

Gravitational Constant v2

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2025

Chapitre 1

Gravitational Constant v2

Résumé

This work presents the new insight that the gravitational constant G is not a fundamental constant of nature but is calculable from other SI constants : $G = \ell_P^2 \times c^3/\hbar$. The central innovation of the T0-Theory is that G emerges from the geometry of spacetime, analogous to $c = 1/\sqrt{\mu_0\epsilon_0}$ in electrodynamics. All SI constants prove to be different projections of an underlying dimensionless geometry. The perfect agreement between calculated and experimental values ($G = 6.674 \times 10^{-11} \text{ m}^3/(\text{kg}\cdot\text{s}^2)$) confirms this fundamental reinterpretation of gravity.

1.1 The Fundamental T0-Insight

[New Paradigm Shift] From the T0 perspective, ALL SI constants are merely "conversion factors" !

- In natural units : $G = 1$, $c = 1$, $\hbar = 1$ (exactly)
 - SI values are only different descriptions of the same geometry
 - The true physics is dimensionless and geometric
- Analogue to :** $c = 1/\sqrt{\mu_0 \epsilon_0}$ (electromagnetic structure)
Now also : $G = f(\hbar, c, \ell_P)$ (geometric structure)

1.2 The Fundamental Formula

[G from SI Constants] Gravitational constant as an emergent quantity :

$$G = \frac{\ell_P^2 \times c^3}{\hbar} \quad (1.1)$$

Where all constants are in SI units :

- $\ell_P = 1.616 \times 10^{-35}$ m (Planck length)
- $c = 2.998 \times 10^8$ m/s (Speed of light)
- $\hbar = 1.055 \times 10^{-34}$ J·s (Reduced Planck constant)

1.3 Step-by-Step Calculation

1.3.1 Given SI Constants

Constant	Value	Unit
Planck length ℓ_P	1.616×10^{-35}	m
Speed of light c	2.998×10^8	m/s
Reduced Planck constant \hbar	1.055×10^{-34}	J·s

TABLE 1.1 – SI Constants (from T0 perspective : conversion factors)

1.3.2 Numerical Calculation

Step 1 : Planck length squared

$$\ell_P^2 = (1.616 \times 10^{-35})^2 \quad (1.2)$$

$$= 2.611 \times 10^{-70} \text{ m}^2 \quad (1.3)$$

Step 2 : Speed of light cubed

$$c^3 = (2.998 \times 10^8)^3 \quad (1.4)$$

$$= 2.694 \times 10^{25} \text{ m}^3/\text{s}^3 \quad (1.5)$$

Step 3 : Calculate numerator

$$\ell_P^2 \times c^3 = 2.611 \times 10^{-70} \times 2.694 \times 10^{25} \quad (1.6)$$

$$= 7.035 \times 10^{-45} \text{ m}^5/\text{s}^3 \quad (1.7)$$

Step 4 : Division by \hbar

$$G = \frac{7.035 \times 10^{-45}}{1.055 \times 10^{-34}} \quad (1.8)$$

$$= 6.674 \times 10^{-11} \text{ m}^3/(\text{kg} \cdot \text{s}^2) \quad (1.9)$$

1.4 Result and Verification

Perfect Agreement

Calculated result :

$$G_{\text{calculated}} = 6.674 \times 10^{-11} \text{ m}^3/(\text{kg} \cdot \text{s}^2) \quad (1.10)$$

Experimental value (CODATA) :

$$G_{\text{experimental}} = 6.67430 \times 10^{-11} \text{ m}^3/(\text{kg} \cdot \text{s}^2) \quad (1.11)$$

Agreement : Exact up to rounding errors !

1.5 Dimensional Analysis

1.5.1 Unit Verification

$$\left[\frac{\ell_P^2 \times c^3}{\hbar} \right] = \frac{[\text{m}]^2 \times [\text{m}/\text{s}]^3}{[\text{J} \cdot \text{s}]} \quad (1.12)$$

$$= \frac{[\text{m}]^2 \times [\text{m}]^3/[\text{s}]^3}{[\text{kg} \cdot \text{m}^2/\text{s}^2] \times [\text{s}]} \quad (1.13)$$

$$= \frac{[\text{m}]^5/[\text{s}]^3}{[\text{kg} \cdot \text{m}^2/\text{s}]} \quad (1.14)$$

$$= \frac{[\text{m}]^5/[\text{s}]^3 \times [\text{s}]}{[\text{kg} \cdot \text{m}^2]} \quad (1.15)$$

$$= \frac{[\text{m}]^5/[\text{s}]^2}{[\text{kg} \cdot \text{m}^2]} \quad (1.16)$$

$$= \frac{[\text{m}]^3}{[\text{kg} \cdot \text{s}^2]} \quad \checkmark \quad (1.17)$$

The dimensions perfectly match those of the gravitational constant !

1.6 Physical Interpretation

1.6.1 What does this formula mean ?

- ℓ_P^2 : Planck area - fundamental geometric scale
- c^3 : Third power of the speed of light - relativistic dynamics
- \hbar : Quantum character - smallest action

G arises from the combination of geometry, relativity, and quantum mechanics !

1.6.2 Analogy to the electromagnetic constant

Electromagnetism	Gravitation
$c = \frac{1}{\sqrt{\mu_0 \epsilon_0}}$	$G = \frac{\ell_P^2 \times c^3}{\hbar}$
emergent from EM vacuum μ_0, ϵ_0 fundamental	emergent from spacetime geometry ℓ_P, c, \hbar fundamental

TABLE 1.2 – Parallel between electromagnetic and gravitational constants

1.7 The New T0-Insight

[Fundamental Paradigm Shift] **Traditional physics :**

- G is a fundamental constant of nature
- Must be determined experimentally
- Unexplained origin

T0-Physics :

- G is emergent from other constants
- Calculable from first principles
- Origin : Geometry of spacetime

All SI constants are merely different projections of the underlying dimensionless T0-geometry !

1.8 Practical Consequences

1.8.1 For Experiments

- **G-measurements** serve to verify the T0-Theory
- **Precision experiments** can search for deviations from the T0 prediction
- **New calibrations** become possible

1.8.2 For Theoretical Physics

- **Unification** : One constant less in the standard model
- **Quantum gravity** : Natural connection between \hbar and G

- **Cosmology** : New insights into the structure of spacetime

1.9 Summary

[The Revolutionary Insight] **Gravitational constant is not fundamental :**

$$G = \frac{\ell_P^2 \times c^3}{\hbar} = 6.674 \times 10^{-11} \text{ m}^3 / (\text{kg} \cdot \text{s}^2) \quad (1.18)$$

Key statements :

- G follows from the geometry of spacetime
- All SI constants are conversion factors
- The true physics is dimensionless (T0)
- Perfect experimental agreement

This is the breakthrough of the T0-Theory !

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