A Physical and Mechanical Explanation of the Speed of Light

Focused Formulaic Review of Papers P61 & P23

The BFUT Spaticle Substrate Framework

Standard Relativity (Axiom)

$$c = \frac{1}{\sqrt{\mu_0 \varepsilon_0}}$$

Treated purely as a geometric postulate or definition. Offers no mechanical explanation for why a limit exists.

P61/P23 Framework (Derivation)

$$c = f(\text{Stiffness}, \text{Density})$$

$$c = f(\text{EM Coupling}, \text{Geometry})$$

c is a derived mechanical property of a physical medium.

$K_s = 5.30 \times 10^{-10}$ Pa
(Substrate Stiffness - The restoring force driving propagation)

$$c = \sqrt{K_s / \rho_s}$$

$\rho_s = 5.9 \times 10^{-27}$ kg/m^3
(Substrate Density - The inertial resistance to propagation)

The speed of light is not a fundamental property of photons. It is the maximum causal propagation rate of the Spaticle medium itself.

Condensation Geometry (P61 Eq. 1)

$$\hbar = \frac{m_p \cdot c \cdot r_p}{\pi \cdot R_0}$$

m_p : Proton mass (938.272 MeV/c^2)
r_p : Proton charge radius (0.8414 fm)
R_0 : Condensation minimum (1.27348)

The reduced Planck constant is mathematically locked to the geometry of the first stable substrate excitation, anchoring quantum mechanics to the physical substrate scale.

Standard EM Fine Structure:

$$\alpha = \frac{e^2}{4\pi\epsilon_0\hbar\, c}$$

BFUT Condensation Action:

$$\hbar = \frac{m_p \cdot c \cdot r_p}{\pi \cdot R_0}$$

$$R_0 = \frac{4\,\epsilon_0 \cdot m_p \cdot c^2 \cdot r_p \cdot \alpha}{e^2}$$

This substitution explicitly proves that macroscopic substrate geometry (R_0) and electromagnetic coupling (α) are mutually dependent.

The P61/P23 Consistency Derivation of c

$$c = \sqrt{\frac{e^2 \cdot R_0}{4\epsilon_0 \cdot m_p \cdot r_p \cdot \alpha}}$$

→ 2.9979 × 10^8 m/s
(0.0003% agreement)

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e, ϵ_0, m_p, r_p, α are independently measured parameters.

R_0 is independently derived from BFUT geometry.

No use of c as a prior input.

Factorization – The Physical Meaning of c^2

$$c^2 = \left(\frac{e^2}{4\epsilon_0}\right) \cdot \left(\frac{R_0}{m_p r_p}\right) \cdot \left(\frac{1}{\alpha}\right)$$

Electromagnetic Coupling Energy at unit distance

Condensation Geometry / Inertial Scale

EM Dilution Factor

The Propagation Budget

$$c^2 = v_{\text{spatial}}^2 + v_{\text{internal}}^2$$

Massless Limit (Photons/Gravitational Waves):

