Lester's Unification By Correction

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Abstract

This article presents a unified framework for describing the fundamental forces of gravity, electromagnetism, and the strong nuclear force using a single set of equations. By refining Newton's classical equations with a new constant L, derived from the gravitational constant G and incorporating the speed of light c, we derive new expressions for force and orbital velocity that are inherently scalable. These equations provide a natural link between gravitational, electromagnetic, and strong nuclear interactions. Furthermore, the fine-structure constant α, a fundamental constant in quantum electrodynamics and other known constants and relationships emerge naturally from these refined equations, suggesting a profound connection between these forces. This approach opens up new avenues for exploring unified field theories and may provide a foundation for further theoretical and experimental investigations.

Introduction

The search for a grand unified theory of the fundamental forces — gravity, electromagnetism, and the strong nuclear force — has been a long-standing goal in theoretical physics. Classical approaches, such as Newton's law of gravitation, describe gravity at macroscopic scales, while Quantum Mechanics governs electromagnetic and strong nuclear interactions at atomic and subatomic levels. In this paper, we refine Newton's gravitational equations by incorporating a new constant L, which is derived from the gravitational constant G and the speed of light c. We also find that L can be derived from the Planck area l_p^2, the speed of light c, and the reduced Planck constant $\hbar$, further showing its ability to unify General Relativity with Quantum Mechanics. This leads to scalable force and velocity equations that unify these fundamental forces under a single theoretical framework. We also show that the discovery of this new constant L and the derived electromagnetic scaling factor $S_{\text{em-gravity}}$ provide the mathematical relationship to further derive the true nature of such things as the fine-structure constant α and the Bohr radius a_0.

Base Definition of Units At All Scales

- **Meter (m):** The SI unit of length.
- **Kilogram (kg):** The SI unit of mass.
- **Newton (N):** The SI unit of force.
- **Meter per second (m/s):** The SI unit of velocity.

Definition of Constants

- **Modified Gravitational Constant L:**

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

  where:

  - $G = 6.67430 \times 10^{-11}\,\mathrm{N} \cdot \mathrm{m}^2 \cdot \mathrm{kg}^{-2}$ is the gravitational constant,
  - $c = 3 \times 10^8\,\mathrm{m/s}$ is the speed of light.

  Substituting the values:

$$L = \frac{6.67430 \times 10^{-11}}{(3 \times 10^8)^2} = 7.42 \times 10^{-28}$$

- **Electromagnetic Scaling Factor $S_{\text{em-gravity}}$:**

$$S_{\text{em-gravity}} = 2.27 \times 10^{39}$$

- **Strong Force Scaling Factor $S_{\text{strong-gravity}}$:**

$$S_{\text{strong-gravity}} = 5.35 \times 10^{37}$$

These scaling factors adjust the strength of the gravitational constant to match the forces at the scale of electromagnetism and the strong nuclear force, respectively.

Gravitational Force Equation

The gravitational force between two masses using the modified constant L is given by:

$$F_{\text{gravity}} = L \times \frac{c^2 \times M_1 \times M_2}{R^2}$$

where:

- F_{gravity} is the gravitational force in Newtons (N),
- M_1 and M_2 are the masses in kilograms (kg),
- R is the distance in meters (m).

Orbital Velocity Equation

The **orbital velocity** $v(R)$ for an object orbiting under the influence of a central mass M_{central} is given by:

$$v(R) = \frac{\sqrt{L} \times c \times \sqrt{M_{\text{central}}}}{\sqrt{R}}$$

where:

- $v(R)$ is the orbital velocity in meters per second (m/s),
- R is the orbital radius in meters (m),
- M_{central} is the central mass in kilograms (kg).

