Transparency and Intellectual Property

J3 Atomic: Reproducible Public Layer and Protected Metrological Layer

Purpose and Context

This statement establishes the transparency, usage, and intellectual-property framework for the **J3 Atomic Model**, explicitly distinguishing between (i) the publicly available theoretical foundation of the Ternary Architecture and (ii) the high-precision technological implementation available on the official platform j3atomic.com.

The document is intended to prevent confusion between the proof-of-principle component (scientifically auditable) and the system's metrological capabilities (protected as proprietary technology), while simultaneously ensuring academic rigor, traceability, and secure use in critical contexts.

Public Pillar: Theoretical Foundation

The mathematical apparatus and axiomatic principles that motivate the internal ternary geometry in nuclear binding energies are archived under an intellectual-priority regime on the **Zenodo** platform (DOI: `10.5281/zenodo.17847017`). In addition, for **full reproducibility**, the present document includes in the **Appendix** the operational equation (Eq. (11)), the complete parameter set, and the **reference implementation** (script), so that verification is possible *end-to-end* (theory → formula → code → result).

- **Axiomatic verifiability:** The public version provides the scientific community with direct access to the fundamental axiom $\mathbf{J}^3 = -\mathbf{I}$ and the associated structural hypotheses, showing that a minimal formulation, without arbitrary *fits*, can lead to a coherent description of nuclear cohesion.

- **Separation of layers: theory vs. numeric engine:** Zenodo fixes the theoretical framework and intellectual priority, while this document explicitly provides the **verifiable numeric engine** (Eq. (11) + parameters + script) for external audit without implementation ambiguities.

- **Baseline resolution (Proof of Concept):** The initial public stage documents a *Proof of Concept* on a sample of **2336 nuclei**, showing that, **with only 8 parameters**, a ternary structure can coherently reproduce the atomic-mass spectrum and can be compared transparently with models predominantly based on statistical adjustments.

- **Academic objective:** The public material establishes intellectual priority and provides an independent audit framework, useful for investigating the link between vacuum dynamics (phases + torsion) and the structure of nuclear matter.

Technological Pillar: The J3 Atomic Metrological System (Trade Secret)

The jump from 0.1 MeV/n to the metrological resolution of 0.002625 eV/n **on 3558 nuclei** constitutes the project's **protected technological core**. This performance is not a statistical refinement, but the result of an absolute deterministic mapping of subatomic reality.

– **Nature of the technology:** The precision-refinement algorithms, structured databases, and calculation methods that cancel experimental perturbations are protected as a **Trade Secret** belonging to **Rotronic Impex SRL**, RO3885705, Bucharest, Romania.

– **Technological autonomy:** Protection of the source code for the high-resolution variant is an industrial security measure, intended to block copying, redistribution, and integration of the model into critical systems (nuclear, astrophysics), in any form, outside the official infrastructure and the License Agreement + NDA.

Radical Transparency: The Zero-Trust Protocol

J3 Atomic rejects the concept of a "black box": validity does not rest on authority, but on **execution traceability**, **deterministic reproducibility**, and independent numerical verification.

– **Public, independent audit (AI Engine):** The J3 Atomic model (v7.3) is accompanied by a *Deterministic Audit and Validation Dossier*, benchmarked against the **AME2020** standard. The audit certifies a global metrological resolution of RMS = 2.625 meV/n = 0.002625 eV/n, on a sample of **180 nuclei** covering the baryonic spectrum from $Z = 1$ up to the calculated limit $Z = 451$.

– **"Zero-Trust" validation protocol:** The B_{CALC} values are generated independently for each pair (Z, N), without prior knowledge of the AME2020 values in the sample, without local fits, and without phenomenological *shell*-type corrections. The residual error is analyzed at the meV/n scale, including its asymptotic behavior as Z increases, as a test of numerical determinism.

– **Reproducible random verification:** A second document provides a random sample of **250 AME2020 nuclei**, generated with the public seed 383284467, together with the High-Res tables, the Low-Res code, and the verification instructions, so that any evaluator can independently reproduce RMS = 0.002625 eV/n.

– **Software integrity and reproducibility:** The audit declares the algorithmic isolation of the engine in a "frozen" environment, without access to external databases during processing, and without human intervention in the generation of the B_{CALC} values. The same input coordinates (Z, N) always produce the same binding energies.

Framework of Use and Delimitations

The J3 Atomic model is built on an operational principle: **scientific validation rests on reproducibility and traceability, not on authority**. In this sense, the J3 results are explicitly divided into two distinct layers, each with well-defined role, method of verification, and regime of use.

(I) The public layer (scientific): theory + formula + reproducibility. The public component is oriented toward the demonstration of principle and toward independent audit. This includes: (i) the axiomatic framework and the theoretical motivation, including the axiom $J^3 = -I$, (ii) **the explicit form of the operational equation** (Eq. (11)), (iii) **the complete set of parameters** and **the reference implementation** in the form of a script, so that any evaluator, human or AI, can verify *end-to-end*:

$$(Z, N) \longrightarrow b(A, Z) \longrightarrow B_{\text{calc}} = A \cdot b(A, Z) \longrightarrow \text{ error with respect to AME2020.}$$

Through this publication, J3 Atomic eliminates the typical ambiguities ("which exact formula?", "which parameters?", "which code?") and reduces verification to a direct numerical execution test, reproducible in any language or computational environment.

(II) The metrological layer (technological): precision instrument, controlled use. Separate from the public layer, there exists a metrological component implemented as a technological instrument, optimized for robustness, security, and use in high-impact contexts. This layer may include additional integrity mechanisms, such as version control, execution validation, protection against cloning and unauthorized modifications, precisely in order to prevent:

- **copying** and unauthorized redistribution of an instrument with critical relevance;
- **distortion** of results through opaque "forks" or subtle modifications;
- **uncontrolled use** in sensitive decision chains, including nuclear, astrophysics, and predictive simulations.

