

Origin of Time in the Multiverse within Pawan Upadhyay's Pressure–Curvature Law of Gravity

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Abstract

The origin of time remains one of the most fundamental unresolved questions in physics and cosmology. In conventional theories, time is often treated as a pre-existing background parameter or as a coordinate within spacetime, without a clear physical origin. This paper presents a novel interpretation of the origin of time within the framework of Pawan Upadhyay's Pressure–Curvature Law of Gravity (PPC Law), extended to a multiverse context. In the PPC framework, time emerges as a physical consequence of gravitational pressure and curvature dynamics. The paper proposes that time originates locally within each universe as pressure gradients and curvature evolve, and that in a multiverse scenario, time is not universal but domain-dependent. Weakening pressure and curvature lead to causal separation of universes, each with its own independent temporal evolution. This provides a physically intuitive, gravity-based explanation for the emergence, direction, and multiplicity of time.

1. Introduction

Time is central to all physical processes, yet its origin is poorly understood. Classical mechanics treats time as absolute, while relativity incorporates time as a coordinate within spacetime geometry. Neither framework explains why time exists or how it begins.

Multiverse theories further complicate the issue by implicitly assuming a single global time or by avoiding the question altogether. In contrast, Pawan Upadhyay's Pressure–Curvature Law of Gravity (PPC Law) offers a framework in which time arises dynamically from physical processes rather than being assumed a priori.

This paper explores the origin of time in a multiverse governed by PPC gravity, proposing that time is an emergent phenomenon tied to pressure-driven curvature evolution.

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,
- ω 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.

In this framework, motion is impossible without curvature, and curvature is impossible without pressure. Time, therefore, must be associated with the progression of motion driven by pressure–curvature dynamics.

3. Time as an Emergent Physical Quantity

In PPC gravity, time is not fundamental. Instead:

- Time emerges when pressure gradients generate curvature.
- Curvature enables motion and change.
- The ordering of change defines time.

Thus:

Time is the measure of evolution of pressure–curvature states.

If pressure and curvature are static, time has no physical meaning.

4. Origin of Time in a Single Universe

At the birth of a universe in the PPC framework:

Energy density is high.

Gravitational pressure is strong.

Curvature evolves rapidly.

Pressure gradients drive intense motion.

This rapid evolution establishes:

A direction of change,

A sequence of states,

A locally defined time parameter.

Therefore:

Time begins when pressure and curvature begin to evolve.

This replaces the abstract notion of “time beginning at the Big Bang” with a physical mechanism.

5. Arrow of Time and Pressure Evolution

The arrow of time in PPC gravity arises naturally:

- Pressure gradients tend to relax over time.
- High-pressure states evolve toward lower-pressure states.
- Curvature becomes progressively weaker on average.
- This monotonic evolution defines a preferred temporal direction.

Thus, the arrow of time is:

A consequence of irreversible pressure redistribution.

6. Multiverse and the Multiplicity of Time

In a multiverse governed by PPC gravity:

- Different regions experience different pressure histories.
- As pressure and curvature weaken over large scales, causal disconnection occurs.

Each causally disconnected region becomes a separate universe.

Crucially:

- Each universe possesses its own independent time.
- There is no global multiversal clock.

7. Origin of Time in Separate Universes

When a new universe becomes causally disconnected:

- External pressure influence vanishes.
- Internal pressure gradients dominate.
- A new, independent temporal evolution begins.

Thus, time in each universe:

Starts with its own pressure–curvature evolution,

Proceeds independently of other universes,

May flow at different effective rates depending on pressure strength.

8. Absence of Time in Weak-Pressure Regions

In the PPC framework:

- Extremely weak pressure and near-flat curvature imply minimal change.
- In the limit of zero pressure gradients, motion ceases.
- Without motion, time loses physical significance.

This suggests that:

“Before” the emergence of a universe, time has no operational meaning.

Time is local, emergent, and conditional.

9. Comparison with Conventional Views of Time

Newtonian physics: Time is absolute and universal.

General Relativity: Time is a geometric coordinate.

Quantum interpretations: Time is often external or problematic.

PPC gravity: Time is pressure-driven and emergent.

The PPC framework thus provides a physical origin for time absent in other theories.

10. Implications for Cosmology and Physics

The PPC origin of time implies:

- No universal multiverse time parameter.
- Possible variation in temporal flow across universes.
- A natural explanation for the arrow of time.
- A link between gravity, time, and entropy through pressure dynamics.

This approach also avoids paradoxes associated with “before the Big Bang.”

11. Pressure–Time Relationship and Time Dilation in PPC Gravity

In Pawan Upadhyay's Pressure–Curvature Law of Gravity (PPC Law), the flow of time is directly governed by gravitational pressure. Time is not an abstract background parameter but a physical quantity that responds to pressure-induced curvature.

The fundamental pressure–time relationship in PPC gravity is:

- Higher gravitational pressure → slower flow of time
- Lower gravitational pressure → faster flow of time

This behavior arises because increased pressure strengthens spacetime curvature, which suppresses the rate of physical processes and clock evolution.

It is essential to distinguish between time rate and time dilation. In the PPC framework:

- When time slows, time dilation increases

- When time speeds up, time dilation decreases

Thus, the complete PPC-consistent chain is:

Higher Pressure \Rightarrow Time Slows \Rightarrow Stronger Time Dilation

Lower Pressure \Rightarrow Time Speeds Up \Rightarrow Weaker Time Dilation

This formulation provides a clear physical interpretation of gravitational time dilation. Regions of strong gravity—such as near massive bodies or black holes—correspond to high-pressure environments where time flows slowly and dilation is strong. Conversely, regions of weak gravity—such as cosmic voids or intergalactic space—correspond to low-pressure environments where time flows faster and dilation is minimal.

In the multiverse context of PPC gravity, this relationship implies that different universes may experience different effective rates of time flow, depending on their internal pressure–curvature histories. Each universe possesses its own temporal evolution governed by local pressure conditions, reinforcing the idea that time is local, emergent, and pressure-dependent, rather than universal.

PPC Key Statement

Higher pressure slows time and enhances time dilation, while lower pressure accelerates time and weakens time dilation; thus, the flow of time itself is a direct physical consequence of gravitational pressure.

12. Limitations and Future Work

This paper presents a conceptual framework. Future research should:

- Develop mathematical models linking pressure evolution to proper time.
- Explore observational consequences.
- Investigate relations with quantum time and thermodynamics.

13. Conclusion

Within Pawan Upadhyay's Pressure–Curvature Law of Gravity, time is not a fundamental background entity but an emergent physical phenomenon arising from the evolution of gravitational pressure and curvature. In a multiverse context, time originates independently in each causally disconnected universe, governed by local pressure–curvature dynamics. This framework provides a coherent, gravity-based explanation for the origin, direction, and multiplicity of time, offering new insight into one of the deepest questions in physics.

Final PPC Statement

Time is born from pressure, shaped by curvature, and defined by motion; where pressure vanishes and curvature flattens, time itself loses meaning.

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