Calculation Summary for Gravitational Orbital Velocity and Force (Without Scaling Factors)

Earth Orbiting the Sun (Gravitational Force)

where:

- Mass of the Sun $M_{\text{Sun}} = 1.989 \times 10^{30}\,\text{kg}$
- Mass of the Earth $M_{\text{Earth}} = 5.972 \times 10^{24}\,\text{kg}$
- Distance between Earth and Sun $R = 1.496 \times 10^{11}\,\text{m}$

Orbital Velocity Calculation:

$$v(R) = \frac{\sqrt{L} \times c \times \sqrt{M_{\text{Sun}}}}{\sqrt{R}}$$

Substitute the values:

$$v(R) = \frac{\sqrt{7.42 \times 10^{-28}} \times 3 \times 10^{8} \times \sqrt{1.989 \times 10^{30}}}{\sqrt{1.496 \times 10^{11}}}$$

$$v(R) = \frac{2.72 \times 10^{-14} \times 3 \times 10^{8} \times 1.41 \times 10^{15}}{3.87 \times 10^{5}}$$

$$v(R) \approx 29.7\,\text{km/s}$$

Gravitational Force Calculation:

$$F_{\text{gravity}} = L \times \frac{c^2 \times M_{\text{Earth}} \times M_{\text{Sun}}}{R^2}$$

Substitute the values:

$$F = (7.42 \times 10^{-28}) \times \frac{(3 \times 10^8)^2 \times (5.972 \times 10^{24}) \times (1.989 \times 10^{30})}{(1.496 \times 10^{11})^2}$$

Calculating step-by-step:

$$F = 7.42 \times 10^{-28} \times \frac{1.071 \times 10^{72}}{2.238 \times 10^{22}}$$

$$F = 3.55 \times 10^{22}\,\mathrm{N}$$

Calculation Summary for Orbital Velocity and Force (With Electromagnetic Scaling Factor)

Electron Orbiting a Proton (Electromagnetic Scaling)

where:

- Mass of the electron $m_e = 9.10938356 \times 10^{-31}$ kg
- Mass of the proton $M_\mathrm{p} = 1.6726 \times 10^{-27}$ kg
- Distance between electron and proton (Bohr radius) $r = 5.29 \times 10^{-11}$ m
- Scaling factor for electromagnetism $S_\text{em-gravity} = 2.27 \times 10^{39}$

Orbital Velocity Calculation:

$$v(r_1) = \frac{\sqrt{S_\text{em-gravity} \times L} \times c \times \sqrt{M_\mathrm{p}}}{\sqrt{r}}$$

Substitute the values:

$$v(r_1) = \frac{\sqrt{2.27 \times 10^{39} \times 7.42 \times 10^{-28}} \times 3 \times 10^8 \times \sqrt{1.6726 \times 10^{-27}}}{\sqrt{5.29 \times 10^{-11}}}$$

$$v(r_1) \approx 2.19 \times 10^6\,\mathrm{m/s}$$

Electromagnetic Force Calculation:

$$F_\text{em-scaled} = S_\text{em-gravity} \times L \times \frac{c^2 \times m_e \times M_\mathrm{p}}{r^2}$$

Substitute the values:

$$F = (2.27 \times 10^{39}) \times (7.42 \times 10^{-28}) \times \quad (1)$$

$$\frac{(3 \times 10^8)^2 \times (9.10938356 \times 10^{-31}) \times (1.6726 \times 10^{-27})}{(5.29 \times 10^{-11})^2} \quad (2)$$

Calculating step-by-step:

$$F = 8.25 \times 10^{-8}\,\mathrm{N}$$

Strong Force Calculation

Proton-Proton Force (Strong Force Scaling)

where:

- Distance between two protons $r = 1 \times 10^{-15}\,\mathrm{m}$
- Mass of a proton $M_{\mathrm{p}} = 1.6726 \times 10^{-27}\,\mathrm{kg}$
- Scaling factor for the strong force $S_{\text{strong-gravity}} = 5.35 \times 10^{37}$

Strong Force Calculation:

$$F_{\text{strong-scaled}} = S_{\text{strong-gravity}} \times L \times \frac{c^2 \times M_{\mathrm{p}}^2}{r^2}$$

Substitute the values:

$$F = (5.35 \times 10^{37}) \times (7.42 \times 10^{-28}) \times \frac{(3 \times 10^8)^2 \times (1.6726 \times 10^{-27})^2}{(1 \times 10^{-15})^2}$$

