

# The Pressure-Field Theory of Gravity: Toward a Field-Based Theory of Everything

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# 1 Introduction

This paper presents a unified framework in which gravity, gauge interactions, particle mass, and quantum phenomena all emerge from a single scalar pressure field,  $\Phi(x, t)$ . This theory, called the Pressure-Field Theory of Gravity (PFTG), replaces spacetime curvature with pressure gradients and treats all known forces as field harmonics.

## 2 Gravitational Sector: Emergent Mass and Field-Sourced Gravity

In PFTG, gravitational effects arise from gradients in a real scalar field, not spacetime curvature. Static solutions to the field equation localize energy, forming stable soliton-like objects that mimic mass.

$$\frac{1}{r^2} \frac{d}{dr} \left( r^2 \frac{d\Phi}{dr} \right) = \frac{dV}{d\Phi} \quad (1)$$

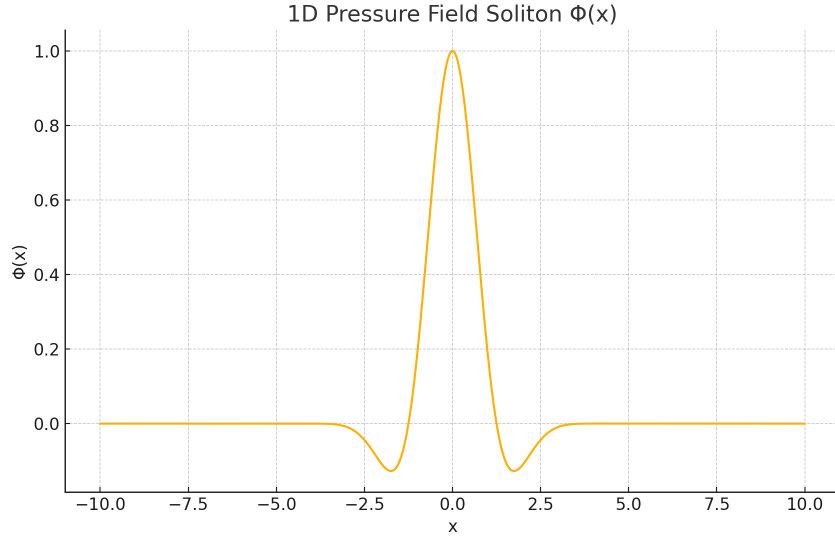


Figure 1: 1D Pressure field soliton  $\Phi(x)$  representing localized mass.

## 3 Gauge Sector: Force Mediation via Pressure Field Modes

Gauge interactions emerge as harmonic excitations of the pressure field. Each mode corresponds to a specific force:

- $n = 1$ : U(1) Electromagnetism

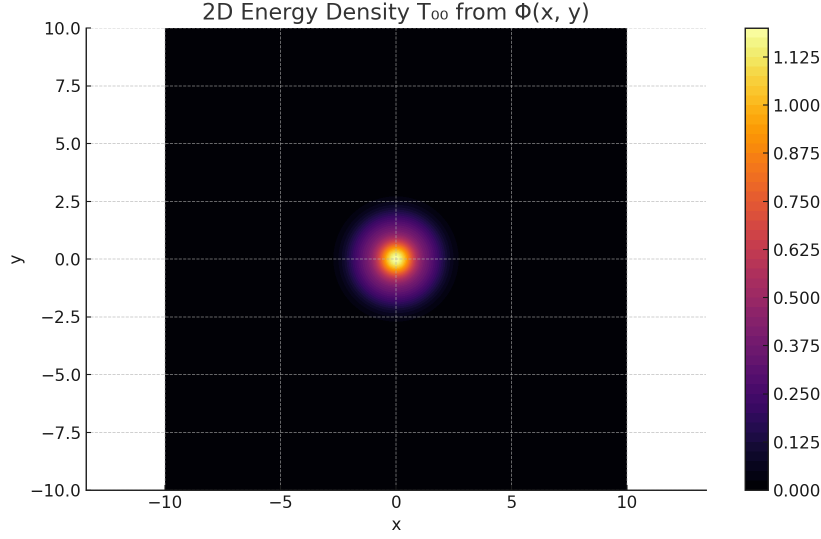


Figure 2: 2D energy density  $T_{00}(x, y)$  from the pressure soliton.

