

Neutrino Formula

Johann Pascher

2025

Neutrino Formula

Abstract

This document presents a mathematically consistent formula structure for neutrino calculations within the T0 model, based on the hypothesis of equal masses for all flavor states (ν_e, ν_μ, ν_τ). The neutrino mass is derived from the photon analogy ($\frac{\xi^2}{2}$ -suppression), and oscillations are explained by geometric phases based on $T_x \cdot m_x = 1$, with quantum numbers (n, ℓ, j) determining phase differences. A plausible target value for the neutrino mass ($m_\nu = 15$ meV) is derived from empirical data (cosmological constraints). The T0 model is based on speculative geometric harmonies without empirical support and is highly likely to be incomplete or incorrect. Scientific integrity requires a clear distinction between mathematical correctness and physical validity.

1 Preamble: Scientific Integrity

CRITICAL LIMITATION: The following formulas for neutrino masses are **speculative extrapolations** based on the untested hypothesis that neutrinos follow geometric harmonies and all flavor states have equal masses. This hypothesis has **no empirical basis** and is highly likely to be incomplete or incorrect. The mathematical formulas are nonetheless internally consistent and error-free.

Scientific Integrity Requires:

- Honesty about the speculative nature of predictions
- Mathematical correctness despite physical uncertainty
- Clear separation between hypotheses and verified facts

2 Neutrinos as "Near-Massless Photons": The T0 Photon Analogy

Fundamental T0 Insight: Neutrinos can be understood as "damped photons."

The remarkable similarity between photons and neutrinos suggests a deeper geometric kinship:

- **Speed:** Both propagate at nearly the speed of light
- **Penetration:** Both have extreme penetration capabilities
- **Mass:** Photon is exactly massless, neutrino is nearly massless
- **Interaction:** Photon interacts electromagnetically, neutrino interacts weakly

2.1 Photon-Neutrino Correspondence

Physical Parallels:

$$\text{Photon: } E^2 = (pc)^2 + 0 \quad (\text{perfectly massless}) \quad (1)$$

$$\text{Neutrino: } E^2 = (pc)^2 + \left(\sqrt{\frac{\xi^2}{2}} mc^2 \right)^2 \quad (\text{nearly massless}) \quad (2)$$

Speed Comparison:

$$v_\gamma = c \quad (\text{exact}) \quad (3)$$

$$v_\nu = c \times \left(1 - \frac{\xi^2}{2} \right) \approx 0.9999999911 \times c \quad (4)$$

The speed difference is only 8.89×10^{-9} – practically unmeasurable!

2.2 Double ξ -Suppression from Photon Analogy

T0 Hypothesis: Neutrino = Photon with Geometric Double Damping

If neutrinos are "near-photons," two suppression factors arise:

- **First ξ Factor:** "Near massless" (like a photon, but not perfect)
- **Second ξ Factor:** "Weak interaction" (geometric coupling)
- **Result:** $m_\nu \propto \frac{\xi^2}{2}$, consistent with the speed difference $v_\nu = c \times \left(1 - \frac{\xi^2}{2}\right)$

Interaction Strength Comparison:

$$\sigma_\gamma \sim \alpha_{\text{EM}} \approx \frac{1}{137} \quad (5)$$

$$\sigma_\nu \sim \frac{\xi^2}{2} \times G_F \approx 8.888888 \times 10^{-9} \quad (6)$$

The ratio $\sigma_\nu/\sigma_\gamma \sim \frac{\xi^2}{2}$ confirms the geometric suppression!

3 Neutrino Oscillations

Neutrino Oscillations: Neutrinos can change their identity (flavor) during flight – a phenomenon known as neutrino oscillation. A neutrino produced as an electron neutrino (ν_e) can later be detected as a muon neutrino (ν_μ) or tau neutrino (ν_τ) and vice versa.

In standard physics, this behavior is described by the mixing of mass eigenstates (ν_1, ν_2, ν_3) connected to flavor states (ν_e, ν_μ, ν_τ) via the PMNS matrix (Pontecorvo-Maki-Nakagawa-Sakata):

$$\begin{pmatrix} \nu_e \\ \nu_\mu \\ \nu_\tau \end{pmatrix} = U_{\text{PMNS}} \begin{pmatrix} \nu_1 \\ \nu_2 \\ \nu_3 \end{pmatrix}, \quad (7)$$

where U_{PMNS} is the mixing matrix.

