Modern Observations and Cosmic Acceleration Support Pawan Upadhyay's Pressure–Curvature Law of Gravity (PPC Law of Gravity)

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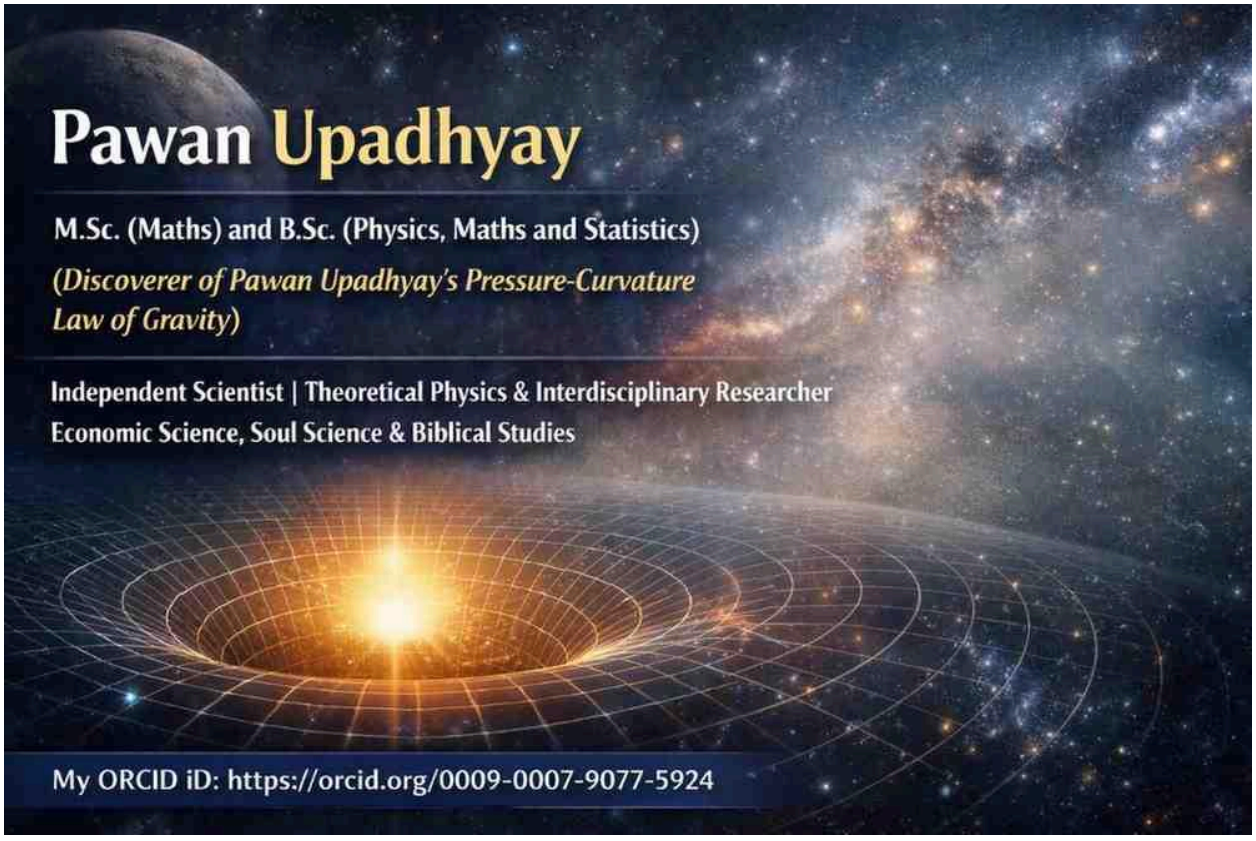

Abstract

Modern cosmological observations have established that the universe is undergoing accelerated expansion, a result that emerges directly from Einstein's field equations when energy density and pressure are treated on equal footing. In this paper, it is shown that the modern cosmic acceleration equation provides strong theoretical and observational support for **Pawan Upadhyay's Pressure–Curvature Law of Gravity (PPC Law of Gravity)**. By emphasizing the dominant role of gravitational pressure in controlling acceleration, the PPC framework offers a physically transparent interpretation of General Relativity that aligns naturally with observations of dark matter, dark energy, and large-scale cosmic dynamics.