- $n = 2$ : SU(2) Weak Force
- $n = 3$ : SU(3) Strong Force

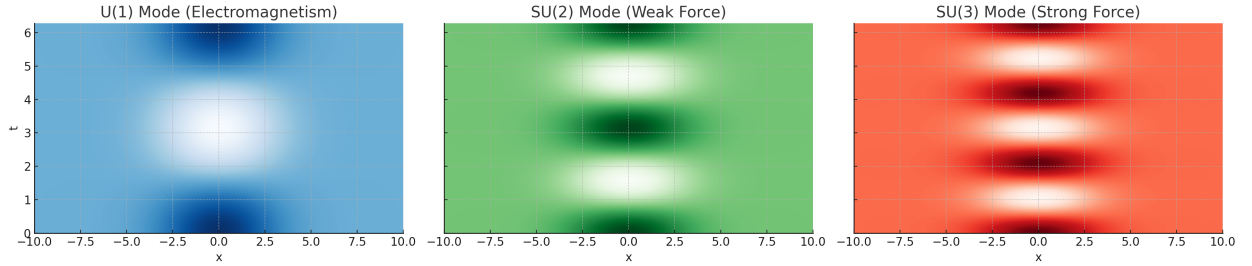


Figure 3: Harmonic pressure modes corresponding to U(1), SU(2), and SU(3) forces.

## 4 Quantum Sector: Particle Formation from Pressure Field Quantization

Particles arise as localized, coherent wavepackets in  $\Phi$ . These pressure solitons replace point particles and encode mass via coupling to the field's vacuum.

$$m_f = y_f \langle \Phi \rangle \quad (2)$$

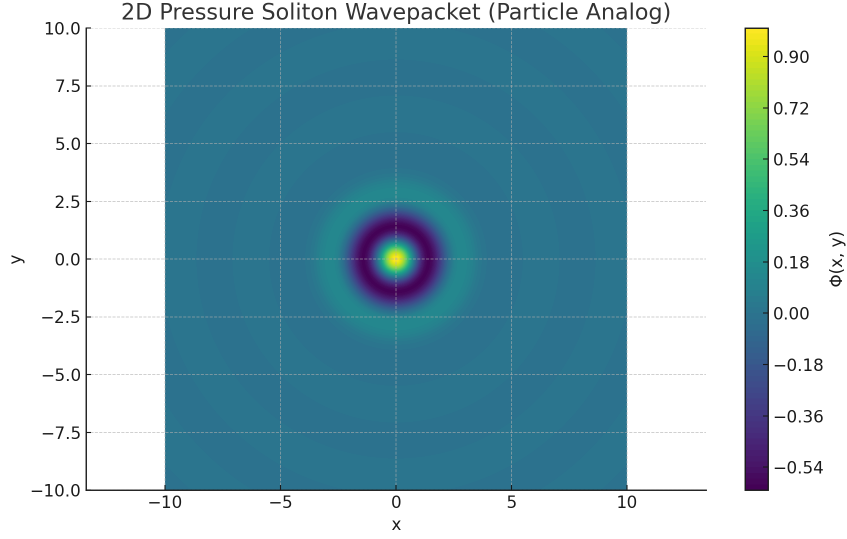


Figure 4: 2D pressure soliton wavepacket representing a quantum particle analog.

## 5 Cosmological Predictions

- **Inflation:** Driven by slow-roll evolution of  $V(\Phi)$ .
- **Dark Energy:** Arises from residual vacuum energy in  $V(\Phi)$ .
- **CMB Ripples:** Seeded by entropy-pressure fluctuations in  $\Phi$ .

## 6 Conclusion and Outlook

PFTG offers a unified theory where:

- Gravity = pressure gradient
- Forces = pressure harmonics
- Particles = soliton wavepackets
- Quantum behavior = field quantization

Future work includes quantization refinement, N-body simulations, and lensing predictions.