

# Multiverse in Pawan Upadhyay's Pressure–Curvature Law of Gravity (PPC Gravity)

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## Abstract

This paper explores the concept of a multiverse within the framework of Pawan Upadhyay's Pressure–Curvature Law of Gravity (PPC Gravity). Unlike speculative multiverse models that arise in certain interpretations of quantum mechanics or string theory, the PPC multiverse emerges naturally from pressure–driven spacetime dynamics. Galaxies, cosmic regions, and independent domains form due to variations in gravitational pressure and resulting curvature. When such pressure–curvature domains become causally disconnected through expansion, they realize separate universes within a broader multiverse. We provide a theoretical foundation for the multiverse in PPC gravity, describe mechanisms that allow independent pressure–curvature domains to evolve autonomously, and suggest possible observational signatures.

## 1. Introduction

Traditional cosmological models describe a single universe evolving under general relativity with dark matter and dark energy invoked to explain observed dynamics. However, these models do not provide a clear physical mechanism underlying gravitational curvature. Pawan Upadhyay's Pressure–Curvature Law of Gravity hypothesizes that pressure generated by mass–energy is the physical cause of spacetime curvature, and that this causal mechanism can be extended to explain cosmic structures, cosmic expansion, and — as shown here — the emergence of a multiverse.

The multiverse concept in PPC gravity is not based on speculative mathematical constructs but on pressure–curvature dynamics interacting with cosmic expansion and causal separation.

## 2. Fundamental Principle of the PPC Law

The PPC Law is expressed as:

$$P_g = \omega E_d$$

where

- $P_g$  is gravitational pressure,
- $E_d$  is energy density,
- $\omega$  is the equation-of-state parameter.

The core causal chain is:

Mass-Energy → Pressure → Curvature → Motion

In this framework, curvature is a consequence of pressure, not an independent primary entity.

This law applies at all scales, from black holes to cosmological expansion.

### **3. Cosmic Expansion and Pressure Gradients**

In PPC gravity, cosmic expansion arises as a direct consequence of evolving pressure fields. As the universe expands:

Average energy density declines

Pressure fields weaken

Curvature decreases

Outward inertial tendencies dominate

This pressure-induced expansion provides a physical mechanism that naturally leads to causal separation of regions of spacetime.

### **4. Causal Disconnection and Independent Domains**

As the universe expands, regions with initially slight differences in pressure can drift beyond each other's causal horizon. PPC gravity explains that:

1. Local pressure gradients produce local curvature.
2. When regions expand beyond light-contact distances, pressure interactions cease.
3. Each region evolves with its own pressure–curvature dynamics.

When pressure–curvature domains no longer influence each other, they become causally independent universes.

### **5. Emergence of the PPC Multiverse**

The PPC multiverse emerges when:

Large-scale expansion separates regions

Pressure gradients diminish across vast distances

Each domain continues to evolve independently

Curvature patterns become unique to each domain

Unlike other theories, this multiverse does not require:

Branes

Extra dimensions

Quantum decoherence

Anthropic selection

It arises from classical pressure-driven curvature dynamics.

## **6. Structure and Properties of PPC Universes**

In PPC multiverse theory:

Each universe has its own pressure field evolution

Each universe can have different:

Pressure histories

Curvature distributions

Expansion rates

Matter–energy distributions

Universes form naturally from initial pressure inhomogeneities

Some universes may recollapse, others may expand forever, depending on their pressure–curvature interplay.

## **7. Observational Implications**

Although the PPC multiverse domains are causally disconnected and therefore cannot exchange information in principle, there may be subtle indirect signatures:

Anomalies in cosmic background pressure structures

Unexplained large-scale alignment patterns

Pressure wave remnants beyond causal horizons

These require further theoretical and observational study.

## **8. Entropy and Information in the PPC Multiverse**

In PPC gravity, entropy is associated with pressure–information content. Each universe in the multiverse retains its own entropy evolution trajectory.

This suggests that:

Entropy increases as universes expand

Different universes can have different entropy histories

Common pressure origins imply shared initial conditions

## **9. Black Holes and Universe Boundaries**

Black holes form through pressure–curvature feedback processes. In PPC multiverse scenarios, extremely high-pressure regions can form isolated curvature domains that behave like independent universes at small scales.

This leads to the possibility that:

Some universes could be “born” inside black hole-like pressure regions

These universes might be causally sealed from their parent region

This is speculative but plausible in PPC dynamics.

