A New Nuclear Model: A Geometric View of Atomic Structure

Introduction

Despite decades of research, we still lack a simple and complete explanation for the structure of the atomic nucleus.

Most existing nuclear theories — such as the shell model, liquid drop model, or cluster-based models — were not designed to explain nuclear structure from clear geometric principles. Instead, they aim to match experimental results through empirical fits, external parameters, or statistical approximations. They do not provide a clear description of how protons and neutrons are physically arranged inside the nucleus.

Even quantum mechanics, the core theoretical tool in particle physics, describes possible states and probabilities — but not an explicit geometric structure of the nucleus. It defines allowed energy levels, not physical layouts.

The Axis–Ring model offers a new perspective: the atomic nucleus is built from principles of symmetry, modularity, and repetition. It is not a random cluster of particles but a structured body composed of repeating units.

Applying this model to known elements reveals that existing measurements — such as energy levels, number of free electrons, and isotope stability — naturally emerge from the geometric structure.

Core Principles of the Model

The model proposes a clear division of the nucleus into two fundamental components:

Central Axis — A straight spine of protons and neutrons that stabilizes the structure. The axis's protons provide strong nuclear binding and generate an electric field perpendicular to the axis.

Rings — A core ring of neutrons tightly bound to the axis, and an outer ring of protons orbiting the neutron core.

The combination of these two components defines the nucleus's geometry, stability, and binding energy.

Why It Matters

With this model, we can:

- Explain why some elements (e.g., Carbon or Nickel) are exceptionally stable.
- Understand why certain fission products repeat consistently.
- Predict which isotopes are likely to decay — even before experimental measurement.
- Clarify "illogical" changes like increasing protons with decreasing neutrons.

- Draw full nuclear structures using geometry alone — with no empirical data required — and calculate precise nuclear energies.

From Probability to Structure

Rather than relying on probabilities or abstract energy levels, this model introduces a new language:

- A language of **structures**
- A language of **symmetry**
- A language of **engineering**
- A language that fully describes how each element forms
- A language that provides a **complete structural description** of the atomic nucleus

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Visual Simulation

3D visualizations of dozens of nuclei built using this model are available at: 👉https://avihadar1.github.io/element-viewer/

The Building Blocks: Structure Before Reaction

We propose that matter originates from pre-structured clusters of neutrons — not chaotic collisions. These dense neutron clusters are inherently organized, similar to a crystal. Before any reaction or external interaction, neutrons are already arranged in ring structures.

The base configuration:

- A 4-neutron axis
- Two adjacent rings, each with 16 neutrons (8 inner + 8 outer)
- Total: 36 neutrons per unit

This unit becomes the building block for future elements.

The Process of Decay and Formation

When a neutron cluster is exposed (e.g., by splitting from a larger mass), a natural decay process begins:

- Outer neutrons decay first
- The two axis-end neutrons convert to protons, stabilizing the axis
- Outer neutron rings begin to decay, forming proton rings around the core
- Protons repel from the axis but remain gravitationally bound to it, forming orbital paths
- The first ring completes before a second begins

This continues until the outer neutron rings are depleted. If stability isn't reached, inner neutrons may begin to decay until equilibrium is achieved.

This process produces a stable nuclear structure, where proton–neutron interaction stems from internal geometry — not from random collisions.

Structural Formula Representation

Each nucleus can be represented using a compact formula:
PN[PxNyEz]N[...]...P

Where:

- **P** = Proton on the axis
- **N** = Neutron on the axis
- **Px** = Number of protons in the ring
- **Ny** = Number of neutrons in the ring
- **Ez** = Repulsion-related deformation (from electric forces)

Example:
Oxygen-16 (O-16): PN[P6N3E0]N[P0N3E0]P
Phosphorus-31 (P-31): PN[P5N6E0]N[P8N8E0]P

Real-World Implications

From analyzing these structures:

- We understand why **Cobalt and Nickel** exhibit anomalies in free electron count.
- We explain why **Argon**, though placed in the 3rd period, behaves like the start of the 4th period.
- We see that **binding energy** is mostly influenced by incomplete rings. Full rings remain energetically stable and do not affect binding energy trends.

Summary

The Axis–Ring model is more than a tool for computing nuclear energy — it's a new way of understanding atomic structure.

It offers, for the first time, a **geometrically coherent** framework for building and analyzing nuclei — based not on statistical fit, but on underlying order.

Whether you're a physicist, engineer, or curious thinker — you're invited to explore, challenge, and build upon this model.

👉Full spreadsheet and 3D models: https://avihadar1.github.io/element-viewer/