T0 Model Overview

Johann Pascher

2025

Chapitre 1

T0 Model Overview

Résumé

Based on the analysis of available PDF documents from the GitHub repository `jpascher/`
`T0-Time-Mass-Duality`, a comprehensive summary has been created. The documents
are available in both German (`.De.pdf`) and English (`.En.pdf`) versions. The T0-Model
pursues the ambitious goal of reducing all physics from over 20 free parameters of the
Standard Model to a single geometric constant $\xi = \frac{4}{3} \times 10^{-4}$. This treatise presents a
complete exposition of theoretical foundations, mathematical structures, and experimental
predictions.

1.1 The T0-Model : A New Perspective for Communications Engineers

1.1.1 The Parameter Problem of Modern Physics

You know from communications engineering the problem of parameter optimization. In designing a filter, you need to set many coefficients ; in an amplifier, you choose different operating points. The more parameters, the more complex the system becomes and the more susceptible to instabilities.

Modern physics has exactly this problem : The Standard Model of particle physics requires over 20 free parameters - masses, coupling constants, mixing angles. These must all be determined experimentally without us understanding why they have precisely these values. It's like having to tune a 20-stage amplifier without understanding the circuit.

The T0-Model proposes a radical simplification : All physics can be reduced to a single dimensionless parameter : $\xi = \frac{4}{3} \times 10^{-4}$.

1.1.2 The Universal Constant ξ

From signal processing, you know that certain ratios always recur. The golden ratio in image processing, the Nyquist frequency in sampling, characteristic impedances in transmission lines. The ξ-constant plays a similar universal role.

The value $\xi = \frac{4}{3} \times 10^{-4}$ arises from the geometry of three-dimensional space. The factor $\frac{4}{3}$ you know from the sphere volume $V = \frac{4\pi}{3}r^3$ - it characterizes optimal 3D packing densities. The factor 10^{-4} arises from quantum field theory loop suppression factors, similar to damping factors in your control loops.

1.1.3 Energy Fields as Foundation

In communications engineering, you constantly work with fields : electromagnetic fields in antennas, evanescent fields in waveguides, near-fields in capacitive sensors. The T0-Model extends this concept : The entire universe consists of a single universal energy field $E(x, t)$.

This field obeys the d'Alembert equation :

$$\Box E = \left(\nabla^2 - \frac{1}{c^2} \frac{\partial^2}{\partial t^2} \right) E = 0$$

This is familiar from electromagnetism - it's the wave equation for electromagnetic fields in vacuum. The difference : In the T0-Model, this one equation describes not only light, but all physical phenomena.

1.1.4 Time-Energy Duality and Modulation

From communications engineering, you know time-frequency dualities. A narrow function in time becomes broad in the frequency domain, and vice versa. The T0-Model introduces a similar duality between time and energy :

$$T(x, t) \cdot E(x, t) = 1$$

This is analogous to the uncertainty relation $\Delta t \cdot \Delta f \geq \frac{1}{4\pi}$ that you use in signal analysis. Where energy is locally concentrated, time passes more slowly - like an energy-dependent clock frequency.

1.1.5 Deterministic Quantum Mechanics

Standard quantum mechanics uses probabilistic descriptions because it has only incomplete information. This is like noise analysis in your systems : When you don't know the exact noise source, you use statistical models.

The T0-Model claims that quantum mechanics is actually deterministic. The apparent randomness arises from very fast changes in the energy field - so fast that they lie below the temporal resolution of our measuring devices. It's like aliasing in signal processing : Changes that are too fast appear as seemingly random artifacts.

The famous Schrödinger equation is extended :

$$i\hbar\frac{\partial\psi}{\partial t} + i\psi\left[\frac{\partial T}{\partial t} + \vec{v}\cdot\nabla T\right] = \hat{H}\psi$$

The additional term $\frac{\partial T}{\partial t} + \vec{v}\cdot\nabla T$ describes coupling to the time field - similar to Doppler terms in moving reference frames.

1.1.6 Field Geometries and System Theory

The T0-Model distinguishes three characteristic field geometries :

1. **Localized spherical fields** : Describe point-like particles. Parameters : $\xi = \frac{\ell_P}{r_0}$, $\beta = \frac{r_0}{r}$.

2. **Localized non-spherical fields** : For complex systems with multipole expansion similar to your antenna theory.

3. **Extended homogeneous fields** : Cosmological applications with modified $\xi_{\text{eff}} = \xi/2$ due to screening effects.

This classification corresponds to system theory : lumped elements (R, L, C), distributed elements (transmission lines), and continuum systems (fields).

