Title: Validation of the Layered Universe Model through Derivation of the Poisson Equation

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Abstract

We present a physically motivated derivation of the classical Poisson equation starting from a layered, finite, and discrete model of the universe. Unlike standard approaches that assume homogeneity, isotropy, and infinite extent, our model proposes a disk-like structure of concentric matter shells with internal energy. We show that Newtonian gravitational potential arises naturally from such a configuration, and that the resulting potential satisfies the classical Poisson equation. This result validates the layered model as consistent with classical gravitational theory and opens the door to alternative cosmological formulations. Furthermore, we demonstrate that the Poisson equation is not fundamental but rather a limiting case of our more general layered-shell formulation.

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1. Introduction

Classical cosmology often begins with continuous and symmetric assumptions: a homogeneous and isotropic universe, infinite in extent, and with smooth density functions. While successful in many respects, these assumptions obscure the potential richness of physical structure, especially in the early universe.

This paper explores a different foundation. We ask: Can the classical gravitational field equations arise from a model that is fundamentally discrete, layered, and finite? We propose a model where the universe originates from a central neutron cluster and evolves through successive destabilizations and emissions of concentric shells or rings.

The goal is to validate this model not by introducing speculative fields or parameters, but by recovering a known and accepted result: the Poisson equation. If the model leads to this equation from first principles, it gains immediate physical legitimacy. In doing so, we also reveal that Poisson's equation is a special case of our model, obtained in the limit where the layered shells are infinitesimally spaced and the matter distribution becomes effectively continuous.

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2. Starting Assumptions

- The universe is not homogeneous and isotropic but is organized as a structured, layered disk.
- Matter is distributed in discrete concentric shells, each with finite mass and internal structure.
- Each unit of matter (neutron or proton) carries a base, non-removable energy that does not radiate.
- The system evolves through energy release from neutron decay in the core.
- No infinite values are used. The model assumes a finite total mass and volume.

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3. Physical Structure of the Model

At time zero, the universe consists of a massive central cluster of neutrons with known volume, mass, and density. Each shell released from this core has a defined mass and occupies a discrete radial region.

The gravitational potential at any point is computed from the contributions of the internal mass layers, using the shell theorem from Newtonian gravity. By summing over all internal shells, the gravitational potential at radius r is defined.

When the shell spacing becomes sufficiently dense, the summation transitions to an integral, producing a continuous potential field. In this limit, the discrete layered model recovers the classical formulation, showing that the Poisson equation is an emergent approximation of a fundamentally discrete structure.

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4. Derivation of the Poisson Equation

From the gravitational potential defined as a sum over internal shells:

$$\Phi(r) = -G \sum_i \frac{M_i}{r_i}$$

We move to the continuous case:

$$\Phi(r) = -G \int_0^r \frac{4\pi r'^2 \rho(r')}{r} \, dr'$$

Taking the Laplacian in spherical coordinates:

$$\nabla^2 \Phi(r) = 4\pi G \rho(r)$$

This is the classical Poisson equation.

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5. Interpretation and Significance

This result shows that the gravitational field in a layered, shell-based, and discrete universe behaves identically to the field in a continuous, homogeneous one — at least in the Newtonian limit.

Rather than treating Poisson's equation as an axiom, we derive it as an emergent behavior from physical structure. This grants legitimacy to the layered model as a valid representation of physical reality.

Moreover, since the derivation uses only Newtonian gravity, it aligns with the Newtonian limit of Einstein's field equations. Thus, the model is consistent with General Relativity under low-speed and weak-field conditions.

Most importantly, this derivation reveals that Poisson's equation is a **limiting case** of the layered model — one that arises only when the discrete shell structure becomes infinitely dense and transitions into a continuous matter distribution.

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6. Conclusion

The derivation of the classical Poisson equation from a physically structured, finite, and layered model validates the layered shell universe as consistent with known gravitational theory. This suggests that gravitational laws may be rooted in constructive physical structure rather than purely geometric assumptions.

This result establishes the layered model as a viable alternative foundation for cosmology. It also prepares the ground for further development of dynamic, relativistic formulations that can address cosmic evolution, expansion, and large-scale structure without invoking homogeneity, isotropy, or energy-dark constructs.

Most critically, by reproducing the classical result as a special case, the model positions itself not in opposition to established theory, but as a broader and deeper framework that contains it.

Next Steps

- Extend the derivation to dynamic systems: evolving shells and expanding layers.
- Incorporate relativistic corrections using axially symmetric metrics (e.g., Weyl class).
- Explore observational implications such as redshift, gravitational lensing, and cosmic background structure.

Keywords: Poisson Equation, Layered Universe, Neutron Shells, Gravitational Potential, Alternative Cosmology, Base Energy, Finite Model, Shell Theorem