TauTimp — **Redshift** from Spatial Flux Growth Rate Onduscular Theory (13Mai2026) Viorel-Mihai Popescu

Abstract

Within the TauTimp (Temporal Undulatory Theory) framework, the cosmological redshift is reinterpreted not as a Doppler effect of recessional velocity but as a consequence of the **spatial flux growth rate** $\Lambda(r)$ generated by the propagation of muon neutrinos (μ_ν) through the onduscular medium. Starting from the variable-coefficient spherical wave equation, we derive the muon neutrino flux $P(r,t)$, extract the spatial growth integrand $\Lambda(r)$, and show that integrating $\Lambda(r)$ from the epoch of first stellar formation ($r_{\min} = 0.431$ Gly) to the onduscular boundary ($2R_s \approx 16.419$ Gly) recovers the observed comoving size of the Local Universe (≈ 93 Gly). The boundary condition yields $R_s = 8.20933$ Gly and an event horizon of $2R_s \approx 16.419$ Gly.

0. Physical Parameters

Symbol	Value	Units	Notes
R_s	7.7664618×10^{25}	m	Onduscular sphere radius
R_s	8.20933	Gly	= 8.20933 billion light-years
$2R_s$	1.5533×10^{26}	m	= 16.419 Gly (event horizon)
R	3.9228×10^{22}	m	= 4.147 million light-years
$r_{\min}$ (cosmological)	0.431	Gly	Epoch of first star formation
$r_{\min}$ (muon flux)	0.290	Gly	Inner onduscular boundary
c	2.99792458×10^{8}	m/s	Speed of light
H_0	67.41	km/s/Mpc	Planck 2018
c/H_0	1.37229×10^{26}	m = 14.505 Gly	Hubble horizon

1. Governing Equation — Onduscular Wave Equation 1.1 The Variable-Coefficient Spherical Wave Equation

The onduscular wave equation for a scalar field $f(r,t)$ under spherical symmetry is: $\boxed{\frac{R_s}{r}\left(f_{rr} + \frac{2}{r} f_r\right) = \frac{1}{c^2} f_{tt}}$

where R_s is the onduscular cosmological radius, r is the radial coordinate, t is cosmic time, and c is the speed of light. This equation has a variable coefficient R_s/r in contrast to the standard wave equation, encoding the coupling between the onduscular medium geometry and wave propagation.

1.2 Physical Interpretation of the Variable Coefficient

The factor R_s/r acts as a **geometric coupling**: at small $r \ll R_s$, the coupling is large (strong onduscular influence); at the boundary $r = 2R_s$, it diminishes to $1/2$. This spatial gradient of coupling is the fundamental origin of the non-linear spatial flux profile $\Lambda(r)$.

2. Muon Neutrino Speed Constraint

The muon neutrino (μ_ν) is treated as a Dirac neutrino with spin quantum number $s = -1/2$, traveling at the speed of light. The condition $|\boldsymbol{v}_\mu| = c$ is expressed via the divergence operator in generalized coordinates $(r,\ ct)$:

$$\frac{df(r,t)}{dt} = \frac{\partial[u(t)\,g(r)]}{\partial t} + \frac{\partial[u(t)\,g(r)]}{\partial r}\cdot\frac{dr}{dt} = c \tag{2}$$

Since $dr/dt = c$ for any r (the muon neutrino propagates at c), equation (2) becomes:

$$g(r)\,\frac{\partial u}{\partial t} + u(t)\,\frac{\partial g}{\partial r}\cdot c = c \tag{3}$$

This is the **space growth constraint**: the total rate of change of the onduscular field equals c at all times and positions, establishing that the space generation rate is constant and equal to c.

3. Muon Neutrino Flux Equation

3.1 Klein–Gordon / Wave Equation for the Flux Density

The probability flux $P(r,t)$ (neutrino flux per unit radial interval) satisfies the standard 1D wave equation in the radial coordinate: $\frac{1}{c^2}\frac{\partial^2 P}{\partial t^2} - \frac{\partial^2 P}{\partial r^2} = 0$

Boundary condition: $P(2R_s,\ t) = 0$ (zero flux at the onduscular boundary).

Initial derivative condition: $\partial_r P|_{r=0,\,t=0} = -R = -3.9228 \times 10^{22}$ m (fixed by the onduscular parameter R).

Normalization: $\int_{r_{\min}}^{2R_s} P\,(r,0)\,dr = 1$

3.2 General Solution via d'Alembert

The general solution of equation (4) is:

$$P(r,t) = F(r+ct) + G(r-ct)$$

where F and G are determined by initial conditions. With $P_1(r) = \partial_t P|_{t=0}$ and the factored form for $P(r,0)$:

$$\boxed{P(r,t) = C[(r - r_{\min})(2R_s - r) - c^2t^2]}$$

At $t = 0$:

$$P(r,0) = C\,(r - r_{\min})\,(2R_s - r)$$

This bell-shaped polynomial vanishes at both boundaries $r = r_{\min}$ and $r = 2R_s$, and is positive on the physical domain $(r_{\min}, 2R_s)$.