Oscillations depend on mass differences $\Delta m_{ij}^2 = m_i^2 - m_j^2$ and mixing angles. Current experimental data (2025) provide:

$$\Delta m_{21}^2 \approx 7.53 \times 10^{-5} \text{ eV}^2 \quad [\text{Solar}] \quad (8)$$

$$\Delta m_{32}^2 \approx 2.44 \times 10^{-3} \text{ eV}^2 \quad [\text{Atmospheric}] \quad (9)$$

$$m_\nu > 0.06 \text{ eV} \quad [\text{At least one neutrino, } 3\sigma] \quad (10)$$

Implications for T0:

- The T0 model postulates equal masses for flavor states (ν_e, ν_μ, ν_τ), implying $\Delta m_{ij}^2 = 0$, which is incompatible with standard oscillations.
- To explain oscillations, the T0 model uses geometric phases based on $T_x \cdot m_x = 1$, with quantum numbers (n, ℓ, j) determining phase differences.

3.1 Geometric Phases as Oscillation Mechanism

T0 Hypothesis: Geometric Phases for Oscillations

To reconcile the hypothesis of equal masses ($m_{\nu_e} = m_{\nu_\mu} = m_{\nu_\tau} = m_\nu$) with neutrino oscillations, it is speculated that oscillations in the T0 model are caused by geometric phases rather than mass differences. This is based on the T0 relation:

$$T_x \cdot m_x = 1,$$

where $m_x = m_\nu = 4.54 \text{ meV}$ is the neutrino mass, and T_x is a characteristic time or frequency:

$$T_x = \frac{1}{m_\nu} = \frac{1}{4.54 \times 10^{-3} \text{ eV}} \approx 2.2026 \times 10^2 \text{ eV}^{-1} \approx 1.449 \times 10^{-13} \text{ s}.$$

The geometric phase is determined by the T0 quantum numbers (n, ℓ, j) :

$$\phi_{\text{geo},i} \propto f(n, \ell, j) \cdot \frac{L}{E} \cdot \frac{1}{T_x},$$

where $f(n, \ell, j) = \frac{n^6}{\ell^3}$ (or 1 for $\ell = 0$) are the geometric factors:

$$f_{\nu_e} = 1, \tag{11}$$

$$f_{\nu_\mu} = 64, \tag{12}$$

$$f_{\nu_\tau} = 91.125. \tag{13}$$

Calculated Phase Differences:

$$\phi_{\nu_e} \propto 1 \cdot \frac{L}{E} \cdot \frac{1}{T_x}, \tag{14}$$

$$\phi_{\nu_\mu} \propto 64 \cdot \frac{L}{E} \cdot \frac{1}{T_x}, \tag{15}$$

$$\phi_{\nu_\tau} \propto 91.125 \cdot \frac{L}{E} \cdot \frac{1}{T_x}. \tag{16}$$

These phase differences could cause oscillations between flavor states without requiring different masses. The exact form of the oscillation probability requires further development but remains highly speculative.

WARNING: This approach is purely hypothetical and lacks empirical confirmation. It contradicts the established theory that oscillations are caused by $\Delta m_{ij}^2 \neq 0$.

4 Fundamental Constants and Units

4.1 Base Parameters

T0 Base Constants:

$$\xi = \frac{4}{3} \times 10^{-4} \approx 1.333333 \times 10^{-4} \quad [\text{dimensionless}] \tag{17}$$

$$\frac{\xi^2}{2} = \frac{\left(\frac{4}{3} \times 10^{-4}\right)^2}{2} \approx 8.888888 \times 10^{-9} \quad [\text{dimensionless}] \tag{18}$$

$$v = 246.22 \text{ GeV} \quad [\text{Higgs VEV}] \tag{19}$$

$$\hbar c = 0.19733 \text{ GeV} \cdot \text{fm} \quad [\text{Conversion constant}] \tag{20}$$

$$T_x = \frac{1}{4.54 \times 10^{-3} \text{ eV}} \approx 2.2026 \times 10^2 \text{ eV}^{-1} \approx 1.449 \times 10^{-13} \text{ s} \quad [\text{T0 Mass}] \tag{21}$$