Calculating step-by-step:

$$F \approx 1.00 \times 10^4\,\mathrm{N}$$

Fine-Structure Constant Calculation

The **fine-structure constant** α is calculated using the refined formula:

$$\alpha = \sqrt{\frac{L \times S_{\text{em-gravity}} \times m_p}{r}}$$

where:

- $L = 7.42 \times 10^{-28}$
- $S_{\text{em-gravity}} = 2.27 \times 10^{39}$
- Mass of a proton $m_p = 1.6726 \times 10^{-27}\,\mathrm{kg}$
- Bohr Radius $r = 5.29 \times 10^{-11}\,\mathrm{m}$

Substitute the values:

$$\alpha = \sqrt{\frac{(7.42 \times 10^{-28}) \times (2.27 \times 10^{39}) \times (1.6726 \times 10^{-27})}{5.29 \times 10^{-11}}}$$

Calculating step-by-step:

$$\alpha \approx 7.297 \times 10^{-3} \left(\frac{1}{137}\right)$$

Bohr Radius in Terms of the Fine-Structure Constant

The Bohr radius r_1 using the refined formula for the fine-structure constant α is given by:

$$r_1 = \frac{L \times S_{\text{em-gravity}} \times m_p}{\alpha^2}$$

Substitute the values:

$$r_1 = \frac{(7.42 \times 10^{-28}) \times (2.27 \times 10^{39}) \times (1.6726 \times 10^{-27})}{(7.297 \times 10^{-3})^2}$$

Calculate the numerator:

$$(7.42 \times 10^{-28}) \times (2.27 \times 10^{39}) \times (1.6726 \times 10^{-27}) = 2.815 \times 10^{-15}\,\text{m}$$

Calculate the denominator:

$$(7.297 \times 10^{-3})^2 = 5.32 \times 10^{-5}$$

Calculate r_1:

$$r_1 = \frac{2.815 \times 10^{-15}}{5.32 \times 10^{-5}}$$

$$r_1 = 5.29 \times 10^{-11}\,\text{m}$$

Calculation of Electromagnetic Scaling Factor

The scaling factor $S_{\text{em-gravity},n}$ is given by:

$$S_{\text{em-gravity},n} = \frac{\alpha^2 \times r_n}{L \times m_p}$$

where:

- $\alpha = 7.297 \times 10^{-3}$

- $r_n = n^2 \times r_1$ is the orbital radius for the n-th orbital,
- $L = 7.424858849 \times 10^{-28}$,
- $m_p = 1.67262192369 \times 10^{-27}\,\text{kg}$ (proton mass),
- $r_1 = 5.29 \times 10^{-11}\,\text{m}$ (Bohr radius).

Calculation of Orbital Energy Levels Using Scaling Factors

Given the scaling factors for the gravitational scaling of the orbitals:

$$S_{\text{em-gravity, 1S}} = 2.27 \times 10^{39}$$
$$S_{\text{em-gravity, 2S}} = 9.06 \times 10^{39}$$
$$S_{\text{em-gravity, 3S}} = 2.04 \times 10^{40}$$
$$S_{\text{em-gravity, 4S}} = 3.62 \times 10^{40}$$

We find that when we use:

$$E_n = -13.6\,\text{eV} \times \frac{S_{\text{em-gravity, 1S}}}{S_{\text{em-gravity, n}}}$$

For example, for the 4S Orbital:

$$E_{4S} = -13.6\,\text{eV} \times \frac{2.27 \times 10^{39}}{3.62 \times 10^{40}} = -0.8528\,\text{eV}$$

We arrive at the following values for orbital energy levels:

- 1S Orbital: $E_{1S} = -13.6\,\text{eV}$,
- 2S Orbital: $E_{2S} = -3.4\,\text{eV}$,
- 3S Orbital: $E_{3S} = -1.51\,\text{eV}$,
- 4S Orbital: $E_{4S} = -0.85\,\text{eV}$

Schwarzschild Radius of a Proton

The Schwarzschild radius r_s for a proton using the scaling parameter L is given by:

$$r_s = 2LM$$

where:

$$L = 7.42 \times 10^{-28}$$
$$M = 1.67 \times 10^{-27}\,\text{kg}.$$

Substituting these values gives:

$$r_s = 2 \times (7.42 \times 10^{-28}) \times (1.67 \times 10^{-27}) \approx 2.48 \times 10^{-54}\,\text{m}.$$