4. Spatial Flux Density 4.1 Definition

The onduscular spatial flux per unit surface area at $t = 0$ is:

$$\Lambda_{\text{flux}}(r) = \frac{P(r,0)}{4\pi r^2} = \frac{C}{4\pi} \cdot \frac{(r - r_{\min})(2R_s - r)}{r^2}$$

4.2 Normalization Coefficient C

From the Hubble-horizon normalization:

$$\int_{r_{\min}}^{2R_s} \Lambda_{\text{flux}}(r)\, dr = \frac{c}{H_0}$$

This identity connects the integrated onduscular flux to the Hubble horizon $R_H = c/H_0$. The analytic evaluation gives:

$$\mathcal{G} \equiv \int_{r_{\min}}^{2R_s} \frac{(r - r_{\min})(2R_s - r)}{r^2}\, dr = (r_{\min} + 2R_s)\ln\frac{2R_s}{r_{\min}} - 2(2R_s - r_{\min}) = 3.3285 \times 10^{26}\ \text{m}$$

Hence:

$$\boxed{C = \frac{4\pi c}{H_0\, \mathcal{G}} = 5.1809\ \text{m}^{-2}}$$

5. Spatial Flux Growth Rate $\Lambda(r)$ and Redshift 5.1 Expanded Form of $\Lambda(r)$

After solving the PDE and extracting the spatial growth integrand as a Laurent series about $r = 0$, the **spatial flux growth rate** takes the form:

$$\boxed{\Lambda(r) = \frac{43.1072}{r^2} - \frac{0.6533}{r} - 0.12012}$$

where r is in billions of light-years. The coefficient $C_2 = -8c^2R_sc_2/7 + 4c_2/7$ is determined by the boundary condition at $r = 2R_s$:

$$c_2 = -\frac{8\,c^2 R_s}{7} + \frac{4}{7}c^2$$

5.2 Full Spatial Flux Solution at $t = 0$

$$\Lambda_{\text{flux}}(r)|_{t=0} = \frac{4R_s^2c^2 - 4c_2R_s^2}{8\pi c^2} \cdot \frac{1}{r^2} - \frac{R_s}{4\pi} \cdot \frac{1}{r} + \frac{c_2}{8\pi c^2}$$

with $R_s = 8.2$ Gly and $c = 3$ (normalized units):

$$\Lambda(r) = \frac{43.1072}{r^2} - \frac{0.6533}{r} - 0.12012$$

5.3 Indefinite Integral (Antiderivative)

$$\int \Lambda(r)\,dr = -\frac{43.10796}{r} - 0.6532788\ln r - 0.1201207\,r + \text{const} \tag{13}$$

where r is in billions of light-years.

6. Comoving Distance Prediction 6.1 Integration from First Stars to the Onduscular Boundary

Starting from the epoch of first star formation at $r_{\min} = 0.431$ Gly (431 million years after the Big Bang), integrating $\Lambda(r)$ to the onduscular boundary $2R_s \approx 16.419$ Gly:

$$\int_{0.431}^{16.419} \Lambda(r)\,dr = 93\;\text{Gly} \tag{14}$$

This result **reproduces the observed comoving diameter of the Local Universe** ($\approx$ 93 billion light-years), providing empirical support for the TauTimp framework.

Physical interpretation: The lower limit $r = 0.431$ Gly corresponds to the moment space (via μ neutrino propagation) and time (via τ neutrino / photon emission from first stars) were simultaneously created within the Local Universe. The upper limit $2R_s$ is the onduscular event horizon.

6.2 Cosmological Boundary Conditions

The TauTimp model is parametrized by:

Parameter	Value	Physical meaning
$2R_s$	$\approx$ 16.419 Gly	Onduscular event horizon (Local Universe boundary)
$r_{\min}$	0.431 Gly	Epoch of first star formation
$\int \Lambda\, dr$	93 Gly	Total comoving size of Local Universe
H_0	67.41 km/s/Mpc	Hubble constant (derived from onduscular parameters)

7. Physical Interpretation of the Redshift 7.1 TauTimp Mechanism

In the standard ΛCDM model, redshift arises from the expansion of space encoded in the scale factor $a(t)$. In TauTimp, redshift arises from the **spatial flux growth rate** $\Lambda(r)$:

> A photon emitted at comoving distance r travels through an onduscular medium whose metric is set by $\Lambda(r)$. The greater the distance, the more "new space" — generated by μ neutrino propagation — the photon must traverse, stretching its wavelength.

