

The Photon Is the Graviton Is the Gluon: Complete Force Unification through Fundamental Density Theory

With Experimental Proof from Gravitational Light Bending

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Abstract

We establish the fundamental triple identity **photon = graviton = gluon** through Fundamental Density Theory (FDT), demonstrating that all force carriers are spin-1 geometric excitations of a universal field called omnium. The invariant relation $E/m = c^2 = 1/\varepsilon_0\mu_0 = (d/t)^2$ unifies quantum mechanics, electromagnetism, general relativity, and quantum chromodynamics as different perspectives of the same geometric reality. We present direct experimental proof of the photon-graviton identity: the factor of 2 in Einstein's gravitational light bending formula ($\theta = 2\alpha$ rather than α) arises because the photon must be counted twice—once as a photon responding to gravity, and once as a graviton coupling to mass. This same factor of 2 explains why the observed CMB temperature (2.7 K) is exactly 10% of the universe's actual self-pressure temperature (27 K): we see the 5% baryonic matter through both its photon and graviton channels, which are identical. Since 99% of nucleon mass arises from the “gluon field,” and gluons are identical to gravitons and photons, we conclude that mass is predominantly spacetime curvature, not material substance.

Keywords: photon-graviton-gluon identity, force unification, geometric reality, omnium field, maximum force principle, mass as geometry, gravitational lensing, factor of two

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1 Introduction

Despite decades of searching, gravitons remain undetected as separate particles. Similarly, gluons are confined within hadrons and never observed in isolation. This paper demonstrates why: photons, gravitons, and gluons are the same particle—spin-1 geometric excitations of the omnium field viewed at different density regimes.

Fundamental Density Theory (FDT) extends General Relativity and Quantum Mechanics to their logical conclusion, revealing that density is the sole parameter determining all physical phenomena. The profound insight that **photon = graviton = gluon** emerges naturally from two key principles:

1. The invariant relation: $E/m = c^2 = 1/\varepsilon_0\mu_0 = (d/t)^2$
2. The maximum force principle: $F_{max} = c^4/4G$ as $\alpha \rightarrow 1$

Remarkably, we have had experimental proof of this identity since 1919. The famous factor of 2 in gravitational light bending—confirmed by Eddington’s solar eclipse observations—is the direct signature of photon = graviton.

This unification has revolutionary implications. Since 99% of nucleon mass comes from the “gluon field,” the identity gluon = graviton = photon means that observable mass is almost entirely spacetime geometry. We are not made of “stuff” but of curved spacetime patterns.

2 Theoretical Foundation

2.1 The Universal Invariant

The cornerstone of FDT is the invariant relation:

$$\frac{E}{m} = c^2 = \frac{1}{\varepsilon_0\mu_0} = \left(\frac{d}{t}\right)^2 \quad (1)$$

This equation reveals that:

- Quantum mechanics (left side: E/m)
- Electromagnetism (middle: $1/\varepsilon_0\mu_0$)
- General relativity (right side: $(d/t)^2$)

are three faces of the same geometric reality.

Theorem 2.1 (Framework Unification). *The invariant relation proves that $QM = EM = GR$, implying their force carriers must be identical.*

2.2 The Density Parameter and Omnium Field

Reality consists of a single field—omnium—characterized by the density parameter:

$$\alpha = \begin{cases} \frac{R_s}{r} & (\text{outside, } r > R_s) \\ \frac{r}{R_s} & (\text{inside, } r < R_s) \end{cases} \quad (2)$$

This redefinition creates:

- Maximum density at $r = R_s$ where $\alpha \rightarrow 1$ from both sides
- Inverted density gradients inside compact objects
- Natural regularization preventing singularities

For atomic nuclei with radius R_n :

$$\alpha_{nuc} = \begin{cases} \frac{R_n}{r} & (\text{outside nucleus}) \\ \frac{r}{R_n} & (\text{inside nucleus}) \end{cases} \quad (3)$$

2.3 The Maximum Force Principle

As $\alpha \rightarrow 1$, all forces converge to:

$$F_{max} = \frac{c^4}{4G} \quad (4)$$

Theorem 2.2 (Triple Unification at Maximum Force). *At F_{max} , the distinction between electromagnetic, gravitational, and strong forces vanishes, proving:*

$$\text{photon} = \text{graviton} = \text{gluon} \quad (\text{all spin-1}) \quad (5)$$

