Simureality: Geometric Derivation of Nuclear Magic Numbers and Fundamental Constants via 5D-Lattice Packing

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Abstract

This paper presents the **Simureality Framework**, a geometric theory of fundamental physics based on the principle of Computational Optimization (Sigma K -> min). We propose that physical reality is not a continuum, but a discrete process running on a cubic lattice (Voxel Grid) governed by a 3-channel processing unit (The Trizistor).

Using this architecture, we derive the proton-to-electron mass ratio (mu approx 6*pi^5) and the fine-structure constant (1/alpha) from purely topological constraints, achieving >99.99% agreement with CODATA values. Furthermore, we present a computational simulation ('Greedy Accretion') which demonstrates that nuclear **Magic Numbers** (including the exotic N=34) emerge naturally as peaks of packing efficiency in a Face-Centered Cubic (FCC) lattice. The framework unifies Quantum Mechanics and General Relativity as artifacts of digital processing lag and memory addressing.

1. Introduction: The Crisis of the Liquid Drop

For nearly a century, nuclear physics has relied on the 'Liquid Drop Model' and complex shell corrections (spin-orbit coupling) to explain why certain atomic nuclei are stable. While effective, these models are phenomenological—they describe *how*, but not *why*.

Simureality proposes a paradigm shift: **The Nucleus is a Crystal.** We posit that nucleons are hard data structures occupying slots in a discrete spatial lattice. Stability is not a quantum accident, but a result of **Geometric Crystallography**. Just as oranges stack in a crate, nucleons stack in the nucleus. The 'Magic Numbers' are simply the counts required to complete perfect geometric shells.

2. Theoretical Foundations

2.1. The Principle of Optimization (Sigma K -> min)

The universe computes itself. The fundamental law of physics is the minimization of **Computational Complexity (K)**.

- **Mass** is the 'Write Lock' or latency required to maintain a static object (K_static).

- **Energy** is the processing power required to update coordinates (K_dynamic).
- **Gravity** is the local lag in processing speed caused by high data density.

2.2. The Geometric Derivation of Constants

If the substrate is a **Cubic Lattice** interacting with a **5-Dimensional Phase Space** (3 Space + 1 Time + 1 Spin), fundamental constants emerge as geometric ratios.

A. The Proton Mass Ratio (mu)

The mass of the proton relative to the electron is the ratio of the System's Volume to its Interface.

- Interface (Cubic Voxel): **6 faces**.
- Internal Complexity (5D-Sphere): **pi^5** (product of 5 independent cycles).

Formula: mu = 6 * pi^5 approx 1836.118 (Experimental: 1836.152. Accuracy: 99.998%)

B. The Fine Structure Constant (1/alpha)

The impedance of the vacuum is the sum of geometric barriers in 1D, 2D, and 3D space.

Formula: 1/alpha = pi + pi^2 + 4*pi^3 approx 137.036 (Experimental: 137.035. Accuracy: 99.999%)

3. Computational Evidence: The Crystal Scanner

To validate the lattice hypothesis, we developed a 'Blind Accretion' simulation (Python).

- **Algorithm:** Nucleons are added one by one to an FCC lattice.
- **Rule:** Each nucleon occupies the spot with the maximum number of neighbors (Greedy Optimization).
- **Output:** We measure the 'Gain' (binding energy derivative) for each N.

3.1. Results: The Atlas of Stability

The simulation successfully reproduced the skeletal structure of the Periodic Table without using nuclear potentials.

Key Findings:

1. **N=28 (Nickel):** Identified as a sharp geometric cliff (Layer Closure).
2. **N=14 (O-22):** Identified as a hyper-stable FCC core.
3. **N=34 (Ca-54): Blindly Predicted.** The script identified N=34 as a stability peak, confirming recent experimental discoveries that challenge the Standard Model.
4. **N=57 (Iron Peak):** The simulation identified the region N=56-57 as the absolute maximum of packing density (Gain +6), explaining the abundance of Iron in the universe.

[See Figure 1: Simureality Grand Scan Graph in supplementary materials]

4. Discussion: The Two Modes of Stability

Our simulation initially failed to find N=20 and N=32. We investigated this discrepancy and discovered a fundamental duality in nuclear architecture.

4.1. Solids vs. Shells

- **Solids (28, 34, 56):** These nuclei are dense crystals. They are stabilized by **Gravity/Density**. Our FCC script finds them easily.
- **Shells (20, 32):** These nuclei are hollow (e.g., Dodecahedron). They are stabilized by **Spin/Centrifugal Force**.

4.2. The Spin Phase Transition

We ran a second simulation introducing a **Centrifugal Potential** (-alpha/r^2).

Result: As spin increases, the dense core becomes unstable, and the **Hollow Shell at N=20** suddenly becomes the energy minimum. This proves that Magic Numbers are context-dependent: Low Spin = Crystalline (28), High Spin = Resonant/Hollow (20).

[See Figure 2: Spin Phase Diagram in supplementary materials]

5. Ontological Conclusion: The Binary Universe

The success of the geometric model leads to a profound ontological conclusion regarding the nature of reality. The universe is constructed from two immutable primitives:

1. **The Perfect Line (1):** Represents Action/Signal (Photon).
2. **The Perfect Sphere (0):** Represents Memory/State (Particle).

All observed phenomena—from the mass of the proton to the stability of iron—are the result of the System optimizing the storage and transmission of these binary states on a discrete, cubic computational lattice.

Simureality is not just a philosophy; it is the reverse-engineered architecture of the physical world.

References & Code

The full source code, reproduction scripts, and datasets are available at:

GitHub Repository: https://github.com/Armatores/Simureality

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