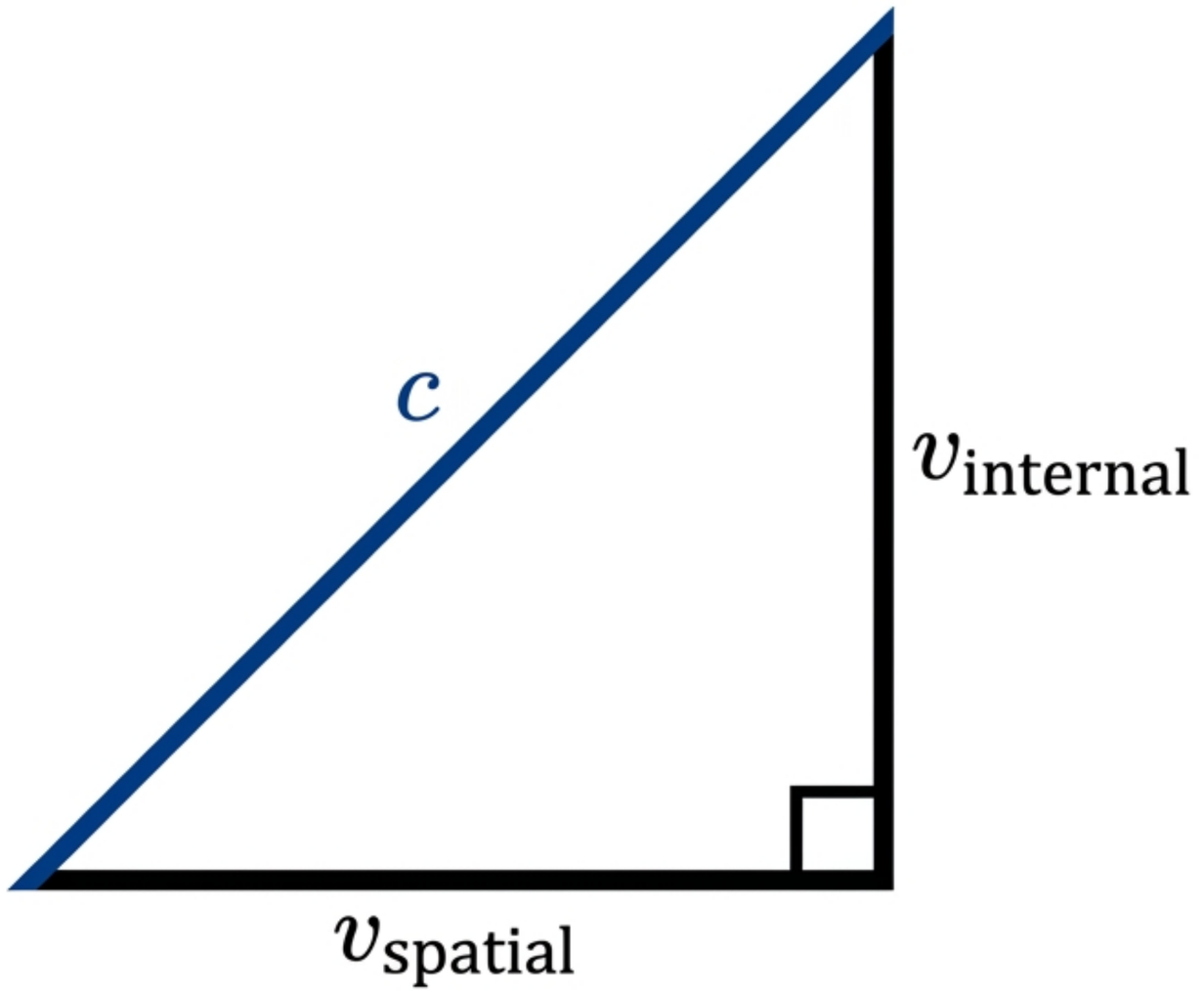
$$v_{\text{internal}} = 0 \rightarrow v_{\text{spatial}} = c.$$

Energy is dedicated 100% to spatial traversal.

Massive Limit:

$$v_{\text{internal}} > 0 \rightarrow v_{\text{spatial}} < c.$$

Energy is diverted to maintain condensational structure (rest mass).



Deriving the Lorentz Efficiency Factor

Step 1: From the budget equation:

$$v_{\text{internal}}^2 = c^2 - v_{\text{spatial}}^2$$

Step 2: Divide by c^2:

$$\frac{v_{\text{internal}}^2}{c^2} = 1 - \frac{v_{\text{spatial}}^2}{c^2}$$

Step 3: Define Propagation Efficiency (η): $\eta = \frac{v_{\text{internal}}}{c} = \sqrt{1 - \frac{v^2}{c^2}}$

The Lorentz factor is the exact fraction of the substrate budget available for internal processes. It dictates time dilation physically, not geometricaly.