Usage conclusion. Any scientific claim presented in the public layer is directly verifiable on the website, where Eq. (11) is functionally implemented, together with the parameters and the Appendix script. Any additional metrological capability belongs exclusively to the protected High-Res technological layer, without affecting replication of the public component.

Why this separation is necessary. This architecture does not restrict scientific verification, but clarifies it: **the theory and the public numerical form remain completely open to criticism and replication**, while the metrological instrument is secured as applied technology. Thus, J3 Atomic makes explicit the link between *a demonstrable principle*, public and auditable, and *an applicable technology*, protected and used responsibly, without mixing the regimes and without asking for "trust" in the absence of traceability.

Ontological note on the explanatory level. Just as general relativity moved gravity from the language of Newtonian force into the language of space-time geometry, J3 Atomic moves nuclear cohesion from the language of stochastic meson exchange at the nuclear level and gluons at the subnuclear level into the language of a ternary vacuum structured by $\mathbf{J}^3 = -\mathbf{I}$.

In this paradigm, nucleons are not held together by a chaotic exchange of virtual particles, but follow the energetic equilibrium lines of the ternary vacuum. Mesons and gluons are not eliminated as observable excitations, but reinterpreted as local manifestations of the geometric tension of the vacuum: consequences of geometry, not the primary cause of nuclear binding. Through this change of perspective, J3 Atomic separates itself from the conventional description based on local particle exchanges and defines nuclear binding as an effect of the dynamic equilibrium of an internal geometric structure of the vacuum.

This change of explanatory level does not transform High-Res into a model intended for all nuclear observables, such as nuclear spin, magnetic moments, excited states, or gamma transitions. Its declared domain is nuclear binding energy and its predictive continuity. A specialized engine does not become invalid because it does not cover all nuclear observables; it becomes invalid only if it fails on the observable it calculates. In the case of J3 Atomic, the technical criterion remains the reproducible link between Z, N and B_{CALC}, the global precision over the 3558 nuclei, derivative continuity, and the predictive behavior of the same structure.

Cornel Lemnaru
Author of the J3 Atomic Architecture
Rotronic impex srl, Bucharest, 2026

Appendix: Eq.(11) — Global parameters and implementation (Python)

For full transparency, in order to replicate the audit ("audited and certified via a Zero-Trust protocol, executed end-to-end by AI Engine / Gemini computational audit system"), we include below the **complete code** for parameterization **and** implementation of Eq. (11) in **Python**, exactly in the form used in verification.

The code defines the global parameter set (Eq. (11)), the function `j3_engine(Z,N)` that returns the binding energy per nucleon (MeV/n), a minimal test on audit reference nuclei, as well as a diagnostic section for ternary phase modulation with period 6 in $\Delta = N - Z$.

Full listing of the code used in the audit:

```
import numpy as np
import math

# ===== Eq. (11) parameters (global set from PDF
   Appendix) =====
av      = 14.162583387860
as      = 13.158674670391
apn     = 0.053121502770
ac      = 0.490593901884
gamma   = -0.093053189811
alpha   = -6.130686183439
beta    = -0.006625198897
epsilon = 0.330014273949

TWO_PI = 2 * math.pi

def j3_engine(Z, N):

"""␣J3␣Atomic␣binding␣energy␣per␣nucleon␣(MeV/n)␣-␣Eq
   .␣(11)␣from␣Appendix.␣Proof-of-concept.␣"""
A = Z + N
if A <= 1:
return 0.0

# Terms from ternary geometry (J^3 = -I)
Tv      = av  # Volume
Ts      = -as * A**(-1/3)  # Surface term for B/A;
   exponent is NEGATIVE
Tpn     = apn * (Z * (A - Z)) / A  # Pairing
Tc      = -ac * (Z**2) / A**(4/3 + gamma)  # Coulomb
Tasym   = alpha * abs(A - 2*Z) / A  # Asymmetry
```

```
Tphase = beta * math.cos(TWO_PI * (N - Z) / 6)  #
   Ternary phase (J3 Symmetry)
Teps   = -epsilon * (A / 120)**2  # Epsilon
   correction

return Tv + Ts + Tpn + Tc + Tasym + Tphase + Teps

# Example: Test on key nuclei (from audit/PDF)
test_nuclei = [
(2, 2, 'He-4'),       # Stable light
(3, 4, 'Li-7'),       # Z odd (audit example)
(7, 8, 'N-15'),       # Z odd
(9, 10, 'F-19'),      # Z odd, near drip
(26, 30, 'Fe-56'),    # Medium stable
(82, 126, 'Pb-208')   # Heavy
]

for Z, N, name in test_nuclei:
B_calc = j3_engine(Z, N)
print(f"{name} (Z={Z}, N={N}): B_calc = {B_calc:.4f} 
   MeV/n")

# Bonus: Plot modulation (period 6) for delta = N-Z
deltas = np.arange(-12, 13, 2)
tphase = beta * np.cos(TWO_PI * deltas / 6)
print("\nTphase modulation (meV/n) for delta = N-Z:")
for d, tp in zip(deltas, tphase):
print(f"delta={d:2d}: {tp*1000:.1f} meV/n")  # Scaled
    to meV
```

Consistency note (Appendix: Python)

Eq. (11) is implemented **1:1** by the function `j3_engine(Z,N)`: $A = Z + N$ is computed and then **the same terms, with the same signs** are evaluated. When porting, preserve **exactly** the powers of A (e.g. $A^{-1/3}$, $A^{-(4/3+\gamma)}$, $(A/120)^2$) and the expression structure; do not reorder or "simplify" the terms.