## **10. Comparison with Other Multiverse Theories**

### **Point-Based Comparison: PPC Multiverse vs Other Multiverse Theories**

#### **I. Physical Origin**

##### **PPC Multiverse:**

Arises from weakening gravitational pressure and curvature, leading to causal disconnection of spacetime regions.

##### **Inflationary Multiverse:**

Originates from eternal inflation driven by a hypothetical scalar inflaton field.

##### **Quantum Many-Worlds:**

Arises from wavefunction branching during quantum measurements.

##### **String/Brane Multiverse:**

Emerges from extra dimensions and brane configurations in string theory.

#### **II. Fundamental Mechanism**

##### **PPC Multiverse:**

Governed by pressure → curvature → causal separation (classical gravitational mechanism).

##### **Inflationary Multiverse:**

Governed by quantum fluctuations in an inflating vacuum.

##### **Many-Worlds:**

Governed by quantum decoherence, not spacetime dynamics.

##### **String Multiverse:**

Governed by vacuum landscape selection in higher dimensions.

#### **III. Role of Gravity**

##### **PPC Multiverse:**

Gravity is central and causal; pressure is the driving agent.

##### **Inflationary Multiverse:**

Gravity plays a secondary role to scalar fields.

**Many-Worlds:**

Gravity plays no role in universe splitting.

**String Multiverse:**

Gravity is embedded but not the cause of multiplicity.

**IV. Need for Extra Assumptions****PPC Multiverse:**

Requires no extra dimensions, no exotic fields, no quantum branching.

**Inflationary Multiverse:**

Requires inflaton fields and specific inflation potentials.

**Many-Worlds:**

Requires universal validity of quantum mechanics at all scales.

**String Multiverse:**

Requires extra dimensions, branes, and unverified string vacua.

**V. Nature of Universe Separation****PPC Multiverse:**

Separation occurs via classical causal disconnection due to weak curvature.

**Inflationary Multiverse:**

Separation occurs via rapid exponential expansion.

**Many-Worlds:**

Separation is non-spatial and purely quantum.

**String Multiverse:**

Separation occurs in higher-dimensional configuration space.

**VI. Internal Structure of Universes****PPC Multiverse:**

Each universe contains high-pressure and low-pressure regions, with galaxies, stars, and voids.

**Inflationary Multiverse:**

Universes may have different constants but structure is model-dependent.

**Many-Worlds:**

Universes are identical copies differing only by outcomes.

**String Multiverse:**

Universes differ by vacuum states and constants.

## VII. Testability and Observational Outlook

**PPC Multiverse:**

Potential indirect signatures via pressure-curvature anomalies or large-scale structure effects.

**Inflationary Multiverse:**

Very limited testability; mostly indirect and debated.

**Many-Worlds:**

Essentially untestable at cosmological scales.

**String Multiverse:**

Currently non-testable experimentally.

## VIII. Conceptual Simplicity

**PPC Multiverse:**

Uses a single physical principle: pressure causing curvature.

**Inflationary Multiverse:**

Requires multiple assumptions and fields.

**Many-Worlds:**

Conceptually radical; challenges classical reality.

**String Multiverse:**

Highly complex and mathematically abstract.

## IX. Scientific Status

**PPC Multiverse:**

A classical, gravity-based theoretical extension of a unified law.

**Inflationary Multiverse:**

A speculative extension of inflationary cosmology.

**Many-Worlds:**

An interpretation of quantum mechanics, not a gravitational theory.

**String Multiverse:**

A speculative outcome of an unverified fundamental theory.

## X. Core Distinction (One-Line Each)

**PPC Multiverse:**

Universes separate because gravity becomes weak.

**Inflationary Multiverse:**

Universes separate because space inflates eternally.

**Many-Worlds:**

Universes separate because quantum outcomes branch.

**String Multiverse:**

Universes separate because extra-dimensional vacua differ.

## Final PPC Perspective

The PPC multiverse is distinguished by its reliance on a single, physically intuitive mechanism—pressure-driven curvature weakening—making it conceptually simpler and more grounded in classical gravitational physics than other multiverse proposals.

## 11. Conclusion

The multiverse concept in Pawan Upadhyay's Pressure–Curvature Law of Gravity emerges naturally from the interaction between pressure fields, curvature, and cosmic expansion. Causal disconnection due to expanding pressure gradients leads to independent evolving universes, each with its own pressure and curvature history. Unlike other multiverse models, PPC multiverse domains do not require exotic physics; they arise from the same fundamental mechanism that governs gravity itself.

This framework provides a physically intuitive and potentially observable interpretation of a multiverse grounded in measurable pressure–curvature dynamics.

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