The standard redshift relation $1 + z = \lambda_{\text{obs}}/\lambda_{\text{rest}}$ is reinterpreted as: $1 + z(r) = 1 + \frac{\Delta\lambda}{\lambda} \propto \int_0^r \Lambda(r')\, dr'$

7.2 Non-linear Radial Dependence

Because $\Lambda(r) \propto r^{-2}$ at small r, the growth rate is **strongly non-linear**:

- $r < 4$ **Gly:** $\Lambda(r)$ is large; photons are redshifted significantly per unit comoving distance. The model predicts a steeper-than-Hubble relation at small distances.
- $r \sim 4$–13 **Gly:** $\Lambda(r)$ has fallen close to zero. Space growth per additional Gly is negligible. This naturally accounts for the apparent acceleration observed in Type Ia supernova surveys — in TauTimp, it is not acceleration but the *decrease of near-zone spatial flux* that creates the illusion.
- $r \to 2R_s$**:** $\Lambda(r) \to 0$. No new space is generated at the onduscular boundary. Photons from sources at the Local Universe edge carry the maximum accumulated redshift.

7.3 The 5th Force — Torsion

TauTimp introduces a **torsion force** as the 5th fundamental interaction:

- For $r < 2R = 2 \times 3.9228 \times 10^{22}$ m $= 8.294$ million Gly: gravity is **attractive**.
- For $r > 2R$: the torsion force is **repulsive**, driving the apparent large-scale acceleration.

This explains the filamentary structure of the cosmic web (SDSS observations): individual stars within galaxy filaments are closer than $2R$, so gravity holds them together; on scales beyond $2R$, torsion generates the observed voids and web topology.

8. Galaxy GN-z11 as a Test Case

The high-redshift galaxy GN-z11 ($z \approx 10.96$) provides a quantitative test. In TauTimp:

- Proper distance at emission: ≈ 1.187 Gly.
- Space expansion factor: ≈ 12.1 (i.e., $1 + z \approx 12.1$).
- Current comoving distance: ≈ 14.36 Gly.
- Total light travel time: ≈ 13.4 Gyr.
- With parameters $\Omega_M = 0.018$, $\Omega_\Lambda = 1$, $H_0 = 69.6$ km/s/Mpc, the cosmological calculator gives: age at redshift z: 1.39 Gyr; comoving radial distance: 82–84.8 Gly; light travel time: ~ 24 Gly.

The TauTimp prediction for the comoving distance at $z \sim 10.96$ is consistent with the ΛCDM-compatible calculator values within the framework's parameter space.

9. Onduscular Hubble Constant Derivation

A central result of TauTimp is that H_0 is not a free parameter but is **derived** from the onduscular geometry:

$$\boxed{H_0 = \frac{4\pi\, c}{C\left[(r_{\min} + 2R_s)\ln\dfrac{2R_s}{r_{\min}} - 2(2R_s - r_{\min})\right]}}$$

With $r_{\min} = 0.290$ Gly and $R_s = 8.2089$ Gly, this gives:

$$H_0 = 67.41\ \mathrm{km\,s^{-1}Mpc^{-1}}$$

in agreement with the Planck 2018 result ($H_0 = 67.4 \pm 0.5$ km/s/Mpc). This constitutes a **postdiction**: the onduscular parameters fix the Hubble constant analytically.

10. Summary of Key Results

Result	Formula / Value
Onduscular wave equation	$(R_s/r)(f_{rr} + 2f_r/r) = f_{tt}/c^2$
Muon neutrino flux $P(r, 0)$	$C(r - r_{\min})(2R_s - r)$
Normalization constant C	$4\pi c/(H_0\, \mathcal{G}) = 5.1809\ \mathrm{m}^{-2}$
Analytic $\mathcal{G}$	$(r_{\min} + 2R_s)\ln(2R_s/r_{\min}) - 2(2R_s - r_{\min}) = 3.3285 \times 10^{26}$ m
Spatial growth rate $\Lambda(r)$	$43.1072/r^2 - 0.6533/r - 0.12012$ (Gly units)
Comoving Universe size	$\int_{0.431}^{16.419} \Lambda\, dr = 93$ Gly
H_0 (derived)	$4\pi c/(C\, \mathcal{G}) = 67.41$ km/s/Mpc
Onduscular boundary	$2R_s = 16.419$ Gly
Torsion force boundary	$2R = 8.294 \times 10^6$ ly
GN-z11 comoving distance	≈ 82–84.8 Gly

References

1. Planck Collaboration (2018). *Planck 2018 results. VI. Cosmological parameters.* A&A 641, A6.
2. Oesch, P. A. et al. (2016). *A remarkably luminous galaxy at z=11.1.* ApJ 819, 129. [GN-z11]
3. Wright, E. L. (2006). *A Cosmology Calculator for the World Wide Web.* PASP 118, 1711. https://www.astro.ucla.edu/~wright/CosmoCalc.html
4. Kim, J. et al. (2022). *Hyperuniformity and large-scale structure of the universe.* SDSS Large-Scale Structure Analysis.
5. Popescu, V.-M. (2025–2026). *Teoria Onduscular㠄(TauTimp) — Derivation of the Temporal Wave Equation.* Unpublished manuscript.

Document: TauTimp / Onduscular Theory — Redshift from Spatial Flux Growth Rate Author: Viorel-Mihai Popescu | Version: 13May 2026