1.1.7 Experimental Verification : Muon g-2

The most convincing argument for the T0-Model comes from precision measurements. The anomalous magnetic moment of the muon shows a 4.2σ deviation from the Standard Model - a clear sign of new physics.

The T0-Model makes a parameter-free prediction :

$$\Delta a_\ell = 251 \times 10^{-11} \times \left(\frac{m_\ell}{m_\mu}\right)^2$$

For the muon ($m_\ell = m_\mu$), this yields exactly the experimental value of 251×10^{-11}. For the electron, a testable prediction of $\Delta a_e = 5.87 \times 10^{-15}$ follows.

This is like a perfect impedance match in a broadband system - strong evidence that the theory correctly describes the underlying physics.

1.1.8 Technological Implications

New physical insights often lead to technological breakthroughs. Quantum mechanics enabled transistors and lasers, relativity theory enabled GPS and particle accelerators.

If the T0-Model is correct, completely new technologies could emerge :
— Deterministic quantum computers without decoherence problems
— Energy field-based sensors with highest precision
— Possibly manipulation of local time rate through energy field control
— New materials based on controlled field geometries

1.1.9 Mathematical Elegance

What makes the T0-Model particularly attractive is its mathematical simplicity. Instead of complex Lagrangians with dozens of terms, a single universal Lagrangian density suffices :

$$\mathcal{L} = \frac{\xi}{E_P^2} \cdot (\partial E)^2$$

This is analogous to your simplest circuits : one resistor, one capacitor, but with universal validity. All the complexity of physics emerges as an emergent property of this one basic principle - like complex network behavior from simple Kirchhoff rules.

The elegance lies in the fact that a single geometric constant ξ determines all observable phenomena, from subatomic particles to cosmological structures.

1.2 Overview of Analyzed Documents

Based on the analysis of available PDF documents from the GitHub repository `jpascher/T0-Time-Mass-Duality`, a comprehensive summary has been created. The documents are available in both German (`.De.pdf`) and English (`.En.pdf`) versions.

1.2.1 Main Documents in GitHub Repository

GitHub Path : https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/

1. **HdokumentDe.pdf** - Master document of complete T0-Framework
2. **Zusammenfassung_De.pdf** - Comprehensive theoretical treatise
3. **T0-Energie_De.pdf** - Energy-based formulation
4. **cosmic_De.pdf** - Cosmological applications
5. **DerivationVonBetaDe.pdf** - Derivation of -parameter
6. **xi_parameter_partikel_De.pdf** - Mathematical analysis of ξ-parameter
7. **systemDe.pdf** - System-theoretical foundations
8. **T0vsESM_ConceptualAnalysis_De.pdf** - Comparison with Standard Model

1.3 Foundations of the T0-Model

1.3.1 The Central Vision

The T0-Model pursues the ambitious goal of reducing all physics from over 20 free parameters of the Standard Model to a single geometric constant :

$$\xi = \frac{4}{3} \times 10^{-4} = 1.3333\ldots \times 10^{-4} \tag{1.1}$$

Document Reference : *HdokumentDe.pdf, Zusammenfassung_De.pdf*

1.3.2 The Universal Energy Field

The core of the T0-Model is a universal energy field (x, t) described by a single fundamental equation :

$$\Box = \left(\nabla^2 - \frac{\partial^2}{\partial t^2}\right) = 0 \tag{1.2}$$

This d'Alembert equation describes :
— All particles as localized energy field excitations
— All forces as energy field gradient interactions
— All dynamics through deterministic field evolution
Document Reference : *T0-Energie_De.pdf, systemDe.pdf*

1.3.3 Time-Energy Duality

A fundamental insight of the T0-Model is the time-energy duality :

$$T_{\text{field}}(x, t) \cdot E_{\text{field}}(x, t) = 1 \tag{1.3}$$

This relationship leads to the T0-time scale :

$$t_0 = 2GE \tag{1.4}$$

Document Reference : *T0-Energie_De.pdf, HdokumentDe.pdf*

1.4 Mathematical Structure

1.4.1 The ξ-Constant as Geometric Parameter

The dimensionless constant $\xi = \frac{4}{3} \times 10^{-4}$ arises from :

1. Three-dimensional space geometry : Factor $\frac{4}{3}$

2. Fractal dimension : Scale factor 10^{-4}

The geometric derivation :

$$\xi = \frac{4\pi}{3} \cdot \frac{1}{4\pi \times 10^4} = \frac{4}{3} \times 10^{-4} \tag{1.5}$$

