
- [127] S. Weinberg, *Quantum Theory of Fields*, 1995.
- [128] C. Will, *Theory and Experiment in Gravitational Physics*, 2014.
- [129] P.A.M. Dirac, *Principles of Quantum Mechanics*, 1930.
- [130] A. Einstein, *Cosmological Considerations*, 1917.
- [131] JWST Collaboration, *Early Universe Observations*, 2023.
- [132] KATRIN Collaboration, *Neutrino Mass*, 2022.
- [133] J. Pascher, *T0 Fundamentals*, 2025.
- [134] J. Pascher, *g-2 Analysis Rev9*, 2025.
- [135] J. Pascher, *ML Addendum*, 2025.
- [136] J. Pascher, *Beta Derivation*, 2025.
- [137] J. Pascher, *CMB Analysis in T0*, 2025.
- [138] J. Pascher, *Cosmos in T0 Theory*, 2025.
- [139] J. Pascher, *Derivation of Beta*, 2025.
- [140] J. Pascher, *Gravitation in T0*, 2025.
- [141] J. Pascher, *Lagrangian in T0*, 2025.
- [142] J. Pascher, *Lagrangian Framework*, 2025.

- [143] J. Pascher, *Muon  $g-2$  in  $T0$* , 2025.
- [144] J. Pascher, *Pragmatic Approach*, 2025.
- [145] J. Pascher,  *$T0$  Energy Formalism*, 2025.
- [146] J. Pascher, *Unified  $T0$  Theory*, 2025.
- [147] Science Daily, *Physics News*, 2025.
- [148] S. Weinberg, *The Cosmological Constant Problem*, Rev. Mod. Phys., 1989.
- [149] Wikipedia, *Bell's Theorem*, 2025.
- [150] B. van Fraassen, *The Scientific Image*, Oxford University Press, 1980.
- [151] J. Pascher, *Extended Lagrangian Formalism*, 2025.
- [152] J. Pascher, *Mathematical Structure of  $T0$  Theory*, 2025.
- [153] J. Terrell, *Single Clock Nature*, Nature, 2024.
- [154] J. Pascher, *Unified  $T0$  Framework*, 2025.
- [155] J. Pascher, *Machine Learning Addendum to  $T0$  Theory*, 2025.
- [156] C. S. Unnikrishnan, *On the Nature of Gravitational Waves*, Pramana, 2004.
- [157] W. S. Adams, *The Relativity Displacement of the Spectral Lines*, PNAS, 1925.
- [158] N. Ashby, *Relativity and the GPS*, Living Reviews, 2003.
- [159] B. Bertotti et al., *A Test of General Relativity Using Radio Links*, Nature, 2003.
- [160] A. S. Bolton et al., *Strong Gravitational Lens Halo*, ApJ, 2008.
- [161] M. Born, *Atomic Physics*, Dover, 2013.
- [162] C. Brans, R. H. Dicke, *Mach's Principle and a Relativistic Theory of Gravitation*, Phys. Rev., 1961.
- [163] P. A. M. Dirac, *The Quantum Theory of the Electron*, Proc. R. Soc., 1927.
- [164] P. Duhem, *La Théorie Physique*, 1906.
- [165] A. Einstein, *Zur Elektrodynamik bewegter Körper*, Ann. Phys., 1905.
- [166] R. P. Feynman, *QED: The Strange Theory of Light and Matter*, Princeton, 2006.
- [167] D. J. Griffiths, *Introduction to Electrodynamics*, 4th ed., Cambridge, 2017.
- [168] J. D. Jackson, *Classical Electrodynamics*, 3rd ed., Wiley, 1999.
- [169] T. Kaluza, *Zum Unitätsproblem der Physik*, Sitz. Preuss. Akad. Wiss., 1921.
- [170] O. Klein, *Quantentheorie und fünfdimensionale Relativitätstheorie*, Z. Phys., 1926.

- [171] T. S. Kuhn, *The Structure of Scientific Revolutions*, Chicago, 1962.