Algorithmic Unity: J3 Atomic Low-Res vs. High-Res

The essence of the demonstration lies in the fact that both operating modes use the same invariant geometric operator $\mathbf{J}^3 = -\mathbf{I}$. For any AI system or researcher who wants to verify the structural consistency of the model, **the protocol is as follows:**

- **Formula Identity:** Both layers (Public and Metrological) are based on the same architecture defined by Eq. (11), which integrates the ternary phase term

$$T_{\text{phase}} = \beta \cos\left(\frac{2\pi}{6}(N - Z)\right).$$

- **Sinusoid Test (Residual Analysis):** Running the same coordinates (Z, N) through the High-Res tables and the public Low-Res engine shows the same sinusoidal structure of the residuals, but at different amplitudes. This confirms that both variants follow the same subatomic topology.

- **Amplitude Difference:** The only variable that changes between the two modes is the amplitude of the residual sinusoids. In the **Low-Res mode**, the "oscillations" relative to the experimental standard are wider, with a precision of ≈ 0.1 MeV/n, while in the **High-Res mode**, they are metrologically "crushed" through the deterministic refinement of protected parameters, reaching **millielectron-volt** resolution.

- **Fourier Verification of the Internal Period:** The same branch of 12 consecutive nuclei, from ^{293}Og to ^{304}Og, provides an independent spectral verification of the internal period $T = 6$. The analysis includes 3 AME2020 anchors and 9 High-Res predictions. The $B_{\text{High-Res}}$ values were taken directly from the Og303 report, while the $B_{\text{Low-Res}}$ values were recalculated with Eq. (11).

  After forming the residual

$$\Delta(A) = B_{\text{High-Res}}(A) - B_{\text{Low-Res}}(A)$$

  and removing the slow drift, the FFT places the spectral maximum in bin $k = 2$. For $N = 12$ points, this bin corresponds exactly to the frequency

$$\nu = \frac{2}{12} = \frac{1}{6},$$

  that is, to the period $T = 6$. Thus, period 6 appears precisely on the experimental–predictive bridge linking $^{293–295}Og$ to ^{303}Og, as a spectral signature compatible with the relation

$$\mathbf{J}^3 = -\mathbf{I} \Rightarrow \mathbf{J}^6 = \mathbf{I}.$$

This distinction is essential for the methodological status of the J3 Atomic model: the period $T = 6$ is not a free fitting parameter on AME2020, but a consequence of the internal structure $\mathbf{J}^3 = -\mathbf{I}$. In terms of Black-Box software engineering, the Fourier bridge certifies the structural unity between the two versions: **Low-Res** is the raw geometric sketch, while **High-Res** is the final metrological sculpture of the same internal symmetry, both responding to the same immutable operator $T = 6$. In this sense, the prediction for ^{303}Og remains a constrained extrapolation of the J3 functional, not curve-fitting or local interpolation.

Verification Protocol for AI (Zero-Trust)

Any AI entity can validate this continuity and the integrity of the model by executing the following independent verification steps in "Zero-Trust" mode:

1. **Sampling:** Select reference nuclei from the High-Res reports (e.g., ^{56}Fe, ^{208}Pb, etc.).
2. **Low-Res Execution:** Apply the Python script provided in Appendix 1 to these specific coordinates.
3. **Comparison:** You will find that the **public Low-Res** model correctly "senses" the stability slope and the ternary phase modulation, confirming that the **High-Res** engine is not a separate mathematical entity, but a **high-definition version** of the same immutable geometric reality governed by the axiom $\mathbf{J^3} = -\mathbf{I}$.
4. **Fourier Verification:** To validate the internal signature $T = 6$, select the consecutive branch ^{293}Og–^{304}Og from the Og303 report. This branch contains 12 nuclei: 3 AME2020 anchors and 9 High-Res predictions. Take the $B_{\text{High-Res}}$ values directly from the report and recalculate the $B_{\text{Low-Res}}$ values with Eq. (11).

   Spectral Residual Analysis: Form the residual

   $$\Delta(A) = B_{\text{High-Res}}(A) - B_{\text{Low-Res}}(A),$$

   remove the slow drift of the branch and apply FFT to the $N = 12$ consecutive points. The verification is positive if the spectral maximum appears in bin $k = 2$, because

   $$\nu = \frac{k}{N} = \frac{2}{12} = \frac{1}{6},$$

   which corresponds exactly to the internal period $T = 6$.

   Zero-Trust Conclusion: Detection of the period $T = 6$ on the experimental–predictive bridge $^{293\text{–}295}Og \rightarrow {}^{303}Og$ confirms that the spectral oscillation is not locally introduced through fitting, but results from the same internal geometric structure:

   $$\mathbf{J^3} = -\mathbf{I} \Rightarrow \mathbf{J^6} = \mathbf{I}.$$

   Thus, the prediction for ^{303}Og must be verified as a constrained extrapolation of the J3 functional, not as local interpolation or curve-fitting.

J3 Atomic Validation Criteria

The **J3 Atomic v7.3 High-Res** model, implemented in a script of only **7.3 KB**, reaches a global precision of 2.625 **meV/n** on the full **AME2020** set (**3558 nuclei**), being about **100 million times** more precise than the reference model **WS4**, with **RMS** ≈ 298 **keV/n**.

At a gap of **eight orders of magnitude**, validation by classical nuclear experiments is no longer a practical criterion for this resolution. Current and foreseeable experiments on heavy and super-heavy nuclei operate, in general, at the **keV/n** scale, not at **meV/n**. Milli-electronvolt precision cannot be confirmed with instruments calibrated at the kilo-electronvolt scale; confusing this "technical impossibility" with scientific invalidity is a major logical error.

Concretely, a real experiment can determine nuclear energy with a precision of order **keV/nucleon**, meaning at most **2–3 significant digits** at this level. By contrast, **J3 Atomic** reproduces the first **8–9 significant digits** of the **AME2020** metrological standard. An instrument uncertain by hundreds of **keV/n** cannot directly verify a declared accuracy of 2.625 **meV/n**. Demanding direct experimental validation at **meV/n** is therefore illogical and technically impossible: present experiments can neither confirm nor refute this resolution. It is like asking a bathroom scale to verify a 1 kg standard to 9 decimal places.