Document Reference : *xi_parameter_partikel_De.pdf, DerivationVonBetaDe.pdf*

1.4.2 Parameter-free Lagrangian

The complete T0-system requires no empirical inputs :

$$\mathcal{L} = \varepsilon \cdot (\partial)^2 \tag{1.6}$$

where :

$$\varepsilon = \frac{\xi}{E_P^2} = \frac{4/3 \times 10^{-4}}{E_P^2} \tag{1.7}$$

Document Reference : *T0-Energie_ De.pdf*

1.4.3 Three Fundamental Field Geometries

The T0-Model distinguishes three field geometries :

1. Localized spherical energy fields (particles, atoms, nuclei, localized excitations)
2. Localized non-spherical energy fields (molecular systems, crystal structures, anisotropic field configurations)
3. Extended homogeneous energy fields (cosmological structures with screening effect)

Specific Parameters :
— Spherical : $\xi = \ell_P/r_0, = r_0/r$, Field equation : $\nabla^2 E = 4\pi G \rho_E E$
— Non-spherical : Tensorial parameters $_{ij}$, ξ_{ij}, multipole expansion
— Extended homogeneous : $\xi_{\text{eff}} = \xi/2$ (natural screening effect), additional Λ_T term
Document Reference : *T0-Energie_ De.pdf*

1.5 Experimental Confirmation and Empirical Validation

1.5.1 Already Confirmed Predictions

Anomalous Magnetic Moment of the Muon

The T0-Model uses the universal formula for all leptons :

$$\Delta a_\ell^{(T0)} = 251 \times 10^{-11} \times \left(\frac{m_\ell}{m_\mu} \right)^2 \tag{1.8}$$

Specific Values :
— Muon : $\Delta a_\mu = 251 \times 10^{-11} \times 1 = 251 \times 10^{-11}$ ✓
— Electron : $\Delta a_e = 251 \times 10^{-11} \times (0.511/105.66)^2 = 5.87 \times 10^{-15}$
— Tau : $\Delta a_\tau = 251 \times 10^{-11} \times (1777/105.66)^2 = 7.10 \times 10^{-7}$
Experimental Success : Perfect agreement with muon g-2 experiment, parameter-free predictions for electron and tau
Document Reference : *CompleteMuon_ g-2_ AnalysisDe.pdf, detailierte_ formel_ leptonen_ anemal_ De.pdf*

Other Empirically Confirmed Values

— Gravitational constant : $G = 6.67430 \ldots \times 10^{-11}\,\mathrm{m^3\,kg^{-1}\,s^{-2}}$ ✓
— Fine structure constant : $^{-1} = 137.036 \ldots$ ✓
— Lepton mass ratios : $m_\mu/m_e = 207.8$ (theory) vs 206.77 (experiment) ✓
— Hubble constant : $H_0 = 67.2\,\mathrm{km/s/Mpc}$ (99.7% agreement with Planck) ✓
Document Reference : *CompleteMuon_ g-2_ AnalysisDe.pdf,*
T0-Theory : Formulas for xi and Gravitational Constant.md

1.5.2 Testable Parameters without New Free Constants

The T0-Model makes predictions for not yet measured values :

Observable	T0-Prediction	Status	Precision
Electron g-2	5.87×10^{-15}	Measurable	10^{-13}
Tau g-2	7.10×10^{-7}	Future measurable	10^{-9}

TABLE 1.1 – Future testable predictions

Important distinction : These are not free parameters but follow directly from the already confirmed muon g-2 formula : $\Delta a_\ell = 251 \times 10^{-11} \times (m_\ell/m_\mu)^2$

1.5.3 Particle Physics

Simplified Dirac Equation

The T0-Model reduces the complex 4×4 matrix structure of the Dirac equation to simple field node dynamics.
Document Reference : *systemDe.pdf*

1.5.4 Cosmology

Static, Cyclic Universe

The T0-Model proposes a unified, static, cyclic universe that operates without dark matter and dark energy.

Wavelength-dependent Redshift

The T0-Model offers alternative mechanisms for redshift :

$$\frac{dE}{dx} = -\xi \cdot f(E/E_\xi) \cdot E \tag{1.9}$$

The T0-Model proposes several explanations (besides standard space expansion) : photon energy loss through ξ-field interaction and diffraction effects. While diffraction effects are theoretically preferred, the energy loss mechanism is mathematically simpler to formulate.
Document Reference : *cosmic_ De.pdf*