4.2 Unit Conventions

Consistent Unit Hierarchy:

$$\text{Standard: } \text{GeV} \quad (22)$$

$$\text{Submultiples: } 1 \text{ eV} = 10^{-9} \text{ GeV} \quad (23)$$

$$1 \text{ meV} = 10^{-12} \text{ GeV} = 10^{-3} \text{ eV} \quad (24)$$

$$\text{Masses: } m[\text{GeV}/c^2] = E[\text{GeV}]/c^2 \approx E[\text{GeV}] \text{ (natural units)} \quad (25)$$

$$\text{Time: } 1 \text{ eV}^{-1} \approx 6.582 \times 10^{-16} \text{ s} \quad (26)$$

5 Charged Lepton Reference Masses

5.1 Precise Experimental Values (PDG 2024)

Verified Particle Masses:

$$m_e = 0.51099895000 \times 10^{-3} \text{ GeV} = 510.99895 \text{ keV} \quad (27)$$

$$m_\mu = 105.6583745 \times 10^{-3} \text{ GeV} = 105.6583745 \text{ MeV} \quad (28)$$

$$m_\tau = 1776.86 \times 10^{-3} \text{ GeV} = 1.77686 \text{ GeV} \quad (29)$$

Unit Conversion to eV:

$$m_e = 510998.95 \text{ eV} = 510998950 \text{ meV} \quad (30)$$

$$m_\mu = 105658374.5 \text{ eV} \quad (31)$$

$$m_\tau = 1776860000 \text{ eV} \quad (32)$$

6 Neutrino Quantum Numbers (T0 Hypothesis)

6.1 Postulated Quantum Number Assignment

Hypothetical Neutrino Quantum Numbers:

$$\nu_e : n = 1, \ell = 0, j = 1/2 \quad [\text{Ground state neutrino}] \quad (33)$$

$$\nu_\mu : n = 2, \ell = 1, j = 1/2 \quad [\text{First excitation}] \quad (34)$$

$$\nu_\tau : n = 3, \ell = 2, j = 1/2 \quad [\text{Second excitation}] \quad (35)$$

Role of Quantum Numbers: The quantum numbers do not affect neutrino masses (since $m_{\nu_e} = m_{\nu_\mu} = m_{\nu_\tau}$) but determine the geometric factors $f(n, \ell, j)$, which govern the oscillation phases.

WARNING: These assignments are purely speculative and lack experimental basis.

6.2 Geometric Factors

T0 Geometric Factors:

$$f(n, \ell, j) = \frac{n^6}{\ell^3} \quad \text{for } \ell > 0 \quad (36)$$

$$f(1, 0, j) = 1 \quad \text{for } \ell = 0 \text{ (special case)} \quad (37)$$

Calculated Values:

$$f_{\nu_e} = f(1, 0, 1/2) = 1 \quad (38)$$

$$f_{\nu_\mu} = f(2, 1, 1/2) = \frac{2^6}{1^3} = 64 \quad (39)$$

$$f_{\nu_\tau} = f(3, 2, 1/2) = \frac{3^6}{2^3} = \frac{729}{8} = 91.125 \quad (40)$$

7 Neutrino Mass Formula

7.1 T0 Hypothesis: Equal Masses with Geometric Phases

T0 Hypothesis: Equal Neutrino Masses with Geometric Phases

The T0 model postulates that all flavor states (ν_e, ν_μ, ν_τ) have the same mass:

$$m_{\nu_e} = m_{\nu_\mu} = m_{\nu_\tau} = m_\nu = 4.54 \text{ meV}.$$

The mass is derived from the photon analogy:

$$m_\nu = \frac{\xi^2}{2} \times m_e = (8.888888 \times 10^{-9}) \times (0.51099895 \times 10^{-3} \text{ GeV}) = 4.54 \text{ meV}.$$

To explain oscillations, a geometric mechanism is postulated based on the T0 relation:

$$T_x \cdot m_x = 1, \quad m_x = 4.54 \text{ meV}, \quad T_x \approx 2.2026 \times 10^2 \text{ eV}^{-1} \approx 1.449 \times 10^{-13} \text{ s}.$$

The oscillation phases are determined by geometric factors $f(n, \ell, j)$:

$$\phi_{\text{geo},i} \propto f_{\nu_i} \cdot \frac{L}{E} \cdot \frac{1}{T_x},$$

where $f_{\nu_e} = 1$, $f_{\nu_\mu} = 64$, $f_{\nu_\tau} = 91.125$.

