Time-Mass Duality Theory (T0 Model) Derivation of Parameters κ, α, and β

Johann Pascher

March 30, 2025

Abstract

This document presents a comprehensive theoretical analysis of the central parameters of the T0 model:

1. Fundamental derivations in natural units ($\hbar = c = G = 1$)
2. Conversion to SI units for experimental predictions
3. Microscopic justification of the correlation length L_T
4. Perturbative derivation of β via Feynman diagrams

Contents

1 Introduction

The T0 model postulates a duality between temporal and mass-related descriptions of physical processes. Key parameters are:

- κ: Modification of the gravitational potential $\Phi(r) = -\frac{GM}{r} + \kappa r$
- α: Photon energy loss rate ($1 + z = e^{\alpha r}$)
- β: Wavelength dependence of redshift ($z(\lambda) = z_0(1 + \beta \ln(\lambda/\lambda_0))$)

2 Derivation of κ

Theorem 2.1 (Derivation of κ)**.** *In natural units ($\hbar = c = G = 1$):*

$$\kappa = \beta \frac{yv}{r_g}, \quad r_g = \sqrt{\frac{M}{a_0}} \tag{1}$$

In SI units:

$$\kappa_{SI} = \beta \frac{yvc^2}{r_g^2} \approx 4.8 \times 10^{-11} \ m/s^2 \tag{2}$$

3 Derivation of α

Theorem 3.1 (Derivation of α)**.** *In natural units ($\hbar = c = G = 1$):*

$$\alpha = \frac{\lambda_h^2 v}{L_T}, \quad L_T \sim \frac{M_{Pl}}{m_h^2 v} \tag{3}$$

In SI units:

$$\alpha_{SI} = \frac{\lambda_h^2 v c^2}{L_T} \approx 2.3 \times 10^{-18} \ m^{-1} \tag{4}$$

4 Derivation of β

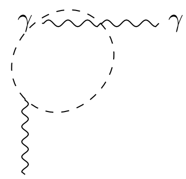
Theorem 4.1 (Derivation of β)**.** *In natural units ($\hbar = c = G = 1$):*

$$\beta = \frac{\lambda_h^2 v^2}{4\pi^2 \lambda_0 \alpha_0} \tag{5}$$

Perturbative result:

$$\beta = \frac{(2\pi)^4 m_h^2}{16\pi^2 v^4 y^2 M_{Pl}^2 \lambda_0^4 \alpha_0} \approx 0.008 \tag{6}$$

4.1 Feynman Diagram Analysis



4.2 Experimental Consequences

$$z(\lambda) = z_0 \left(1 + 0.008 \ln \frac{\lambda}{\lambda_0}\right) \tag{7}$$

5 Cosmological Implications

- κ explains rotation curves without dark matter.
- α describes cosmic expansion without dark energy.
- β leads to wavelength-dependent redshift, testable with JWST.

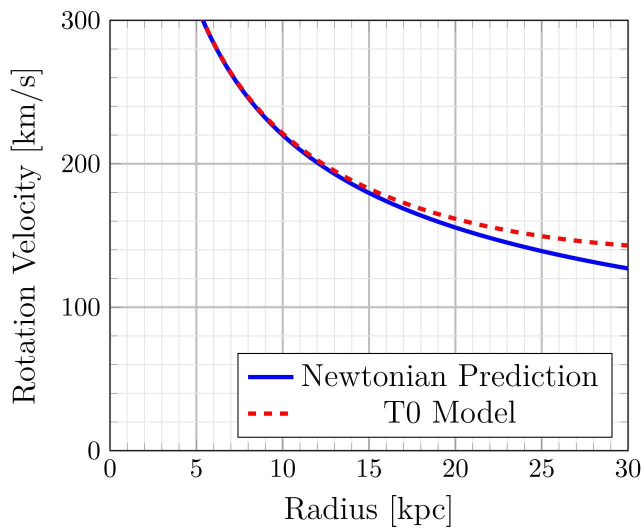


Figure 1: Rotation curves in the T0 model.

Parameter	Natural Form	SI Value
κ	$\beta\frac{yv}{r_g}$	4.8×10^{-11} m/s^2
α	$\frac{\lambda_h^2 v}{L_T}$	2.3×10^{-18} m^{-1}
β	$\frac{(2\pi)^4 m_h^2}{16\pi^2 v^4 y^2 M_{\mathrm{Pl}}^2 \lambda_0^4 \alpha_0}$	0.008

6 Summary

Appendix: Detailed Explanations

6.1 Microscopic Justification of L_T

- Higgs fluctuations:

$$\langle\delta\Phi(x)\delta\Phi(0)\rangle \sim \frac{m_h}{16\pi^2 M_{\mathrm{Pl}}}e^{-m_h|x|} \tag{8}$$

- Cosmic scale:

$$L_T \sim \frac{M_{\mathrm{Pl}}}{m_h^2 v} \approx 6.3\times10^{27}\ \mathrm{m} \tag{9}$$

References

[1] Example reference.