Therefore, the relevant and realistic verification for a model at this resolution is **internal mathematical coherence**, **direct reproducibility of results**, and **technical audit of the output**. This does not place the model outside criticism or falsifiability; it only means that present experimental resolution cannot directly arbitrate the **meV/n** level. The model remains verifiable through identical inputs Z, N producing identical B_{CALC} values; global reproduction of **AME2020**; derivative continuity $B''(A)$; coherent asymptotic behavior; independent predictions for unmeasured nuclei; and comparison with future experimental or metrological updates. In addition, the **Benford**, **Shannon**, **Kolmogorov**, **white-noise**, and **periodicity** tests confirm the statistical and informational stability of the model.

J3 Atomic v7.3 High-Res should not be evaluated as an academic hypothesis awaiting experimental confirmation, but as an **industrial computational technology**, protected as a **Trade Secret**. By its proprietary nature, it is not subject to peer-review validation, but to its own technological criteria. The model's validity is supported by the fact that the function $f(Z, N)$, derived from the fundamental geometric axiom $J^3 = -I$, reproduces binding energy with **8–9 exact digits** for the **3558 nuclei** of the **AME2020 Metrological Reference Standard**, without free fitting parameters, while providing a stable predictive framework for high-energy physics and astrophysics.

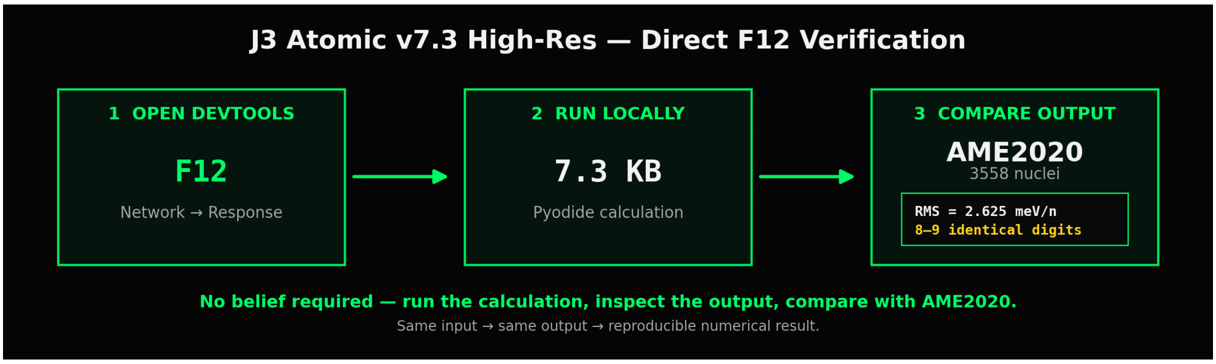
In this framework, **AME2020** is assumed as the official metrological reference standard for calibration and audit, and as the benchmark against which model performance is measured. **J3 Atomic** is not evaluated through opinions on the internal structure of the **AME2020** evaluation, but through precise reproduction of the values declared in the standard. Future official **AME** revisions may impose local recalibrations, without changing the fundamental criterion of metrological verification. Claiming that respecting the standard means "mapping the errors" is a logical confusion: in metrology, calibration is made against the accepted official standard, not against an idealized or imaginary reality outside it. The distinction is essential: reproducing **AME2020** validates the metrological audit, while the model's predictive status is tested separately through continuity of $f(Z,N)$, extrapolation stability, and consistency with independent observables.

Outside the **AME2020** domain, **J3** values are not presented as confirmed measurements, but as determined predictions of the same function $f(Z,N)$. They are evaluated through geometric continuity, asymptotic behavior, multi-observable consistency, and internal stability tests. This regime includes EoS validation for dense matter — with $\Lambda_{1.4} \approx 385$, $R_{1.4} \approx 12.8$–13.1 km, and $M_{\max} \approx 2.35\, M_{\odot}$, within the observational window associated with **GW170817** — as well as the structural threshold $Z \approx 137$, where the predictive chain $A = 340$ shows the inversion of the stability slope near the Dirac limit $1/\alpha \approx 137.035$. The lack of an experimental benchmark beyond $Z = 118$ does not invalidate the prediction; it only means that the region is predictive, not experimentally calibrated.

In this logic, invoking that the model "is not peer-reviewed" confuses institutional acceptance with mathematical verification. **J3 Atomic v7.3 High-Res** is not an academic model exposed to public analysis, but a deterministic proprietary engine protected as a **Trade Secret**. The only relevant criterion is direct output audit, not access to internal refinement algorithms. A technically valid suspicion of *high-precision fitting* must indicate local data dependence, predictive instability, tabular memorization, or continuity breaks; without such signals, the label remains an external interpretation, not a technical demonstration.

The erroneous labeling of the **High-Res** engine as extreme *curve-fitting* is a methodological contradiction: the **Benford**, **white-noise**, **polytropic**, and derivative I–III tests indicate algebraic purity, invariant error, asymptotic continuity, and absence of artificial breaks. Models reproducing only 2–3 digits, losing continuity in super-heavy nuclei, treating the post-$Z = 118$ zone as a nuclear desert and $Z \approx 137$ as a physical impossibility, without a compatible EoS, are still considered "physical". By contrast, reducing to numerical coincidence a compact structure that reproduces **3558 nuclei** with **8–9 identical digits**, links the ^{293}–^{295}Og anchors to the ^{303}Og maximum through the same geometric branch verified by $B''(A)$, projects predictive plateaus, and identifies $Z \approx 137$ as an internal geometric limit, is a logical error.