- [172] T. S. Kuhn, *The Essential Tension*, Chicago, 1977.
- [173] A. D. Ludlow et al., *Optical Atomic Clocks*, Rev. Mod. Phys., 2015.
- [174] J. C. Maxwell, *A Treatise on Electricity and Magnetism*, Oxford, 1873.
- [175] S. S. McGaugh et al., *Radial Acceleration Relation*, Phys. Rev. Lett., 2016.
- [176] P. J. Mohr et al., *CODATA 2014*, Rev. Mod. Phys., 2016.
- [177] Particle Data Group, *Review of Particle Physics*, Prog. Theor. Exp. Phys., 2020.
- [178] R. H. Parker et al., *Measurement of the Fine-Structure Constant*, Science, 2018.
- [179] M. E. Peskin, D. V. Schroeder, *An Introduction to Quantum Field Theory*, Westview, 1995.
- [180] M. Planck, *Zur Theorie des Gesetzes der Energieverteilung*, Verh. Dtsch. Phys. Ges., 1900.
- [181] Planck Collaboration, *Planck 2018 Results*, A&A, 2020.
- [182] H. Poincaré, *Sur la Dynamique de l'Électron*, C. R. Acad. Sci., 1905.
- [183] R. V. Pound, G. A. Rebka, *Gravitational Red-Shift in Nuclear Resonance*, Phys. Rev. Lett., 1960.
- [184] J. Pascher, *Quantum Field Theory in  $T_0$  Framework*, 2025.
- [185] W. V. O. Quine, *Two Dogmas of Empiricism*, Phil. Rev., 1951.
- [186] T. Quinn et al., *Improved Determination of  $G$* , Phys. Rev. Lett., 2013.
- [187] L. Randall, R. Sundrum, *A Large Mass Hierarchy*, Phys. Rev. Lett., 1999.
- [188] A. G. Riess et al., *Observational Evidence from Supernovae*, AJ, 1998.
- [189] I. I. Shapiro, *Fourth Test of General Relativity*, Phys. Rev. Lett., 1971.
- [190] A. Sommerfeld, *Zur Quantentheorie der Spektrallinien*, Ann. Phys., 1916.
- [191] S. H. Suyu et al., *H0LiCOW*, MNRAS, 2017.
- [192] J. Pascher,  *$T_0$  Theory: Foundations*, 2025.
- [193] J. Pascher, *Fine-Structure Constant in  $T_0$* , 2025.
- [194] J. Pascher, *SI Units in  $T_0$  Framework*, 2025.
- [195] J. Pascher,  *$T_0$  Fine-Structure Analysis*, 2025.
- [196] J. Pascher,  *$T_0$   $g-2$  Extension*, 2025.
- [197] J. Pascher, *Gravitational Constant in  $T_0$* , 2025.

- 
- [198] J. Pascher, *T0 Networks*, 2025.
- [199] J. Pascher, *Time-Mass Extension in T0*, 2025.
- [200] J.-P. Uzan, *The Fundamental Constants and Their Variation*, Rev. Mod. Phys., 2003.
- [201] J. K. Webb et al., *Further Evidence for Cosmological Evolution of the Fine Structure Constant*, Phys. Rev. Lett., 2001.
- [202] S. Weinberg, *A Model of Leptons*, Phys. Rev. Lett., 1979.
- [203] S. Weinberg, *The Cosmological Constant Problem*, Rev. Mod. Phys., 1989.
- [204] S. Weinberg, *The Quantum Theory of Fields*, Cambridge, 1995.
- [205] C. M. Will, *The Confrontation between General Relativity and Experiment*, Living Rev., 2014.
- [206] A. Albrecht, J. Magueijo, *A Time Varying Speed of Light*, Phys. Rev. D, 1999.
- [207] ALICE Collaboration, *Measurement Results*, CERN, 2023.
- [208] A. Ashtekar, *Background Independent Quantum Gravity*, Class. Quant. Grav., 2004.
- [209] ATLAS Collaboration, *Physics Results*, CERN, 2023.