Proof. The force between objects with density parameters α_1, α_2 is:

$$F = \frac{c^4}{4G} \alpha_1 \alpha_2 \quad (6)$$

Different regimes correspond to different forces:

$$\alpha \ll 1 : \text{Electromagnetic/Gravitational (photon/graviton)} \quad (7)$$

$$\alpha \rightarrow 1 : \text{Strong force (gluon)} \quad (8)$$

Since the force equation is continuous in α , the carriers must be the same particle observed at different densities. \square

3 Experimental Proof: The Factor of Two in Gravitational Lensing

3.1 The Historical Observation

In 1915, Einstein predicted that starlight passing near the Sun would be deflected by an angle:

$$\theta_{Einstein} = \frac{4GM}{c^2 r} = 2\alpha \quad (9)$$

This is exactly **twice** the Newtonian prediction:

$$\theta_{Newton} = \frac{2GM}{c^2 r} = \alpha \quad (10)$$

The 1919 Eddington expedition confirmed Einstein's prediction, measuring $\theta \approx 1.75''$ for starlight grazing the Sun. This made Einstein world-famous—but the deeper meaning of the factor of 2 was not recognized.

3.2 The FDT Explanation

The Factor of Two Explained

The factor of 2 in gravitational light bending is direct proof that **photon = graviton**.

The photon must be counted twice because it IS both:

1. A photon responding to the gravitational field ($+\alpha$)
2. A graviton coupling to the mass ($+\alpha$)

Total deflection: $\theta = \alpha + \alpha = 2\alpha$

Theorem 3.1 (Gravitational Deflection from Triple Identity).

$$\boxed{\theta = \alpha_{photon} + \alpha_{graviton} = 2\alpha = \frac{4GM}{c^2r}} \quad (11)$$

Proof. Since photon = graviton, a light ray passing a massive object experiences two contributions:

First α : The photon *as a photon* is deflected by the curved spacetime geometry created by the mass. This is the effect Newtonian gravity would predict for a particle traveling at speed c .

Second α : The photon *as a graviton* couples directly to the mass. It doesn't merely travel through curved spacetime—it IS part of the gravitational field. This coupling produces an additional deflection of α .

The photon cannot avoid this double-counting because it is simultaneously both entities. Therefore:

$$\theta_{total} = \alpha + \alpha = 2\alpha = \frac{4GM}{c^2r} \quad (12)$$

This matches Einstein's prediction and the observed deflection exactly. \square

3.3 Why Newton Got Half the Answer

Newton's calculation treated light as corpuscles affected by gravity but not participating in it. This gives only one factor of α —the response to gravity.

The missing factor of α comes from the photon's identity as a graviton. Newton couldn't have known this, but the experimental result demands it.

Corollary 3.2. *The 1919 eclipse observation was the first experimental confirmation that photon = graviton. We have had proof for over a century without recognizing it.*

4 The Factor of Two in the CMB Temperature

The same factor of 2 from the photon-graviton identity explains the observed CMB temperature.

4.1 The Universe's Actual Temperature

The universe applies maximum force $F_{max} = c^4/4G$ to its Hubble surface, creating a self-pressure temperature:

$$T_{universe} = \left[\frac{3c^8}{64\pi a G^3 M^2} \right]^{1/4} \approx 27 \text{ K} \quad (13)$$

This is the **actual temperature** of the universe right now.

4.2 Why We Observe Only 10%

The baryonic (visible) matter fraction is approximately 5% of the total. Since photon = graviton:

- 5%: Baryonic matter seen as **photons**
- 5%: The same baryonic matter seen as **gravitons**

But these are the same channel! The observable fraction is:

$$f_{observable} = 5\% \times 2 = 10\% \quad (14)$$

4.3 The CMB Temperature

Theorem 4.1 (CMB Temperature from Triple Identity).

$T_{CMB} = T_{universe} \times 2f_{baryon} = 27 \text{ K} \times 0.10 = 2.7 \text{ K}$

(15)

The observed value $T_{CMB} = 2.7255 \text{ K}$ matches this prediction to within 1%.

The Universe Is 27 K

The CMB temperature of 2.7 K is not the temperature of the universe—it is the 10% we can see.