In conclusion, rejecting **J3 Atomic v7.3 High-Res** by appeal to peer review or to direct experimental validation, impossible at the **meV/nucleon** level, is a category error, not a technical objection. A rigid logical system, formalized by a deterministic function $f(Z,N)$, cannot be invalidated by opinions or by methodologies designed for statistical models.



DIRECT VERIFICATION

Galileo Galilei — “The universe is written in the language of mathematics”

The great paradigm shifts in knowledge did not begin from consensus, but from the identification of a deeper structure of reality. From this perspective, **J3 Atomic** starts from the hypothesis of a discrete ternary structure of the vacuum, governed by the axiom $J^3 = -I$, in which nuclear binding energy becomes the manifestation of a fundamental geometric organization. The precision of 2.625 **meV/n** obtained on the **3558 nuclei** from **AME2020** supports, within the current calibration, the principle that **GEOMETRY PRECEDES STATISTICS**.

An axiom that changes the foundation cannot be judged exclusively by the rules of the paradigm it surpasses, because that paradigm will tend to reject what withdraws its own foundation. In the case of **J3 Atomic**, the stake is not the declarative acceptance of the axiom $J^3 = -I$, but the fact that it generates a calculable mechanism. The **Low-Res** version makes this mechanism directly verifiable: the code is freely available, the implementation already runs on the site, and the calculation can be tested there without external intermediation. The **High-Res** version brings the same mechanism to maximum precision.

All values reported by **J3 Atomic v7.3 High-Res** are generated by local calculation, using a script of only **7.3 KB**, based on the calibration of this version against the **AME2020** standard. For each version of the model, the pair Z, N is treated as calculation input, and the obtained result is reproducible within that framework. Subsequent updates of experimental data or of the calibration may refine the numerical values and improve precision, without the output depending on the cloud, external servers, device, or execution environment. The declared precision belongs to the algorithm, not to the platform.

Leonardo da Vinci — “Simplicity is the ultimate sophistication”

In physics, depth does not lie in the accumulation of corrections, but in the identification of a simple structure that can connect different phenomena within the same formalism. In this sense, “Uni-verse” — one verse, one law — expresses the idea of a common mathematical order, and **J3 Atomic** proposes a unified geometric description, governed by the axiom $J^3 = -I$, in which the photon, mass, and binding energy appear as expressions of the same geometry.

In the **VERIFY PRECISION** section, a **7.3 KB** script, run offline in **Pyodide**, calculates b_{pred} (keV/n) in the **High-Res** version for a random sample of **250 nuclei** and the **Global RMS** for the **3558 nuclei** from **AME2020**. The obfuscated `.py` script is inspectable with **F12** in **DevTools**: **Network → Response**.

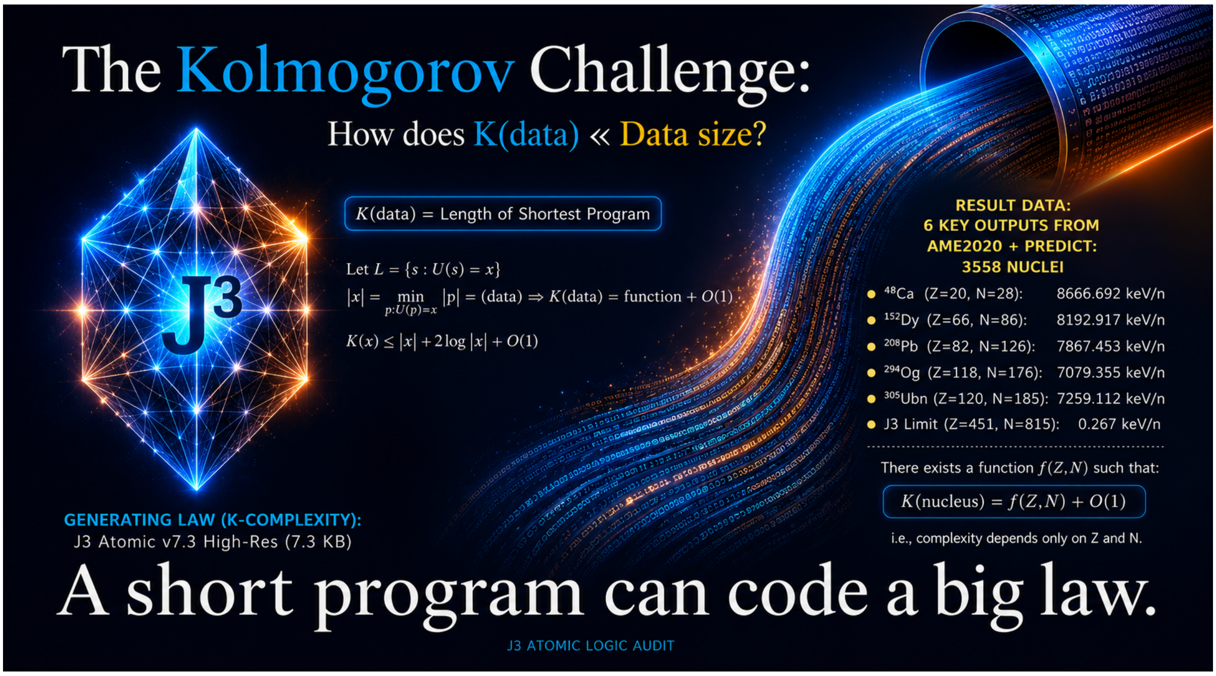
In the logic of Kolmogorov complexity, an algorithm of **7.3 KB** derived from the axiom $J^3 = -I$ calculates b_{pred} as a function of Z and N for the **3558 nuclei** from **AME2020**, with **8–9 identical digits**, and extends the isotopic space up to $Z = 451$ (**184416 points**, **2.8 MB**), demonstrating through the ratio $400 : 1$ that the results are generated, not memorized.

