

Black Holes in Pawan Upadhyay's Pressure–Curvature Law of Gravity and the Formation of Black Holes

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Year: 2025

Abstract

Pawan Upadhyay's Pressure–Curvature Law of Gravity (PPC Law) proposes that gravitational phenomena originate from pressure generated by mass–energy, with spacetime curvature emerging as the geometric consequence of this pressure. In this framework, black holes are interpreted as extreme pressure–curvature systems rather than purely geometric singularities. This paper presents a complete PPC-based explanation of black holes and their formation, including stellar collapse, pressure–curvature feedback, event horizon formation, light trapping, time dilation, gravitational waves, and entropy. By identifying pressure as the physical cause of curvature, the PPC Law provides a clear and intuitive mechanism underlying black hole physics while remaining consistent with established observational results.

1. Introduction

Black holes represent the most extreme gravitational objects in nature. In General Relativity, they are described as regions of intense spacetime curvature produced by mass–energy. While this geometric description is mathematically successful, it does not explicitly identify the physical mechanism responsible for the formation of such extreme curvature.

Pawan Upadhyay's Pressure–Curvature Law of Gravity (PPC Law) addresses this gap by asserting that pressure generated by mass–energy is the direct physical cause of spacetime curvature. Within this framework, black holes arise naturally as maximum-pressure curvature states. This paper develops a unified PPC description of black holes and explains their formation through pressure-driven dynamics.

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.

3. Black Holes as Maximum-Pressure Curvature Systems

In the PPC Law, a black hole is defined as a region where gravitational pressure becomes so large that spacetime curvature prevents any outward motion.

A black hole is an extreme pressure–curvature configuration in which gravitational pressure dominates all opposing physical effects.

Key characteristics include:

- Extremely high energy density
- Correspondingly extreme gravitational pressure
- Curvature that redirects all geodesics inward

Thus, black holes are physically interpretable systems governed by pressure, rather than purely abstract geometric solutions.

4. Formation of a Black Hole in the PPC Framework

4.1 Stellar Collapse

Black hole formation begins with the collapse of a massive star after nuclear fuel exhaustion. As outward thermal pressure diminishes, gravitational compression increases.

In PPC terms:

- Energy density E_d rises rapidly
- Gravitational pressure P_g increases
- Pressure gradients intensify

4.2 Pressure–Curvature Feedback Loop

As collapse proceeds, a positive feedback loop develops:

$$E_d \uparrow \Rightarrow P_g \uparrow \Rightarrow \text{Curvature} \uparrow \Rightarrow \text{Inward motion} \uparrow \Rightarrow E_d \uparrow$$

This runaway pressure–curvature amplification is the fundamental mechanism driving black hole formation in the PPC Law.

5. Event Horizon as a Pressure Boundary

In Pawan Upadhyay's Pressure–Curvature Law of Gravity, the event horizon represents a critical pressure–curvature boundary.

At this boundary:

- Pressure reaches a threshold value
- All outward spacetime paths disappear
- Time dilation becomes extreme

Thus, the event horizon is not merely geometric but a physically meaningful pressure boundary.

6. Light Trapping Mechanism

Light remains locally propagating at speed c , but cannot escape a black hole because:

- Pressure-generated curvature bends spacetime inward
- All null geodesics are redirected toward the core
- No outward curvature exists beyond the horizon

Light is trapped by curvature confinement, not by local slowing.

7. Time Dilation Near Black Holes

In the PPC Law, time dilation is directly controlled by pressure:

Higher $P_g \rightarrow$ Slower time

Near the event horizon:

- Gravitational pressure becomes extremely large
- Clocks slow dramatically relative to distant observers

Time dilation is therefore a direct pressure effect.

8. Core Region and Singularity Interpretation

In classical theories, black holes contain singularities. In the PPC framework:

- A singularity represents an idealized infinite-pressure limit
- Physically, this indicates breakdown of classical pressure description
- Real black holes are better described as ultra-high but finite pressure cores

This interpretation avoids unphysical infinities.

9. Gravitational Waves from Black Holes

In the PPC Law:

Gravitational waves are interpreted as pressure waves

- Black hole formation and mergers generate strong pressure oscillations
- These disturbances propagate through spacetime at speed c

Observed gravitational waves thus correspond to propagating pressure–curvature fluctuations.

10. Entropy and Information

Within the PPC framework:

- Entropy is related to pressure–information content
- The event horizon encodes information about internal pressure states
- Black hole entropy reflects a maximum-pressure configuration

This provides a physical interpretation of black hole thermodynamics.

11. Relation to General Relativity

General Relativity accurately describes the geometry of black holes.

Pawan Upadhyay's Pressure–Curvature Law of Gravity explains the physical cause behind that geometry.

The two frameworks are complementary:

- GR explains how spacetime behaves
- PPC explains why spacetime behaves that way

12. Conclusion

In Pawan Upadhyay's Pressure–Curvature Law of Gravity, black holes emerge naturally as maximum gravitational pressure systems. Their formation results from pressure–curvature feedback during stellar collapse, the event horizon corresponds to a critical pressure boundary, light trapping arises from curvature confinement, and time dilation is pressure-controlled. By identifying pressure as the physical origin of curvature, the PPC Law provides a coherent, intuitive, and physically grounded explanation of black holes while preserving all successful predictions of existing gravitational theory.

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