GRAVITATIONAL LATTICE HYPOTHESIS 2.0:

The Fractal-Tetrahedral Architecture of the Universe

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ABSTRACT

This paper proposes a revised cosmological hypothesis addressing the missing mass problem (Dark Matter) by transitioning from a "fluid" model to a "solid-state" model (Solid State Universe). The hypothesis posits that Dark Matter consists of **Primordial Black Holes (PBHs)** arranged in a **fractal tetrahedral lattice**. This model naturally explains the flat rotation curves of galaxies through the fractal dimension of the lattice and redefines gravity as elastic tension within this cosmic structure. Furthermore, it interprets gravitational waves not as ripples in empty space, but as phonons (vibrations) propagating through this crystalline architecture.

1. INTRODUCTION: THE STANDARD MODEL CRISIS

Observations of stellar rotation velocities in galaxies (Vera Rubin, 1970) revealed a fundamental discrepancy with Newtonian dynamics. The velocity of stars at the galactic periphery does not decrease but remains constant, implying the presence of vast amounts of invisible matter. The standard model (Lambda-CDM) assumes the existence of a "halo" — a diffuse cloud of collisionless particles (WIMPs). However, despite decades of experimentation, direct detection of WIMPs has failed. This failure reopens the door for alternative candidates, specifically Primordial Black Holes (PBHs), the existence of which is consistent with recent gravitational wave detections by LIGO/Virgo.

2. HYPOTHESIS: THE CRYSTALLINE UNIVERSE

2.1. The Primordial Nodes (Hardware of Reality)

Unlike stellar black holes formed by the collapse of massive stars, the building blocks of this lattice are Primordial Black Holes (PBHs) formed from density fluctuations within a fraction of a second after the Big Bang.

- **Specification:** These objects fall into the "asteroid mass window" (10^{17} kg to 10^{22} kg) but are compressed to the size of an atom ($\approx 10^{-15}$ m).
- **Function:** These microscopic, super-massive nodes act as the "anchors" or "pixels" of reality, carrying the mass and information of the lattice.

2.2. Tetrahedral Geometry

We replace the concept of a simple cubic lattice with a **Tetrahedral Lattice** (Isotropic Vector Matrix).

- **Stability:** The tetrahedron is the most stable 3D structure, incapable of deformation without altering edge lengths. This suggests that the vacuum is not empty space, but a **super-rigid, elastic crystalline structure** defined by PBH vertices.

2.3. Fractal Distribution (Sierpinski Structure)

The distribution of nodes in the lattice is not homogeneous (like a salt crystal) but **fractal** (recursive clustering, e.g., Sierpinski tetrahedron model).

- This explains the existence of cosmic structures across all scales: from star clusters to galaxies and the Cosmic Web. Matter is suspended upon this invisible, self-similar skeleton.

3. MATHEMATICAL MODEL: ELASTICITY AND FRACTALS

3.1. Mass Distribution via Fractal Dimension

The observed flat rotation curves of galaxies ($v \approx$ const) are a direct consequence of the lattice's fractal geometry. In a classical volume, mass increases as $M \propto r^3$. In our model, the sum of PBH masses ($\Sigma\, m\_PBH$) increases according to the fractal dimension D:

$M(r) \propto r^D$

If the lattice has a fractal dimension of $D \approx 1$ to 2 (corresponding to a "porous" web), the ratio M/r naturally remains constant. This results in constant orbital velocity without the need for additional "magic" matter.

3.2. Revised Velocity Equation (The Elastic Term)

The orbital velocity equation is extended to include the elastic component of the lattice (analogous to Hooke's Law). Gravity is not merely point-source attraction but also the lattice's resistance to deformation:

$v^2 = (G\, /\, r) \times [\, M\_vis + \Sigma\, m\_PBH\,] + (k \cdot \Delta x\, /\, m)$

Where:

- **$\Sigma\, m\_PBH$**: The sum of node masses, increasing linearly with radius due to fractal geometry.
- **k**: The stiffness modulus of the vacuum (spacetime).
- **Δx**: Local deformation of the lattice caused by the presence of the star.

4. PREDICTIONS AND OBSERVATIONAL EVIDENCE

4.1. Quantized Microlensing (The "Pixel" Effect)

If Dark Matter is composed of discrete PBHs in a lattice (not a gas), gravitational microlensing of background stars will not exhibit a smooth Gaussian brightness curve.

- **Prediction:** Observed light curves will exhibit **"steps" or fractal patterns (jagged edges)** caused by light passing discrete lattice nodes. Light effectively "jumps" across the pixels of reality.

4.2. Gravitational Waves as Phonons

Signals detected by LIGO are not ripples in empty nothingness.

- **Interpretation:** They are **phonons** (sound waves/vibrations) propagating through the elastic tetrahedral lattice. The merger of two black holes vibrates the "strings" of this cosmic instrument. The lattice's conductivity allows these waves to travel vast distances without significant energy loss.

5. DISCUSSION: THE UNIVERSE AS INFORMATION

This model implies a radical shift in understanding reality. If the universe is composed of discrete nodes (PBHs) carrying information (Holographic Principle) and arranged in a geometric lattice:

1. **Dark Matter** is not a "substance" but the mass of the universe's "hardware" (structural framework).
2. **The Universe is a Computational System:** Primordial Black Holes function as logic gates or memory cells.
3. **Future Research:** We propose re-evaluating data from the OGLE project to search for fractal patterns in microlensing time series, which would confirm the existence of the PBH "Asteroid Window."