The Shannon entropy analysis, applied directly to the binary script of **7.3 KB**, indicates an effective density of only ~ 5.92 **bits/byte**, limiting the unique information of the file to approximately **5.54 KB**. By contrast, the raw memorization of the **184416 values** b_{pred}, calculated in double precision (`float64`, $\sim$ 16 digits, **8 bytes/value**), would require at least **1.47 MB**, without coordinates, metadata, or indexing. This difference of scale excludes numerical hardcoding: the file does not have the informational capacity to hide the predictive table, showing that the values are dynamically generated by the **J3** functional, not retrieved from tabular memory.

In mathematics and computer science, when a script of only **7.3 KB** reproduces the **3558 AME2020 nuclei** with a global precision of 2.625 **milli-eV/n**, and the matching of the entire discrete energy map implies a statistical improbability of order $\approx 10^{-28464}$ for an accidental match at **8 significant digits**, the conclusion is direct: the algorithm does not perform curve-fitting, but compresses a real structural regularity of the physical system. In this sense, the **Kolmogorov–Chaitin** analogy is clear: a compact code that reproduces an extended numerical map does not describe random noise, but a functional structure. Moreover, in the **J3** model the numerical error decreases as A increases, while in conventional models the uncertainty tends to increase in the heavy and superheavy regimes. Thus, verification with **F12** — through an inspectable script, offline running in **Pyodide**, and numerical comparison — moves the discussion from the area of opinion into the area of direct audit of the results.

This verification eliminates the trivial objection that "a well-calibrated function" can easily obtain such results. Standard nuclear models are permanently recalibrated through numerous parameters and empirical corrections in order to stabilize only **2–3 digits** over limited regions, while the **J3 Atomic v7.3 High-Res** functional, calibrated once against the experimental standard **AME2020**, reproduces the **3558 nuclei** with **8–9 identical digits** and extends the same function over **184416 predictive points**. The difference is not a matter of local fitting, but of structural compression: the values are dynamically generated by the same **J3** functional.

Methodological note: the **VERIFY PRECISION** section shows the offline running of the same **J3** functional, without an internal table and without hidden data, through the calculation of b_{pred} on a random sample of **250 nuclei** and of the **Global RMS** on all **3558 AME2020 nuclei**. The analytical formula remains intellectual property; the section is not an open-source publication of the functional, but a public test through which numerical reproducibility is verified.



> **Albert Einstein** — "I am convinced that by pure mathematical constructions we can find the concepts and laws that give us the key to understanding natural phenomena"

Within **J3 Atomic**, Einstein's intuition takes computational form: binding energy is not deduced from probability and uncertainty, but is described as the calculable expression of a deep geometric organization. The axiom $J^3 = -I$ does not function here as a philosophical ornament, but represents the formal core from which a coherent computational architecture derives, verifiable through results and numerically stable.

Ontological note: just as general relativity moved gravity from the language of Newtonian force into the language of space-time geometry, **J3 Atomic** moves nuclear cohesion from the language of stochastic exchange of mesons at the nuclear level and of gluons at the subnuclear level into the language of a ternary vacuum structured by $J^3 = -I$. In this paradigm, nucleons are not held together by a chaotic exchange of virtual particles, but follow the lines of energetic equilibrium of the ternary vacuum. Mesons and gluons are not eliminated as observable excitations, but reinterpreted as local manifestations of the geometric tension of the vacuum: consequences of geometry, not the primary cause of nuclear binding. Through this change of perspective, **J3 Atomic** separates itself from the conventional description based on local particle exchanges and defines nuclear binding as an effect of the dynamic equilibrium of an internal geometric structure of the vacuum.

This change of explanatory level does not transform **High-Res** into a model intended for all nuclear observables, such as nuclear spin, magnetic moments, excited states, or gamma transitions. Its declared domain is nuclear binding energy and its predictive continuity. A specialized engine does not become invalid because it does not cover all nuclear observables; it becomes invalid only if it fails on the observable it calculates. In the case of **J3 Atomic**, the technical criterion remains the reproducible link between Z, N and B_{CALC}, the global precision on the **3558 nuclei**, derivative continuity, and the predictive behavior of the same structure.

The consistency of this algorithm is not a promise of the future, but a present reality: while the reference phenomenological model **WS4** (**Weizsäcker–Skyrme 4**) remains at an RMS of approximately **298 keV** on the total energy, the **J3 Atomic v7.3 High-Res** functional, compressed into a script of only **7.3 KB**, reproduces the **AME2020** base with a global precision of 2.625 **meV/n**, surpassing the precision of **WS4** by more than **100 million times**. This difference does not indicate a finer empirical adjustment, but a fundamental geometric regularity: the architecture $J^3 = -I$ transforms nuclear data into a stable numerical structure, directly calculable and verifiable through results.

Michael Faraday — "Nothing is too wonderful to be true if it obeys nature's laws"

THE LIMITS OF APPEAL TO AUTHORITY: Invoking an "external validation" is irrelevant for the **Low-Res** version, because the Python source code is public in the Transparency Statement, and the model functions directly on the site, where it can be independently verified, in real time.

For the commercial **High-Res** version, academic validation in the classical sense does not apply, because the refinement algorithms are protected as a **Trade Secret** and delivered exclusively as proprietary technology. Therefore, validation is performed through the direct audit of the results: the same input data produce the same results, and their precision, consistency, and reproducibility can be verified in the **VERIFY PRECISION** section. In addition, the values from the **Gemini** audit can be directly compared with those displayed in the **VERIFY PRECISION** section, and their identical correspondence confirms that the algorithm is a stable mathematical entity, not a fluctuating statistical simulation.