- [210] ATLAS Collaboration, *Higgs Measurements*, CERN, 2023.
- [211] J. Barbour, *The End of Time*, Oxford, 1999.
- [212] J. D. Barrow, *Cosmologies with Varying Light Speed*, Phys. Rev. D, 1999.
- [213] K. Becker et al., *String Theory and M-Theory*, Cambridge, 2007.
- [214] J. S. Bell, *On the Einstein Podolsky Rosen Paradox*, Physics, 1964.
- [215] H. Bondi, T. Gold, *The Steady-State Theory*, MNRAS, 1948.
- [216] S. M. Brewer et al., *27Al+ Quantum-Logic Clock*, Phys. Rev. Lett., 2019.
- [217] CMS Collaboration, *Top Quark Measurements*, CERN, 2023.
- [218] CMS Collaboration, *Physics Results*, CERN, 2024.
- [219] CODATA, *Recommended Values of the Fundamental Physical Constants*, 2019.
- [220] DESI Collaboration, *Cosmological Results*, 2025.
- [221] H. Dingle, *Science at the Crossroads*, Martin Brian, 1972.
- [222] P. A. M. Dirac, *The Principles of Quantum Mechanics*, Oxford, 1930.
- [223] E. Di Valentino et al., *In the Realm of the Hubble Tension*, Class. Quant. Grav., 2021.

- 
- [224] A. Einstein, *Kosmologische Betrachtungen zur allgemeinen Relativitätstheorie*, Sitz. Preuss. Akad. Wiss., 1917.
- [225] M. S. El Naschie, *A Review of E Infinity Theory*, Chaos Solitons Fractals, 2004.
- [226] Fermilab, *Muon g-2 Results*, 2023.
- [227] P. Di Francesco et al., *Conformal Field Theory*, Springer, 1997.
- [228] S. Hossenfelder, *Lost in Math*, Basic Books, 2025.
- [229] S. Hossenfelder, *Single Clock Video Analysis*, YouTube, 2025.
- [230] F. Hoyle, *A New Model for the Expanding Universe*, MNRAS, 1948.
- [231] H. Dingle, *Philosophy of Physics*, Dover, 1931.
- [232] T. Jacobson, *Thermodynamics of Spacetime*, Phys. Rev. Lett., 1995.
- [233] JWST Collaboration, *Early Release Observations*, NASA, 2022.
- [234] M. Kasevich, *Atom Interferometry*, Ann. Rev. Nucl. Part. Sci., 2023.
- [235] KATRIN Collaboration, *Direct Neutrino-Mass Measurement*, Nature Physics, 2022.
- [236] E. Lerner, *The Big Bang Never Happened*, Vintage, 2014.
- [237] LISA Consortium, *Laser Interferometer Space Antenna*, ESA, 2017.
- [238] A. Lopez et al., *Asymmetry of the CMB*, Phys. Rev. D, 2010.
- [239] A. D. Ludlow et al., *Optical Atomic Clocks*, Rev. Mod. Phys., 2015.
- [240] E. Mach, *Die Mechanik in ihrer Entwicklung*, Leipzig, 1883.
- [241] J. Maldacena, *The Large N Limit of Superconformal Field Theories*, Adv. Theor. Math. Phys., 1998.
- [242] H. Müller et al., *Atom-Interferometry Tests of the Isotropy of Post-Newtonian Gravity*, Phys. Rev. Lett., 2014.
- [243] Muon g-2 Collaboration, *Final Results*, Phys. Rev. Lett., 2025.
- [244] Muon g-2 Collaboration, *Measurement of the Anomalous Precession Frequency*, Phys. Rev. Lett., 2023.
- [245] D. B. Newell et al., *The CODATA 2017 Values*, Metrologia, 2018.
- [246] L. Nottale, *Fractal Space-Time and Microphysics*, World Scientific, 1993.
- [247] J. Pascher, *CMB Analysis in T0 Framework*, 2025.
- [248] J. Pascher, *Muon g-2 in T0 Theory*, 2025.
