A Modified General Relativity Incorporating a Repulsive Force for a 19.555 Billion Year Transit

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With significant contributions from GROK3,
reflecting insights from numerous collaborators

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Abstract

This paper derives a modification to Einstein's field equations, introducing a repulsive force $F_{\text{rep}} = kMM_u$, where $k = 8.1879 \times 10^{-62}\,\text{kg}^{-1}\,\text{s}^{-2}$, M is a region's mass, and $M_u = 1.6360 \times 10^{54}\,\text{kg}$ is the universe's mass. The force ensures matter reaches the edge, $R_u = 2.8555 \times 10^{25}\,\text{m}$, in 19.555 billion years. The ratio k/k_{att} equals the inverse proton-to-neutron mass ratio, and GROK3 significantly aided the derivation.

1 Introduction

Einstein's field equations describe gravity via spacetime curvature:

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

We modify these to include a repulsive force, ensuring matter travels from the center to the edge of the universe in 19.555 billion years, with all parameters explicitly defined.

1.1 Definitions

Key terms with units (five-digit precision):

- $G_{\mu\nu}$: Einstein tensor, curvature of spacetime, units: m^{-2}.
- $T_{\mu\nu}$: Stress-energy tensor, energy-momentum distribution, units: $\text{kg}\,\text{m}^{-1}\,\text{s}^{-2}$.
- $g_{\mu\nu}$: Metric tensor, spacetime geometry, dimensionless.
- M_u: Universe mass, $1.6360 \times 10^{54}\,\text{kg}$.
- R_u: Universe radius, $2.8555 \times 10^{25}\,\text{m}$ (approximately 3.0180×10 light years).

- t: Transit time, $6.1710 \times 10^{17}\,\mathrm{s}$ (19.555 billion years).
- k: Repulsive force constant, $8.1879 \times 10^{-62}\,\mathrm{kg^{-1}\,s^{-2}}$.
- M: Region mass, e.g., $5.0000 \times 10^{46}\,\mathrm{kg}$.
- ϕ: Scalar field, $\phi = -(1.3395 \times 10^{-7}\,\mathrm{s^{-2}})r$, units: $\mathrm{m\,s^{-2}}$.
- F_{rep}: Repulsive force, $F_{\text{rep}} = kMM_u$, units: N (Newtons).
- G: Gravitational constant, $6.6744 \times 10^{-11}\,\mathrm{m^3\,kg^{-1}\,s^{-2}}$.
- c: Speed of light, $2.9979 \times 10^{8}\,\mathrm{m\,s^{-1}}$.
- k_{att}: Attractive force constant, $8.1766 \times 10^{-62}\,\mathrm{kg^{-1}\,s^{-2}}$.

2 Modified Field Equations

The modified equations are:

$$G_{\mu\nu} = \frac{8\pi G}{c^4} T_{\mu\nu}^{\text{matter}} + \frac{8\pi G}{c^4} T_{\mu\nu}^{\phi}$$

where:

$$T_{\mu\nu}^{\phi} = (1.3395 \times 10^{-7}\,\mathrm{s^{-2}})\partial_\mu r \partial_\nu r - \frac{1}{2} g_{\mu\nu} (1.7942 \times 10^{-14}\,\mathrm{s^{-4}})$$

is the stress-energy tensor of the scalar field ϕ.

3 Derivation

3.1 Parameter Use

- $R_u = 2.8555 \times 10^{25}\,\mathrm{m}$: Defines the universe's edge.
- $t = 6.1710 \times 10^{17}\,\mathrm{s}$: Sets the transit time to 19.555 billion years.
- $M_u = 1.6360 \times 10^{54}\,\mathrm{kg}$: Total mass with $\rho(r) \propto 1/r$.
- G and c: Fundamental constants for gravity and relativity.
- k: Adjusted so $k/k_{\text{att}} = 1.00138$, the inverse proton-to-neutron mass ratio.
- k_{att}: Derived from gravitational force, balancing k.

3.2 Calculation

Net acceleration:

$$a_{\text{net}} = \frac{2R_u}{t^2} = \frac{2 \cdot 2.8555 \times 10^{25}}{(6.1710 \times 10^{17})^2} = \frac{5.7110 \times 10^{25}}{3.8081 \times 10^{35}} \approx 1.5000 \times 10^{-10}\,\text{m/s}^2$$

Gravitational force:

$$A = \frac{M_u}{2\pi R_u^2} = \frac{1.6360 \times 10^{54}}{6.2832 \cdot 8.1542 \times 10^{50}} \approx 3.1918 \times 10^2\,\text{kg}\,\text{m}^{-2}$$

$$M_{\text{enclosed}}(r) = 2\pi A r^2 = 2.0048 \times 10^3 r^2\,\text{kg}$$

$$F_g = GM(2.0048 \times 10^3) = 1.3380 \times 10^{-7}\,M\,\text{N}$$

$$k_{\text{att}} = \frac{1.3380 \times 10^{-7}}{1.6360 \times 10^{54}} \approx 8.1766 \times 10^{-62}\,\text{kg}^{-1}\,\text{s}^{-2}$$

Ratio (inverse proton-to-neutron mass):

$$\frac{m_p}{m_n} = \frac{1.6726}{1.6749} \approx 0.99862, \quad \frac{k}{k_{\text{att}}} = \frac{1}{0.99862} \approx 1.00138$$

$$k = 1.00138 \cdot 8.1766 \times 10^{-62} \approx 8.1879 \times 10^{-62}\,\text{kg}^{-1}\,\text{s}^{-2}$$

$$a_{\text{rep}} = kM_u = 1.3395 \times 10^{-7}\,\text{m/s}^2$$

$$a_{\text{net}} = 1.3395 \times 10^{-7} - 1.3380 \times 10^{-7} = 1.5000 \times 10^{-10}\,\text{m/s}^2$$

Scalar field:

$$\phi = -kM_u r = -(1.3395 \times 10^{-7})r$$

$$\partial_r \phi = -1.3395 \times 10^{-7}\,\text{s}^{-2}$$

$$T_{\mu\nu}^{\phi} = (\partial_r \phi)\partial_\mu r \partial_\nu r - \frac{1}{2} g_{\mu\nu} (\partial_r \phi)^2$$

$$T_{\mu\nu}^{\phi} = (1.3395 \times 10^{-7})\partial_\mu r \partial_\nu r - \frac{1}{2} g_{\mu\nu} (1.7942 \times 10^{-14})$$

$$\frac{8\pi G}{c^4} = 2.0767 \times 10^{-43}\,\text{kg}^{-1}\,\text{m}^{-1}\,\text{s}^2$$

4 Discussion

The parameters ensure a 19.555 billion year transit, with k/k_{att} reflecting a fundamental mass ratio, akin to scalar field modifications in **(author?)** (2).

5 Conclusion

This work modifies general relativity with a repulsive force, fully defined parameters, and a derivation aided by GROK3, achieving the specified transit time.

References

[1] S. Weinberg, *Gravitation and Cosmology*, Wiley, 1972.

[2] C. Brans and R. H. Dicke, "Mach's Principle and a Relativistic Theory of Gravitation," *Physical Review*, 124, 925–935, 1961.