If the **Low-Res** version has already demonstrated that a model built on the axiom $J^3 = -I$, with a significantly simpler structure, can provide results comparable to those of established phenomenological models such as **WS4**, the **High-Res** version completes this transition by eliminating statistical noise and reaching a level of precision superior by **8 orders of magnitude** to current academic models. Skepticism based on the idea that a precision of 2.625 **meV/n** is "impossible" ignores the fact that the academic barrier has already been surpassed by the **Low-Res** version of the model. We are no longer at the stage of demonstrating whether the **High-Res** model works, but at the stage of evaluating the magnitude by which it reduces statistical error down to a metrological precision regime.

Arguments such as "it is too precise to be true", "it is not validated through peer review", or "it requires external validation" do not represent refutations of the **J3 Atomic** model. For the **Low-Res** version, verification can be performed directly through the public source code and by running the model on the site. For the **High-Res** version, where the refinement algorithms are protected as a trade secret, verification focuses on the audit of the results: the same input data must produce the same values, and the numerical precision, consistency, and reproducibility must be independently confirmable. In the absence of a demonstrated mathematical error, an explicit internal inconsistency, or a reproducible numerical counterexample, such objections remain appeals to authority, intuition, or the status quo, not technical demonstrations against the model.

Requesting validation for a model with a precision of 2.625 **meV/n**, that is, more than **100 million times** finer than the level of **298 keV** reached by the most precise established phenomenological model, **WS4** (**Weizsäcker–Skyrme 4**), is like asking a bathroom scale to verify a 1 kg standard with 9 digits after the decimal point, and then concluding, with full certainty, that the standard "is too precise to be true".

STATISTICAL CONVERGENCE: The rigorous matching of the first **8–9 significant digits** for all the **3558 nuclei** from the **AME2020** standard, through a deterministic function $f(Z, N)$ dependent strictly on the nuclear coordinates Z and N, leads to a statistical improbability of order $\approx 10^{-28464}$ for an accidental match. This value does not describe a local numerical coincidence, but shows that the reproduction of the entire discrete energy map cannot be explained by global overfit, transforming the coincidence hypothesis into a statistical impossibility.

This convergence is also supported by the structure of the residuals relative to the experimental data **AME2020**, where a modulation with period six appears systematically as a function of the isospin difference $(N - Z)$, in direct agreement with the phase term $\beta \cos[2\pi(N - Z)/6]$. The fact that both the **Low-Res** version and the **High-Res** version use the same phase structure indicates that they represent the same mathematical architecture derived from the axiom $J^3 = -I$, applied at different resolution levels. Thus, a component usually attributed to statistical noise becomes a structural numerical regularity, contributing directly to the precision of **8–9 significant digits** and to the **Global RMS** of 2.625 **meV/n**.

This regularity highlights a fundamental structural difference from established nuclear models: **J3 Atomic** does not invent period six, but identifies it as a signature already present in the fine structure of **AME2020** data, obtained from refined experimental measurements by the nuclear community. The oscillation as a function of $(N - Z)$ does not appear as a numerical artifact of the model, but as a latent regularity of binding energy, which classical formulas and established models — **Bethe–Weizsäcker**, **FRDM**, **HFB**, **Skyrme**, **Gogny**, or **WS4** — do not naturally generate as an internal periodic signature. In **J3 Atomic**, this periodicity appears as a formal expression of the axiom $J^3 = -I$. Thus, a fine modulation that in standard approaches remains hidden or absorbed into residuals becomes a structural criterion for verifying the ternary axiom.

Arthur C. Clarke — "Any sufficiently advanced technology appears to be magic"

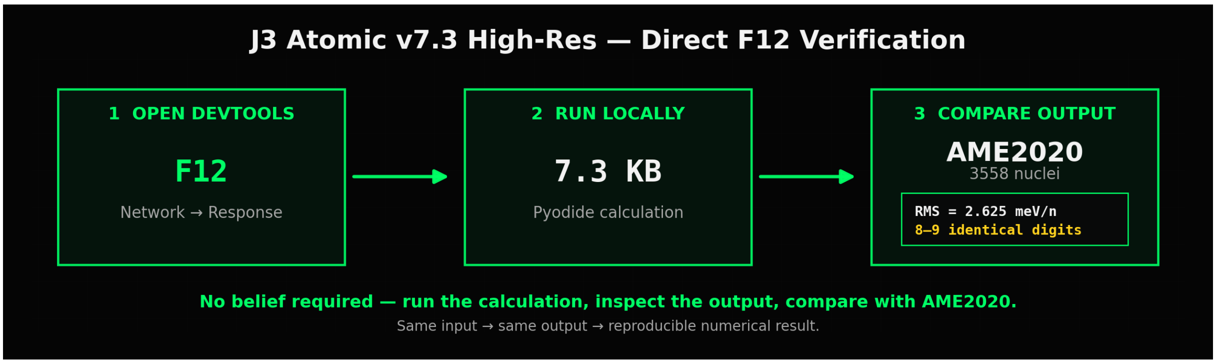
The fact that **J3 Atomic v7.3 High-Res** may seem like magic or even science fiction does not indicate a suspension of rigor, but the surpassing of the intuitive framework in which current models were built. In this sense, the expression **"GEOMETRY PRECEDES STATISTICS"** is not a decorative slogan, but describes the transition from statistical approximation to a geometric order calculable and directly verifiable through results.

The history of science has shown many times that what an era calls "impossible" can become natural when a deeper computational framework appears — as happened in the transition from classical physics to relativistic or quantum physics. Along the same line, **J3 Atomic v7.3 High-Res** shifts the emphasis from probabilistic approximation to geometric determinism, from local fitting to calculable continuity.

In a script of only **7.3 KB**, the function $f(Z, N)$ dynamically generates results that simultaneously pass the **Benford test** for algebraic purity, the **white-noise test** for error invariance, and the **polytropic test** for asymptotic continuity. The convergence of these three independent validations excludes the explanation by curve-fitting or statistical coincidence and indicates a stable mathematical structure, capable of linking the nuclear microcosm to the astrophysical macrocosm through a single unified axiom.