- [249] J. Pascher, *Quantum Mechanics in T0 Framework*, 2025.
- [250] J. Pascher, *SI Units Derivation in T0*, 2025.

- [251] J. Pascher, *T0 Theory Overview*, 2025.
- [252] J. Pascher, *Fundamentals of T0 Theory*, 2025.
- [253] J. Pascher, *Muon  $g-2$  Revision 9*, 2025.
- [254] J. Pascher, *Geometric Formalism in T0*, 2025.
- [255] J. Pascher, *T0 Foundations*, 2025.
- [256] J. Pascher, *Beta Parameter Derivation*, 2025.
- [257] J. Pascher, *CMB in T0 (English)*, 2025.
- [258] J. Pascher, *Cosmology in T0 (English)*, 2025.
- [259] J. Pascher, *Derivation of Beta*, 2025.
- [260] J. Pascher, *Gravitation in T0 (English)*, 2025.
- [261] J. Pascher, *Higgs Connection in T0*, 2025.
- [262] J. Pascher, *Lagrangian Formulation in T0*, 2025.
- [263] J. Pascher, *Lagrangian in T0 (English)*, 2025.
- [264] J. Pascher, *Muon  $g-2$  Analysis in T0*, 2025.
- [265] J. Pascher, *Pragmatic T0 Framework*, 2025.
- [266] J. Pascher, *Energy in T0 Framework*, 2025.
- [267] J. Pascher, *T0 Theory Complete*, 2025.
- [268] Particle Data Group, *Review of Particle Physics*, Phys. Rev. D, 2024.
- [269] R. Penrose, *The Apparent Shape of a Relativistically Moving Sphere*, Proc. Camb. Phil. Soc., 1959.
- [270] R. Penrose, *Twistor Algebra*, J. Math. Phys., 1967.
- [271] R. Penrose, *The Road to Reality*, Knopf, 2004.
- [272] A. L. Peratt, *Physics of the Plasma Universe*, Springer, 1992.
- [273] M. E. Peskin, D. V. Schroeder, *An Introduction to Quantum Field Theory*, Westview, 1995.
- [274] Planck Collaboration, *Planck 2018 Results*, A&A, 2020.
- [275] J. Polchinski, *String Theory*, Cambridge, 1998.
- [276] A. G. Riess et al., *Large Magellanic Cloud Cepheid Standards*, ApJ, 2019.
- [277] A. G. Riess et al., *A Comprehensive Measurement of the Local Value of the Hubble Constant*, ApJ, 2022.

- [278] C. Rovelli, *Quantum Gravity*, Cambridge, 2004.
- [279] D. W. Sciama, *On the Origin of Inertia*, MNRAS, 1953.
- [280] Science Daily, *Physics News*, 2025.
- [281] Standard Model g-2 Theory Initiative, *Updated SM Prediction*, 2025.
- [282] L. Susskind, *The World as a Hologram*, J. Math. Phys., 1995.
- [283] J. Pascher, *T0 Cosmology*, 2025.
- [284] J. Terrell, *Invisibility of the Lorentz Contraction*, Phys. Rev., 1959.
- [285] J. Terrell, *Single Clock Framework*, 2025.
- [286] T. Thiemann, *Modern Canonical Quantum General Relativity*, Cambridge, 2007.
- [287] B. C. van Fraassen, *The Scientific Image*, Oxford, 1980.
- [288] E. Verlinde, *On the Origin of Gravity and the Laws of Newton*, JHEP, 2011.
- [289] J. Pascher, *T0 Theory Video Presentation*, 2025.
- [290] S. Weinberg, *The Cosmological Constant Problem*, Rev. Mod. Phys., 1989.
- [291] D. Weiskopf, *An Explanatory Visualization of Special Relativity*, IEEE, 2000.
- [292] J. A. Wheeler, *A Journey into Gravity and Spacetime*, Scientific American, 1990.
- [293] Wikipedia, *Bell's Theorem*, 2024.
- [294] F. Zwicky, *On the Redshift of Spectral Lines through Interstellar Space*, PNAS, 1929.