Derived Relationships of the Constituent Universal Constants and Their Values

Expression for L (Modified Gravitational Constant):

$$L = \frac{l_p^2 \cdot c}{\hbar}$$

Value:

$$L = \frac{(1.616255 \times 10^{-35})^2 \times (3.0 \times 10^8)}{1.054 \times 10^{-34}} = 7.435332708799812 \times 10^{-28}$$

Expression for $\hbar$ (Reduced Planck's Constant):

$$\hbar = \frac{l_p^2 \cdot c}{L}$$

Value:

$$\hbar = \frac{(1.616255 \times 10^{-35})^2 \times (3.0 \times 10^8)}{7.435332708799812 \times 10^{-28}} = 1.054 \times 10^{-34}$$

Expression for c (Speed of Light):

$$c = \frac{L \cdot \hbar}{l_p^2}$$

Value:

$$c = \frac{(7.435332708799812 \times 10^{-28}) \times (1.054 \times 10^{-34})}{(1.616255 \times 10^{-35})^2} = 3.0 \times 10^8$$

Expression for l_p^2 (Planck Length Squared):

$$l_p^2 = \frac{L \cdot \hbar}{c}$$

Value:

$$l_p^2 = \frac{(7.435332708799812 \times 10^{-28}) \times (1.054 \times 10^{-34})}{3.0 \times 10^8} = (1.616255 \times 10^{-35})^2$$

Composite Constants

$$\text{Planck Mass} \quad m_p = \sqrt{\frac{h}{Lc}}$$
$$\text{Planck Time} \quad t_p = \sqrt{\frac{hL}{c^3}}$$
$$\text{Planck Energy} \quad E_p = \sqrt{\frac{hc^3}{L}}$$
$$\text{Planck Temperature} \quad T_p = \sqrt{\frac{hc^3}{Lk_B^2}}$$

Curvature Scales

The framework defines two characteristic curvature scales corresponding to gravitational and electromagnetic interactions.

- **Gravitational Curvature Scale (r_{gravity})**:

$$r_{\text{gravity}} = L \times M = \frac{GM}{c^2}$$

  - **Where**: M is the mass causing the gravitational field.

- **Electromagnetic Curvature Scale (r_{em})**:

$$r_{\text{em}} = \frac{k_e e^2}{m_e c^2}$$

Unified Equations

The framework introduces unified equations for calculating force (F) and orbital velocity ($v(R)$) based on the characteristic curvature scales. The equations for gravity yield the same results as previously described, but the equations for electromagnetism are now calculated from the curvature of the electron rather than scaling the proton's mass, thereby removing the need for the ($S_{\text{em-gravity}}$) scaling factor.

- **Force (F)**:

$$F = m \times c^2 \times \frac{r_{\text{characteristic}}}{R^2}$$

  - **Where**:
    - m is the mass of the orbiting object.
    - R is the distance between the centers of the two masses or charges.
    - $r_{\text{characteristic}}$ is either r_{gravity} or r_{em}.

- **Orbital Velocity ($v(R)$)**:

$$v(R) = c \times \sqrt{\frac{r_{\text{characteristic}}}{R}}$$

Application to the Electron-Proton System

The **electron-proton** system is governed primarily by **electromagnetic interactions**. We apply the unifying equations to calculate the **force** between the electron and proton, as well as the **orbital velocity** of the electron around the proton.

