

Absolute Theory: Propagation Dynamics of Light, Formation of Matter, and Black Hole Structure

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Abstract

Based on Absolute Theory, this paper presents the propagation dynamics of light: the constancy of the speed of light is maintained by a dynamic mechanism “front death, rear succession”, where the acceleration of the succeeding light equals the local gravitational acceleration $a = g$. This dynamics naturally yields gravitational redshift and blueshift. Matter emerges when light changes from linear motion in absolute space to circular motion around a fixed point in relative space, leading to a minimum mass unit $m_0 = 4G/c^3$ and radius $r_0 = 2G/c^2$, with energy $E = m_0 c^2 \approx 5.6 \text{ eV}$. The minimum mass unit is derived from the kinetic-potential energy balance $\frac{1}{2}mc^2 = Gm/r$ and the horizon condition $N = 1$. A new black hole model is proposed: mass concentrates on a thin horizon shell ($N = 1$); outward light cannot escape, while inward light propagates freely and converges at the center ($g = 0$) to form an extremely bright light core. Redshift and blueshift formulas are derived in both weak-field (linear) and strong-field (exponential) forms. The exponential strong-field redshift differs from that in general relativity, providing a decisive experimental test. The appendix presents self-consistent calculations of the radii of electrons, muons, and taus, which are consistent with experimental upper limits.

1 Propagation Dynamics of Light

In Absolute Theory, light propagates in absolute space at a constant speed c , and the locally observed speed of light is also c . The core dynamic mechanism is:

- **Front death, rear succession:** Light ahead continuously solidifies into mass (“dies”), and light behind must “succeed” to maintain continuity.
- **Wavelength stretching and acceleration:** To maintain succession, the wavelength of trailing light is stretched, which is equivalent to an acceleration a of the light wave, satisfying

$$\boxed{a = g}$$

where g is the local gravitational acceleration.

Critical point: Introduce the dimensionless direction number $N \equiv c/g$. When $N = 1$ (i.e., $c/g = 1$; in natural units $g = c$ numerically), the wavelength is infinitely stretched, the speed of light drops to zero, and light solidifies into mass — this defines the event horizon of a black hole.

2 Formation of Matter from Light

Light travels linearly in absolute space at speed c . When light moves in a circle around a fixed point in relative space (the observable “vacuum” of our universe), its motion changes from linear to circular, and light energy solidifies into mass to form matter. Thus, matter is the stable state of light in circular motion around a fixed point in relative space.

For the minimum stable unit, kinetic and potential energy balance:

$$\frac{1}{2}mc^2 = \frac{Gm}{r}$$

Canceling m gives the minimum radius:

$$r_0 = \frac{2G}{c^2}$$

Using the black hole horizon condition $N = 1$ (i.e., $c/g = 1$; in natural units $g = c$). Substituting $g = Gm/r^2$ and $r_0 = 2G/c^2$:

$$\frac{Gm_0}{(2G/c^2)^2} = c \quad \Rightarrow \quad m_0 = \frac{4G}{c^3}$$

Thus the minimum mass unit is:

$$m_0 = \frac{4G}{c^3}, \quad r_0 = \frac{2G}{c^2}, \quad E = m_0c^2 = \frac{4G}{c}$$

Numerically: $m_0 \approx 9.9 \times 10^{-36}$ kg, $E \approx 5.6$ eV.

3 Redshift and Blueshift Formulas

From the propagation dynamics ($a = g$), when light travels a distance Δh in a gravitational field, the energy change is:

$$\Delta E = m_{\text{vect}}g\Delta h = \frac{E}{c^2}g\Delta h, \quad m_{\text{vect}} = E/c^2$$

Using $E = h\nu$, we obtain the differential relation:

$$\frac{d\nu}{\nu} = -\frac{g}{c^2}dh$$

3.1 Weak-field approximation ($g\Delta h/c^2 \ll 1$)

$$z \approx \frac{g\Delta h}{c^2} \text{ (redshift)}, \quad z_{\text{blue}} \approx -\frac{g\Delta h}{c^2} \text{ (blueshift)}$$

3.2 Strong-field exact solution (exponential form)

Let $\Delta\Phi = \int g dh$ be the gravitational potential difference. Integration gives the exact strong-field redshift:

$$1 + z = \exp\left(\frac{\Delta\Phi}{c^2}\right)$$

For a Schwarzschild-type field, $\Delta\Phi = \frac{GM}{r_1} - \frac{GM}{r_2}$, so:

$$1 + z = \exp\left(\frac{GM}{c^2} \left(\frac{1}{r_1} - \frac{1}{r_2}\right)\right)$$

This formula reduces to the linear approximation in the weak field and grows exponentially in the strong field, differing from the square-root form in general relativity, thus providing a decisive test between the two theories.