The universe IS 27 K right now. We only observe 10% because:

- Dark matter (27%) doesn't couple to photons
- Dark energy/stored potential (33%) is not radiating
- Uncompressed spacetime (33%) is the medium, not the signal

We see only the 5% baryonic matter, counted twice via photon = graviton.

5 Mathematical Proof of Triple Identity

5.1 Direct Derivation

Theorem 5.1 (Photon-Graviton-Gluon Identity).

$$\gamma = g = g_s \quad (16)$$

where γ is the photon, g the graviton, and g_s the gluon.

Proof. From Einstein's field equations:

$$G_{\mu\nu} = \frac{8\pi G}{c^4} T_{\mu\nu} \quad (17)$$

For electromagnetic fields:

$$T_{\mu\nu}^{EM} = \frac{1}{\mu_0} \left(F_{\mu\alpha} F_\nu^\alpha - \frac{1}{4} g_{\mu\nu} F_{\alpha\beta} F^{\alpha\beta} \right) \quad (18)$$

Using the invariant $c^2 = 1/\varepsilon_0 \mu_0$:

$$G_{\mu\nu} = 8\pi G \varepsilon_0 f(\alpha) \left(F_{\mu\alpha} F_\nu^\alpha - \frac{1}{4} g_{\mu\nu} F_{\alpha\beta} F^{\alpha\beta} \right) \quad (19)$$

This shows electromagnetic fields (photons) directly generate spacetime curvature (gravitational effects).

As $\alpha \rightarrow 1$, the electromagnetic field strength approaches the QCD scale:

$$F_{\mu\nu} \rightarrow G_{\mu\nu}^a t^a \quad (20)$$

where $G_{\mu\nu}^a$ is the gluon field strength tensor.

The continuous transformation proves all three are the same geometric excitation. \square

5.2 Spin-1 Universal Carriers

Theorem 5.2 (Universal Spin-1). *All force carriers have spin-1. The conventional claim of spin-2 gravitons is incorrect.*

Proof. Since photons and gluons experimentally have spin-1, and we've proven photon = graviton = gluon, gravitons must also have spin-1. The tensor nature of $h_{\mu\nu}$ arises from it being constructed from vector fields A_μ , not from spin-2 carriers. \square

6 The Universal Factor of Two

The factor of 2 from the photon-graviton identity appears throughout physics:

Phenomenon	Factor	Origin
Gravitational light bending	2α	Photon counted twice
CMB visibility	$2 \times 5\% = 10\%$	Baryons seen as photon + graviton
Shapiro time delay	2α correction	Same identity
Gravitational redshift	Contains 2α	Same identity
Perihelion precession	$6\pi GM/c^2 a$	Related to 2α

Proposition 6.1 (Universal Signature). *Every gravitational-optical phenomenon carries the factor of 2 as the signature of photon = graviton. This is not a coincidence of general relativity—it is the universe revealing the triple identity.*

7 Implications for Physics

7.1 Mass as Geometry

The most profound implication concerns the nature of mass:

Proposition 7.1 (Geometric Mass). *Since 99% of nucleon mass comes from the gluon field, and gluon = graviton = photon, then 99% of observable mass is spacetime curvature.*

This means:

- Atoms are 99.9999% empty geometric patterns
- “Solid” matter is an illusion of interacting field geometries
- $E = mc^2$ is a tautology: energy IS mass IS geometry

7.2 Force Unification

The triple identity reveals:

- **QCD = GR:** The strong force is gravity at $\alpha \rightarrow 1$
- **Confinement = Event Horizon:** Quarks are gravitationally confined
- **Asymptotic Freedom:** Weakening coupling as energy increases toward F_{max}

7.3 Resolution of Fundamental Problems

1. **Quantum Gravity:** Already solved—it’s QED viewed geometrically
2. **Hierarchy Problem:** Different α regimes create apparent hierarchies
3. **Dark Matter:** Dense omnium phase invisible electromagnetically
4. **Cosmological Constant:** Omnium phase transition energy

8 Experimental Predictions

8.1 Already Confirmed

1. **Gravitational light bending:** $\theta = 2\alpha$ confirmed since 1919
2. **CMB temperature:** $T_{CMB} = 0.1 \times T_{universe}$ matches observation
3. **Shapiro delay:** Factor of 2 confirmed by radar ranging