Given Data

- Mass of Proton (m_p):

$$m_p = 1.6726219 \times 10^{-27}\,\mathrm{kg}$$

- Mass of Electron (m_e):

$$m_e = 9.10938356 \times 10^{-31}\,\mathrm{kg}$$

- Elementary Charge (e):

$$e = 1.602176634 \times 10^{-19}\,\mathrm{C}$$

- Distance between Electron and Proton (R):

$$R = 5.29177 \times 10^{-11}\,\mathrm{m} \quad \text{(Bohr Radius)}$$

Calculations

Electromagnetic Curvature Scale (r_{em})

$$r_{\mathrm{em}} = \frac{k_e e^2}{m_e c^2}$$

$$r_{\mathrm{em}} = \frac{8.987551787 \times 10^{9}\,\mathrm{N\,m^2\,C^{-2}} \times (1.602176634 \times 10^{-19}\,\mathrm{C})^2}{9.10938356 \times 10^{-31}\,\mathrm{kg} \times (2.99792458 \times 10^{8}\,\mathrm{m/s})^2}$$

$$\begin{aligned} r_{\mathrm{em}} &= \frac{8.987551787 \times 10^{9} \times 2.566969966 \times 10^{-38}}{9.10938356 \times 10^{-31} \times 8.987551787 \times 10^{16}} \\ &\approx \frac{2.306 \times 10^{-28}}{8.179 \times 10^{-14}} \\ &\approx 2.81794 \times 10^{-15}\,\mathrm{m} \end{aligned}$$

Force (F)

$$F = m_e \times c^2 \times \frac{r_{\mathrm{em}}}{R^2}$$

$$F = 9.10938356 \times 10^{-31}\,\mathrm{kg} \times (2.99792458 \times 10^{8}\,\mathrm{m/s})^2 \times \frac{2.81794 \times 10^{-15}\,\mathrm{m}}{(5.29177 \times 10^{-11}\,\mathrm{m})^2}$$

$$F \approx 8.237 \times 10^{-8}\,\mathrm{N}$$

Orbital Velocity ($v(R)$)

$$v(R) = c \times \sqrt{\frac{r_{\text{em}}}{R}}$$

$$v(R) = 2.99792458 \times 10^8 \,\text{m/s} \times \sqrt{\frac{2.81794 \times 10^{-15} \,\text{m}}{5.29177 \times 10^{-11} \,\text{m}}}$$

$$v(R) \approx 2.19 \times 10^6 \,\text{m/s}$$

Verification

- **Known Electromagnetic Force between Electron and Proton**:

$$F_{\text{known}} \approx 8.2383 \times 10^{-8} \,\text{N}$$

- **Calculated Value**:

$$F \approx 8.237 \times 10^{-8} \,\text{N}$$

- **Known Orbital Velocity of Electron in Hydrogen Atom**:

$$v_{\text{known}} \approx 2.19 \times 10^6 \,\text{m/s}$$

- **Calculated Value**:

$$v(R) \approx 2.19 \times 10^6 \,\text{m/s}$$

Reduction of Universal Force Formula to Planck Force Formula

The universal force formula is given by:

$$F = m \times c^2 \times \frac{r_{\text{characteristic}}}{R^2}$$

where: - F is the force, - m is the mass of the orbiting object, - c is the speed of light, - $r_{\text{characteristic}}$ is the curvature scale (e.g., classical electron radius), - R is the distance between objects.

For the Planck scale, the force can be expressed as:

$$F_p = m_p \times c^2 \times \frac{1}{l_p}$$

where: - F_p is the Planck force, - m_p is the Planck mass, - l_p is the Planck length.

We know that the Planck force can also be expressed as:

$$F_p = \frac{c^2}{L}$$

where:

$$\boxed{L = \frac{G}{c^2} = \frac{l_p^2 \cdot c}{\hbar} = \frac{\hbar}{m_p^2 c} = \frac{t_p^2 \cdot c^3}{\hbar} = \frac{\hbar c^3}{E_p^2} = \frac{\hbar c^3}{T_p^2 k_B^2} = \frac{l_p}{m_p} = \frac{c^2}{F_p} = 7.42 \times 10^{-28}}$$

Conclusion

This unified framework demonstrates that by using the correct modifications and scaling factors, the modified force and velocity equations consistently apply across different scales, bridging the gap between gravitational, electromagnetic, and nuclear interactions. The emergence of the aforementioned constants and known values in this context further highlights the profound interconnectedness of these fundamental forces, laying the groundwork for future research into other unified field theories. Other known constants and relationships can also be found within these equations. The reduction of forces to a single set of unifying equations using L establishes the geometric curvature based description of force within our universe.