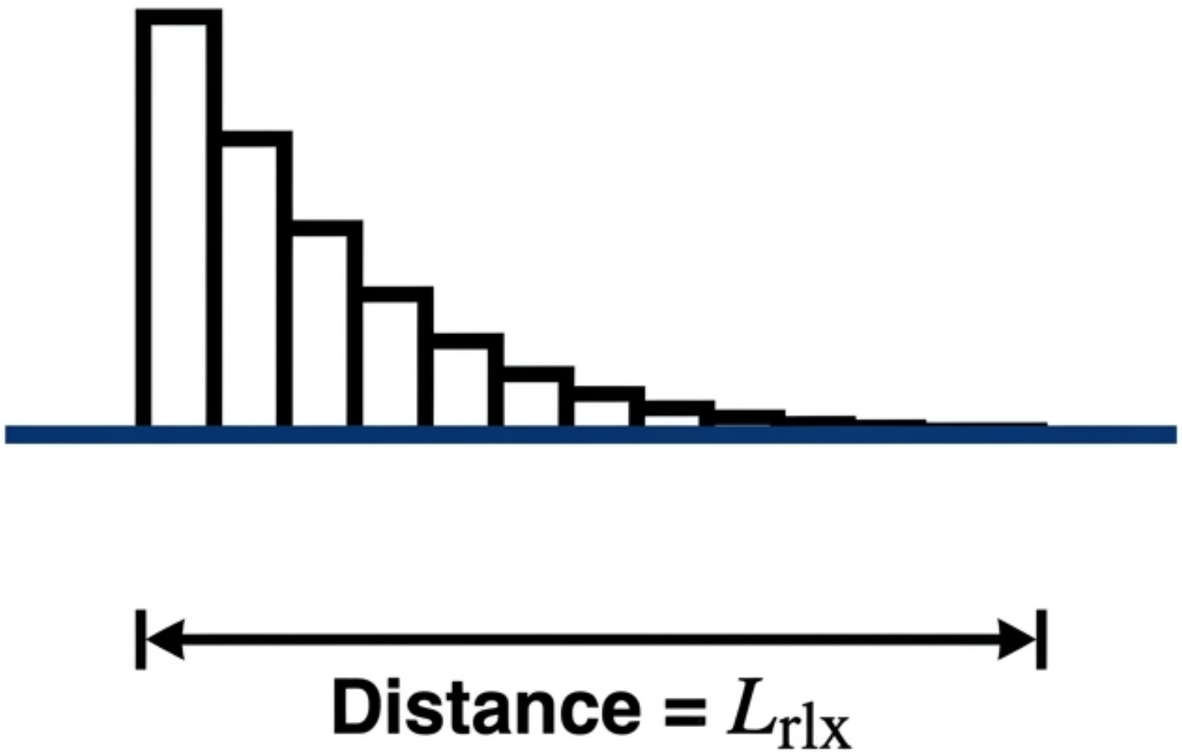
Carrier Dynamics & Relaxation

Carrier Relaxation Time:

$$\tau_c = \frac{1}{c\sqrt{3\rho_s}} = 4.6\ \text{ms}$$

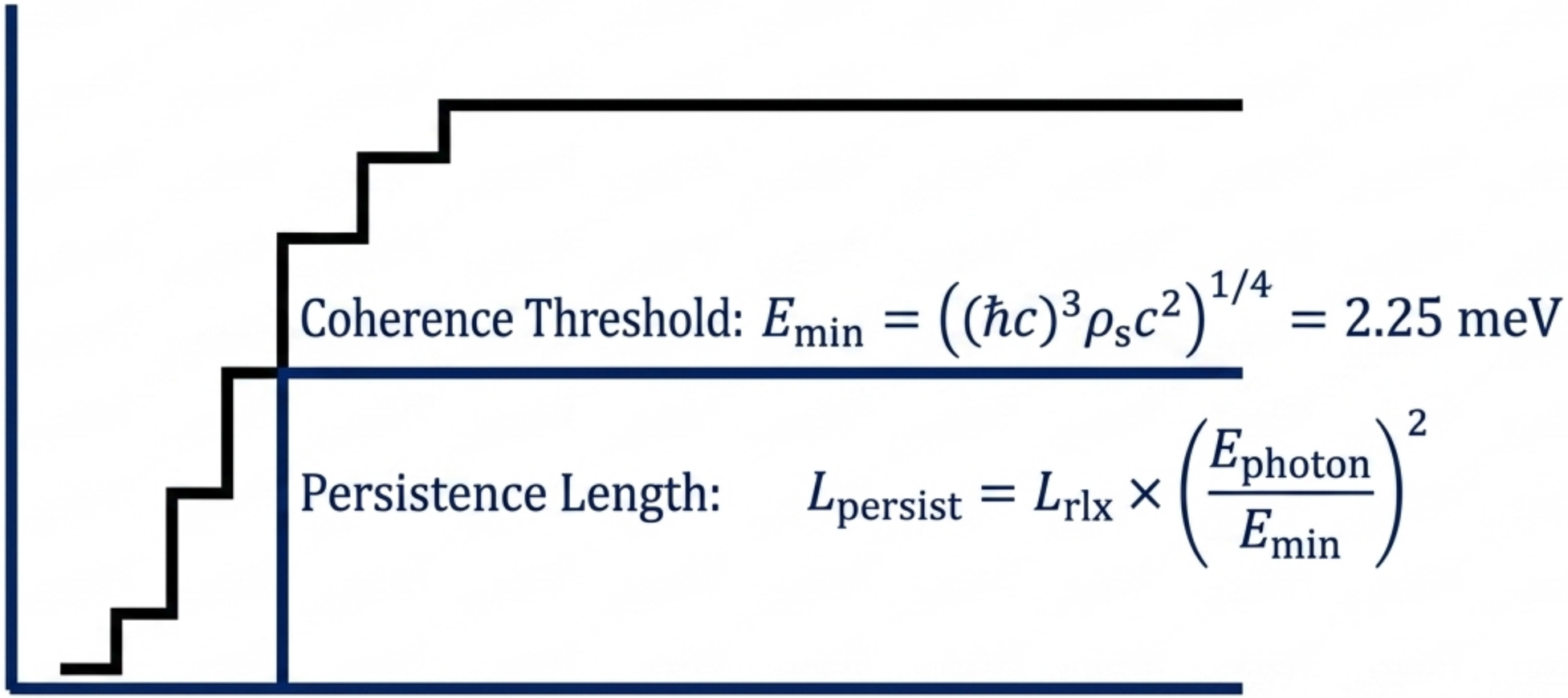
Substrate Relaxation Length:

$$L_{\text{rlx}} = c \cdot \tau_c = 1{,}380\ \text{km}$$



Context: This is the vacuum relaxation floor. The fastest the medium can structurally reorganize following a disturbance.

Photon Soliton Mechanics (Below the Speed Limit)



Insight: Photons only maintain stable soliton propagation at c when $E > E_{\min}$. Below this strict mathematical threshold, they dissolve into linear waves.

Synthesis Matrix – The Mathematical Paradigm Shift

Phenomenon	Standard Model Formula	BFUT (P61/P23) Derived Formula
Speed of Light	Axiomatic Postulate	$c = \sqrt{\frac{e^2 R_0}{4\varepsilon_0 m_p r_p \alpha}}$
Planck Constant	Empirical Fit	$\hbar = \frac{m_p c r_p}{\pi R_0}$
Lorentz Factor	Spacetime Geometry	$\eta = \frac{v_{internal}}{c}$ (Propagation Budget)
Massless Speed Equivalence	Unexplained Coincidence	Both EM & Gravitational waves lack condensation maintenance, utilizing 100% of c.

Light does not define the universal speed limit. The universal speed limit defines the behavior of light.

The finite propagation capacity of the Spaticle field determines the maximum rate at which organized physical reality can evolve.