Rationale:

- The mass 4.54 meV is consistent with the cosmological constraint ($\Sigma m_\nu = 0.01362 \text{ eV} < 0.07 \text{ eV}$).
- Geometric phases enable oscillations without mass differences, supporting the equal-mass hypothesis.
- This hypothesis is highly speculative and lacks empirical confirmation.

Formula: $m_{\nu_i} = 4.54 \text{ meV}$

Total Mass:

$$\Sigma m_\nu = 3 \times 4.54 \text{ meV} = 13.62 \text{ meV} = 0.01362 \text{ eV}$$

Comparison with Plausible Target Value:

- ν_e, ν_μ, ν_τ : 4.54 meV vs. 15 meV (Agreement: 30.3%)
- Σm_ν : 13.62 meV vs. 45 meV (Deviation: Factor ≈ 3.30)

CRITICAL FINDING: The hypothesis of equal masses with geometric phases is incompatible with experimental oscillation data ($\Delta m_{21}^2 \approx 7.53 \times 10^{-5} \text{ eV}^2$, $\Delta m_{32}^2 \approx 2.44 \times 10^{-3} \text{ eV}^2$), as it implies $\Delta m_{ij}^2 = 0$. The geometric approach is purely speculative and requires further theoretical and experimental validation.

8 Plausible Target Value Based on Empirical Data

8.1 Derivation from Measurements

Plausible Target Value: The T0 model postulates equal masses for all flavor states (ν_e, ν_μ, ν_τ). Thus, a single target value for the neutrino mass m_ν is derived based on empirical data (as of 2025):

- Cosmological Constraint: $\Sigma m_\nu = 3m_\nu < 0.07 \text{ eV} \implies m_\nu < 23.33 \text{ meV}$.
- Oscillation Data: $\Delta m_{21}^2 \approx 7.53 \times 10^{-5} \text{ eV}^2$, $\Delta m_{32}^2 \approx 2.44 \times 10^{-3} \text{ eV}^2$, typically requiring different masses. The T0 model bypasses this via geometric phases.
- Plausible Target Value: $m_\nu \approx 15 \text{ meV}$, lying between the solar (8.68 meV) and atmospheric scales (50.15 meV) and satisfying the cosmological constraint:

$$\Sigma m_\nu = 3 \times 15 \text{ meV} = 45 \text{ meV} = 0.045 \text{ eV} < 0.07 \text{ eV}.$$

Rationale:

- The target value is consistent with the cosmological constraint and lies within the order of magnitude of oscillation data.
- The equal-mass hypothesis is supported by geometric phases, distinguishing the T0 model from standard physics.
- The value is plausible but not directly measured, as flavor masses are mixtures of eigenstates.
- The T0 mass (4.54 meV) is below the target value (30.3%) but also cosmologically consistent.

9 Experimental Comparison

9.1 Current Experimental Upper Limits (2025)

Experimental Limits:

$$m_{\nu_e} < 0.45 \text{ eV} \quad [\text{KATRIN, 90\% CL}] \quad (41)$$

$$m_{\nu_\mu} < 0.17 \text{ MeV} \quad [\text{Muon decay, indirect}] \quad (42)$$

$$m_{\nu_\tau} < 18.2 \text{ MeV} \quad [\text{Tau decay, indirect}] \quad (43)$$

$$\Sigma m_\nu < 0.07 \text{ eV} \quad [\text{DESI+Planck, 95\% CL}] \quad (44)$$

$$\Delta m_{21}^2 \approx 7.53 \times 10^{-5} \text{ eV}^2 \quad [\text{Solar}] \quad (45)$$

$$\Delta m_{32}^2 \approx 2.44 \times 10^{-3} \text{ eV}^2 \quad [\text{Atmospheric}] \quad (46)$$

$$m_\nu > 0.06 \text{ eV} \quad [\text{At least one neutrino, } 3\sigma] \quad (47)$$