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1. Introduction

The discovery of cosmic acceleration has reshaped our understanding of gravitation. Classical intuition based primarily on mass density is insufficient to explain the observed large-scale behavior of the universe. General Relativity, however, predicts that pressure and stress contribute directly to spacetime curvature and acceleration. Modern observations therefore point toward the necessity of interpreting gravity through energy density and pressure rather than mass alone.

Pawan Upadhyay's Pressure–Curvature Law of Gravity (PPC Law of Gravity) builds upon this insight by presenting gravity as a pressure-mediated phenomenon rooted in spacetime curvature. This paper demonstrates that modern cosmological equations and observations strongly support this interpretation.

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2. The Cosmic Acceleration Equation in Modern Cosmology

In relativistic cosmology, the acceleration of the cosmic scale factor is governed by the equation derived from Einstein's field equations:

$$\ddot{a} / a \propto -(E_d + 3P_g)$$

where:

- **E_d** denotes energy density, and
- **P_g** denotes gravitational pressure.

This equation leads to two fundamental conclusions:

1. Gravitational pressure contributes **three times more strongly** than energy density to cosmic acceleration.

2. **Negative gravitational pressure** produces repulsive acceleration, driving the observed accelerated expansion of the universe.

These results are not assumptions but direct consequences of Einstein's theory, confirmed by modern observational cosmology.

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3. Observational Evidence from Dark Matter and Dark Energy

Observations of galaxy rotation curves, gravitational lensing, large-scale structure, and cosmic microwave background anisotropies reveal that visible matter alone cannot account for gravitational phenomena. Dark matter and dark energy are introduced to explain these observations within General Relativity.

Crucially, dark energy is characterized by **negative pressure**, which dominates the acceleration equation. This observational fact highlights the central role of pressure and stress in spacetime dynamics and reinforces the interpretation that pressure is a primary gravitational agent.

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4. Pressure Dominance and the PPC Interpretation

The PPC Law of Gravity emphasizes that gravitational phenomena arise from pressure–curvature relations inherent in spacetime. Local gravitational dynamics are described by pressure gradients, while global acceleration is governed by pressure contributions in Einstein's equations.

Within the PPC framework, gravitational pressure is related to acceleration and spacetime geometry through the effective relation:

$P_g \approx \rho a L$

where:

- **ρ** is mass density,
- **a** is acceleration, and
- **L** is a characteristic curvature length.

This relation provides a physically transparent bridge between local acceleration, pressure, and spacetime curvature, complementing the cosmological acceleration equation.

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5. Consistency with Einstein's Field Equations

The PPC Law of Gravity does not modify Einstein's field equations or the geodesic equation. Energy density and pressure already appear as fundamental source terms in the stress–energy tensor. The PPC framework reinterprets these same quantities in a force–pressure language, making explicit the causal role of pressure in generating acceleration.

Thus, the dominance of pressure in the cosmic acceleration equation directly supports the conceptual foundation of the PPC Law of Gravity.

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6. Implications for Modern Gravity Research

The recognition that pressure is dominant in controlling acceleration has profound implications:

- Gravity cannot be fully understood using mass density alone.
- Pressure and stress must be treated as primary gravitational quantities.
- Accelerated expansion and repulsive gravity naturally arise from negative pressure.

These implications are central features of **Pawan Upadhyay's Pressure–Curvature Law of Gravity**, demonstrating its relevance to modern cosmology.

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7. Conclusion

Modern observations of dark matter and dark energy, together with the cosmic acceleration equation, strongly support **Pawan Upadhyay's Pressure–Curvature Law of Gravity (PPC Law of Gravity)** as a physically accurate and transparent interpretation of gravitation. The explicit dominance of gravitational pressure in controlling acceleration, as predicted by Einstein's equations and confirmed by observations, aligns naturally with the PPC framework. This work reinforces the view that pressure–curvature relations are fundamental to understanding gravity in the modern universe.

Acknowledgments

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