1.5.5 Quantum Mechanics

Deterministic Quantum Mechanics

The T0-Model develops an alternative deterministic quantum mechanics :
Eliminated Concepts :
— Wave function collapse dependent on measurement
— Observer-dependent reality in quantum mechanics
— Probabilistic fundamental laws
— Multiple parallel universes
— Fundamental randomness
New Concepts :
— Deterministic field evolution
— Objective geometric reality
— Universal physical laws
— Single, consistent universe
— Predictable individual events

Modified Schrödinger Equation

$$i\hbar\frac{\partial\psi}{\partial t} + i\psi\left[\frac{\partial T_{\text{field}}}{\partial t} + \vec{v}\cdot\nabla T_{\text{field}}\right] = \hat{H}\psi \tag{1.10}$$

Deterministic Entanglement

Entanglement arises from correlated energy field structures :

$$E_{12}(x_1, x_2, t) = E_1(x_1, t) + E_2(x_2, t) + E_{\text{corr}}(x_1, x_2, t) \tag{1.11}$$

Modified Quantum Mechanics

— Continuous energy field evolution instead of collapse
— Deterministic individual measurement predictions
— Objective, deterministic reality
— Local energy field interactions
Document Reference : *QM-Detrmistic_ p_ De.pdf, scheinbar_ instantan_ De.pdf, QM-testenDe.pdf, T0-Energie_ De.pdf*

1.6 Theoretical Implications

1.6.1 Elimination of Free Parameters

The T0-Model successfully eliminates the over 20 free parameters of the Standard Model through :
— Reduction to one geometric constant
— Universal energy field description
— Geometric foundation of all physics

1.6.2   Simplification of Physics Hierarchy

Standard Model Hierarchy :

$$\text{Quarks \& Leptons} \rightarrow \text{Particles} \rightarrow \text{Atoms} \rightarrow \text{ ? ? ?} \tag{1.12}$$

T0-Geometric Hierarchy :

$$\text{3D-Geometry} \rightarrow \text{Energy Fields} \rightarrow \text{Particles} \rightarrow \text{Atoms} \tag{1.13}$$

Document Reference : *T0-Energie_ De.pdf, Zusammenfassung_ De.pdf*

1.6.3   Epistemological Considerations

The T0-Model acknowledges fundamental epistemological limits :
— Theoretical underdetermination
— Multiple possible mathematical frameworks
— Necessity of empirical distinguishability
Document Reference : *T0-Energie_ De.pdf*

1.7   Future Perspectives

1.7.1   Theoretical Development

Priorities for further research :

1. Complete mathematical formalization of the ξ-field

2. Detailed calculations for all particle masses

3. Consistency checks with established theories

4. Alternative derivations of the ξ-constant

1.7.2   Experimental Programs

Required measurements :

1. High-precision spectroscopy at various wavelengths

2. Improved g-2 measurements for all leptons

3. Tests of modified Bell inequalities

4. Search for ξ-field signatures in precision experiments

Document Reference : *HdokumentDe.pdf*

1.8   Final Assessment

1.8.1   Essential Aspects

The T0-Model demonstrates a novel approach through :
— Radical simplification : From 20+ parameters to one geometric framework
— Conceptual clarity : Unified description of all physics
— Mathematical elegance : Geometric beauty of the reduction
— Experimental relevance : Remarkable agreement with muon g-2

1.8.2 Central Message

The T0-Model shows that the search for the theory of everything may possibly lie not in greater complexity, but in radical simplification. The ultimate truth could be extraordinarily simple.

Document Reference : *HdokumentDe.pdf*

1.9 References

All documents are available at : https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/

1.9.1 German Versions

— HdokumentDe.pdf (Master document)
— Zusammenfassung_De.pdf (Theoretical treatise)
— T0-Energie_De.pdf (Energy-based formulation)
— cosmic_De.pdf (Cosmological applications)
— DerivationVonBetaDe.pdf (-parameter derivation)
— xi_parameter_partikel_De.pdf (ξ-parameter analysis)
— systemDe.pdf (System-theoretical foundations)
— T0vsESM_ConceptualAnalysis_De.pdf (Standard Model comparison)

1.9.2 English Versions

Corresponding `.En.pdf` versions available
Email : johann.pascher@gmail.com

Bibliographie

[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

[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, *T0 Theory*, 2025. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/systemEn.pdf

[122] J. Pascher, *Fine Structure in T0*, 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/LagrandianVergleichEn.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 T0*, 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 T0*, 2025. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/T0_Neutrinos_En.pdf

[168] J. Pascher, *Koide Formula in T0*, 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, *T0 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 T0*, 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, *Xi 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 Xi*, 2025. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/T0_xi_ursprung_En.pdf

[179] J. Pascher, *Time in T0 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/detailierte_formel_leptonen_
anemal_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