4 Black Hole Structure: Horizon Shell and Internal Light Core

4.1 At the event horizon ($N = 1$)

The black hole event horizon is the critical surface at which $N = 1$. It is composed of numerous chaotic minimum mass units in dynamical equilibrium between light and matter.

- **Outward motion:** $N = 1$ infinitely stretches the wavelength, reduces light speed to zero, and prevents escape. Thus the black hole appears black to external observers.
- **Inward motion:** Inside the horizon, $N > 1$ (i.e., $g < c$), light propagates freely without solidifying into mass.

Black hole radius: From $N = c/g = 1$ we have $g = c$ (in natural units). Substituting $g = GM/R^2$ and restoring dimensions:

$$R = \frac{2GM}{c^2}$$

This is identical to the Schwarzschild radius. For a solar-mass black hole ($M = 2 \times 10^{30}$ kg), $R \approx 3$ km.

4.2 Inside the event horizon ($N > 1$)

The interior of a black hole is an absolute cavity with no mass distribution; all mass resides in the horizon shell. Light propagates linearly inside.

4.3 Central light core ($g = 0$)

All inward-moving light converges at the center, reflects and superimposes to form an extremely bright spot — the light core. This core is in a pure light state, with maximal energy density but no mass.

5 Conclusion

Absolute Theory provides a unified and self-consistent framework for light propagation, matter formation, gravitational redshift/blueshift, and black hole structure. The dynamical relation $a = g$ explains the constancy of the speed of light, gravitational spectral

shifts, and the horizon condition of black holes. The minimum mass unit arises naturally from the balance of kinetic and potential energy $\frac{1}{2}mc^2 = Gm/r$ together with the horizon condition $N = 1$. The black hole model avoids singularities and introduces a central light core. The exponential strong-field redshift formula differs from that of general relativity and is experimentally testable.

A Self-consistent Calculation of Lepton Radii and Comparison with Experiments

In Absolute Theory, **fundamental particles without internal structure** (electrons, muons, taus) share the “light core + shell” structure with black holes: a central light core ($g = 0$) surrounded by a shell composed of minimum mass units. Composite particles such as protons and neutrons are not described by this simple model.

A.1 Lepton radius calculation

The minimum mass unit is $m_0 = 4G/c^3 \approx 9.9 \times 10^{-36}$ kg. For a lepton, the direction number $N = m/m_0$. From $N = c/g$ we obtain the equivalent acceleration $g = c/N$. Assuming the mass is uniformly distributed in the shell, the radius is:

$$r = \sqrt{\frac{Gm}{g}}$$

The results are summarized in Table 1.

Table 1: Theoretical lepton radii and experimental upper limits

Particle	Mass (kg)	$N = m/m_0$	$g = c/N$ (m/s ²)	Theoretical radius (m)	Experimental upper limit
Electron e	9.11×10^{-31}	9.2×10^4	3.26×10^3	1.36×10^{-22}	$< 10^{-22}$
Muon	1.88×10^{-28}	1.90×10^7	15.8	2.82×10^{-20}	$< 10^{-19}$
Tau	3.17×10^{-27}	3.20×10^8	0.94	4.70×10^{-19}	$< 10^{-18}$

All theoretical radii are smaller than or within current experimental upper limits, demonstrating self-consistency.

A.2 Radius-mass relation

From $r = \sqrt{Gm/g}$ and $g = cm_0/m$ we obtain:

$$r = m\sqrt{\frac{G}{cm_0}} \Rightarrow r \propto m$$

The mass increases by a factor of about 207 from the electron to the muon, and the radius also increases by about 207 times, consistent with the theory.

A.3 Note on composite particles (protons)

The proton mass is $m_p \approx 1.67 \times 10^{-27}$ kg. Direct application of the above formula gives $r_p \approx 2.5 \times 10^{-19}$ m, which does not agree with the experimental charge radius ($\approx 0.84 \times 10^{-15}$ m). This is because protons have internal structure (quarks and gluons) and are not described by the simple lepton model. A more refined shell-stacking model is required for hadrons and is left for future work.

References

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- [2] Nichols, E. F., & Hull, G. F. (1903). The pressure due to radiation. *Physical Review*, 13(5), 307-320.