9.2 Safety Margins for T0 Hypothesis

Table 1: Safety Margins of the T0 Hypothesis Against Experimental Limits

Parameter	T0 Mass (4.54 meV)	Target Value (15 meV)
m_{ν_e} vs 0.45 eV	$99200\times$	$30\times$
m_{ν_μ} vs 0.17 MeV	$3.74\text{E}7\times$	$11333\times$
m_{ν_τ} vs 18.2 MeV	$4.01\text{E}9\times$	$1.21\text{E}6\times$
Σm_ν vs 0.07 eV	$5.14\times$	$1.56\times$
Σm_ν vs 0.06 eV	$4.41\times$	$1.33\times$

T0 Hypothesis:

- The T0 mass (4.54 meV) is consistent with cosmological constraints ($\Sigma m_\nu = 0.01362 \text{ eV} < 0.07 \text{ eV}$) and lies below the target value (15 meV, 30.3%).
- Geometric phases ($T_x \cdot m_x = 1$) provide a speculative mechanism for oscillations but are incompatible with standard oscillations.
- Physical Rationale: The mass is based on $\frac{\xi^2}{2}$ -suppression, consistent with the speed difference $v_\nu = c \times \left(1 - \frac{\xi^2}{2}\right)$.

10 Consistency Checks and Validation

10.1 Dimensional Analysis

Dimensional Consistency:

$$[\xi] = 1 \quad \checkmark \text{ dimensionless} \quad (48)$$

$$[m_e] = \text{GeV} \quad \checkmark \text{ energy/mass} \quad (49)$$

$$\left[\frac{\xi^2}{2} \times m_e\right] = \text{GeV} \quad \checkmark \text{ energy/mass} \quad (50)$$

$$[f_{\nu_i}] = 1 \quad \checkmark \text{ dimensionless} \quad (51)$$

$$[m_\nu] = \text{eV} \quad \checkmark \text{ (fixed mass)} \quad (52)$$

$$[T_x] = \text{eV}^{-1} \quad \checkmark \text{ (time)} \quad (53)$$

All formulas are dimensionally consistent.

10.2 Mathematical Consistency

Consistency of the Hypothesis:

- The formula $m_\nu = \frac{\xi^2}{2} \times m_e = 4.54 \text{ meV}$ is physically grounded in the photon analogy and consistent with the speed difference.
- Geometric phases based on $f(n, \ell, j)$ and $T_x \cdot m_x = 1$ provide a speculative mechanism for oscillations.
- No free parameters except ξ , simplifying the theory.

10.3 Experimental Validation

Validation Status (as of 2025):

- The T0 mass (4.54 meV) satisfies cosmological constraints ($\Sigma m_\nu = 0.01362 \text{ eV} < 0.07 \text{ eV}$) and is close to the target value (15 meV, 30.3%).
- Incompatible with standard oscillations ($\Delta m_{ij}^2 = 0$), but geometric phases offer a speculative workaround.
- The target value (15 meV) is consistent with cosmological constraints but not directly measured.

11 Conclusion

Summary and Outlook:

- The T0 model postulates equal neutrino masses ($m_\nu = 4.54 \text{ meV}$) based on the photon analogy ($\frac{\xi^2}{2} \times m_e$), consistent with the speed difference ($v_\nu = c \times \left(1 - \frac{\xi^2}{2}\right)$).
- Geometric phases based on $T_x \cdot m_x = 1$ and quantum numbers ($f_{\nu_e} = 1$, $f_{\nu_\mu} = 64$, $f_{\nu_\tau} = 91.125$) speculatively explain oscillations without mass differences.
- The plausible target value ($m_\nu = 15 \text{ meV}$) is derived from empirical data (cosmological constraint) and lies within the order of magnitude of oscillation data but is not directly measured.
- The T0 mass (4.54 meV) is reasonably close to the target value (30.3%), satisfies cosmological constraints, but is incompatible with standard oscillations.
- The T0 model remains speculative, relying on geometric harmonies without empirical basis.
- Future experiments (2025–2030, e.g., KATRIN upgrade, DESI, Euclid) could further test or refute the T0 hypothesis, particularly the geometric oscillation mechanism.
- Scientific integrity requires clearly communicating the speculative nature of the T0 model and awaiting further tests.

References

- [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, *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/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 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 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 T_0 Theory*, 2025. https://github.com/jpascher/T0-Time-Mass-Duality/blob/main/2/pdf/Zusammenfassung_En.pdf
- [182] J. Pascher, *RSA in T_0 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, *T_0 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, *T_0 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, *Ξ 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