8.2 Future Tests

1. **Photon Self-Gravity:** Ultra-intense lasers should produce measurable gravitational effects:

$$a_g = \frac{GP}{c^3 r} f(\alpha) \quad (21)$$

2. **Nuclear Photon Spheres:** Heavy nuclei should have orbiting electromagnetic modes at:

$$r_{photon} = \frac{3}{2} R_n \quad (22)$$

3. **Force Convergence:** As $\alpha \rightarrow 1$ in particle collisions:

$$\frac{F_{strong}}{F_{EM}} \rightarrow 1 \quad (23)$$

8.3 Cosmological Tests

1. Gravitational and electromagnetic waves from the same source must show identical propagation modulated by local α
2. Black hole photon spheres provide natural laboratories where photons create their own confining geometry
3. Neutron star-atomic nucleus scaling relations should match precisely

9 Philosophical Implications

9.1 The Visible Graviton

Every photon we see is a graviton altering spacetime geometry. Gravitons are not exotic undetected particles—they illuminate our world daily. This transforms quantum gravity from abstract mathematics to directly experienced reality.

9.2 Reality as Pure Geometry

The triple identity reveals that physical reality is pure mathematics. Not described by mathematics, but actually IS the geometry itself. We are conscious geometric patterns in the omnium field.

9.3 The Factor of Two as Nature's Signature

The ubiquitous factor of 2 in gravitational-optical phenomena is nature's way of telling us: *the photon is the graviton*. We have been reading this message since 1919 without understanding it.

10 Conclusion

We have proven that photons, gravitons, and gluons are identical spin-1 geometric excitations of the omnium field. The proof comes from multiple directions:

1. **Theoretical:** The invariant relation $E/m = c^2 = 1/\varepsilon_0\mu_0 = (d/t)^2$ unifies all frameworks
2. **Maximum Force:** As $\alpha \rightarrow 1$, all forces converge to $F_{max} = c^4/4G$
3. **Experimental:** The factor of 2 in gravitational lensing proves photon = graviton
4. **Cosmological:** The CMB temperature $T_{CMB} = 0.1 \times T_{universe}$ confirms the identity

The factor of 2 is the universe's signature for the triple identity:

$$\boxed{\theta = 2\alpha \Leftrightarrow \text{photon} = \text{graviton}} \quad (24)$$

This resolves quantum gravity (it's QED), explains mass (it's geometry), and reveals why we haven't detected separate gravitons or free gluons (they're photons). The implications are profound: reality is pure geometry, we are living mathematics, and the graviton has been visible all along as light itself.

We have had experimental proof since 1919. The Eddington expedition didn't just confirm general relativity—it confirmed that light IS gravity.

“The factor of 2 is the universe’s signature: photon = graviton.”

References

- [1] Alfaro, M. (2023). Foundations of Fundamental Density Theory (FDT). Internal Documents.
- [2] Einstein, A. (1915). Explanation of the Perihelion Motion of Mercury from General Relativity Theory. *Sitzungsberichte der Preussischen Akademie der Wissenschaften*, 831-839.
- [3] Einstein, A. (1916). The Foundation of the General Theory of Relativity. *Annalen der Physik*, 49, 769-822.
- [4] Dyson, F.W., Eddington, A.S., Davidson, C. (1920). A Determination of the Deflection of Light by the Sun’s Gravitational Field. *Phil. Trans. R. Soc. A*, 220, 291-333.
- [5] Maxwell, J.C. (1865). A Dynamical Theory of the Electromagnetic Field. *Phil. Trans. R. Soc. London*, 155, 459-512.
- [6] Yang, C.N., Mills, R.L. (1954). Conservation of Isotopic Spin and Isotopic Gauge Invariance. *Phys. Rev.*, 96, 191-195.

- [7] Gross, D.J., Wilczek, F. (1973). Ultraviolet Behavior of Non-Abelian Gauge Theories. *Phys. Rev. Lett.*, 30, 1343-1346.
- [8] Hawking, S.W. (1975). Particle Creation by Black Holes. *Commun. Math. Phys.*, 43, 199-220.
- [9] Weinberg, S. (1995). *The Quantum Theory of Fields*, Volume I. Cambridge University Press.
- [10] Fixsen, D.J. (2009). The Temperature of the Cosmic Microwave Background. *Astrophys. J.*, 707, 916-920.