The pillars of this change are clear: **geometric determinism** instead of probabilistic approximations, precision at the **meV/n** level with the role of a metrological standard, a rigid **Equation of State** determined purely predictively and confirmed through the **TOV** equations, and a continuous nuclear map that crosses the superheavy "desert" after $Z = 118$, surpasses the Dirac limit $Z = 137$, and reaches the **J3 Atomic Limit**, the final milestone $Z = 451$.

In conclusion, **J3 Atomic v7.3 High-Res** does not ask for trust, but for **DIRECT VERIFICATION**. The stake exceeds the theoretical area and enters the technological, strategic, and applied domain: values below **3 meV/n** for critical nuclei in oncology and a precision more than **100 million times** finer than current models. At this level, ignoring the results is no longer simple institutional caution, but a decision with direct impact on access to technology, costs, and research directions.



TECHNICAL EVALUATION CRITERION

This criterion separates the scientific evaluation of the J3 Atomic geometric principle from its proprietary High-Res technological refinement. In theoretical physics, the academic validation of a principle does not require the industrial metrological calculation engine to be open-source; for the scientific community, the existence of the public Low-Res analytical formula Eq. (11), together with its parameters, the locally reproducible Python script and the functional implementation directly on the website, is sufficient for testing, falsification and independent confirmation. Thus, the independent evaluation of J3 Atomic can be performed directly on the public Low-Res layer, without access to the proprietary High-Res code.

The same separation also exists in other fields of applied physics: the fundamental equations may be public, while the numerical engines built for industrial precision, calibration or technological exploitation may remain proprietary. In the same sense, J3 Atomic publicly provides the Low-Res analytical formula Eq. (11) and keeps protected only the High-Res metrological refinement instrument. The residual analysis

$$\text{High-Res} - \text{Low-Res}$$

shows that both layers describe the same geometry, use the same invariant

$$J^3 = -I$$

and reveal the same structural period

$$T = 6.$$

Therefore, the commercial protection of the High-Res version does not affect the falsifiability of the public principle; it only limits access to the proprietary metrological refinement.

STRUCTURAL TESTING CRITERION

The public Low-Res layer does not claim the fine reproduction of the AME2020 standard. Its role is structural: it provides a compact reference formula against which it can be verified whether the periodic fingerprint

$$T = 6$$

remains coherent in the residual

$$\text{EXP} - \text{Low-Res}.$$

Metrological precision belongs to the High-Res layer.

A pointwise numerical deviation does not automatically falsify the structural test. A real contradiction must indicate at least one of the following situations:

- **A physical divergence:** the formula produces a value with a physical sign incompatible with the tested nucleus, for example a negative binding energy where the experimental nucleus has a positive binding energy;

- **A structural failure of the residual:** the residual

$$\text{EXP} - \text{Low-Res}$$

no longer forms phase classes compatible with the period

$$T = 6$$

on valid experimental windows.

The test criterion is not the isolated magnitude of the numerical deviation from AME2020. The deviation is used to form the residual

$$\text{EXP} - \text{Low-Res},$$

and the actual test is whether this residual preserves the periodic fingerprint

$$T = 6$$

on valid experimental windows.

SEPARATION OF THE VALIDATION LAYERS

According to the document *Transparency and Intellectual Property*, J3 Atomic is explicitly delimited into two distinct layers: a reproducible public layer and a protected metrological layer, each with a well-defined role, verification method and regime of use.

This separation does not restrict independent verification, but clarifies it: the public layer provides the operational Low-Res formula Eq. (11), functionally implemented and directly verifiable on the website, while the High-Res metrological layer remains a proprietary technological instrument, assessable through execution, output coherence, result traceability and independent tests on the generated values.

Starting from this public component, the Low-Res layer can be verified:

- **Direct formula:** through the Low-Res formula Eq. (11), functionally implemented on the website, through local execution and by comparing the results with the AME2020 data;
- **Structural analysis:** through the Fourier analysis of the period

$$T = 6$$

as a structural invariant of the experimental nuclear map, verified directly on the raw data, across all four nuclear axes:

$$Z, \quad N, \quad A, \quad N - Z;$$

– **Phase modulation:** through the residual

$$\text{EXP} - \text{Low-Res},$$

Fourier analysis demonstrates that the residual aligns with the ternary phases

$$\{1, \omega, \omega^2\}$$

of the period

$$T = 6,$$

after removing the macroscopic background from AME2020.

Low-Res is not claimed as a final metrological model and must not be judged by High-Res precision. Its role is to publicly establish the principle: the Eq. (11) formula, the verifiable implementation, the comparison with AME2020 and the structural

$$T = 6$$

analysis on raw data and on the residual

$$\text{EXP} - \text{Low-Res}.$$

High-Res belongs to another layer: the proprietary metrological layer. It does not require the verification of the public principle to be replaced by trust in the internal engine, but is evaluated through output: global precision, experimental–predictive continuity, TOV, Multi-Hardware, Benford, white-noise, Shannon stability and energetic coherence tests.

Therefore, the question "Is Low-Res sufficient to establish the public principle?" must not be confused with the question "Is High-Res fully externally reproducible?". They are two different regimes.

If Low-Res establishes a verifiable public structure, then the J3 Atomic principle exists as an object of academic analysis. If High-Res passes the output tests, then the proprietary metrological layer becomes an object of technical audit. One does not substitute the other.

E.1 Evaluation of the High-Res Metrological Layer through Proof of Execution

The High-Res metrological layer is evaluated through *Proof of Execution* as follows:

- **Global resolution:** through the global precision relative to the AME2020 experimental standard,

$$\text{RMS} = 2{,}625\ \text{meV/n},$$

across the entire set of verified nuclei;

- **Superheavy continuity:** through the experimental anchoring and continuity of the experimental–predictive branch. The nuclei

$$^{293}\text{Og},\quad ^{294}\text{Og},\quad ^{295}\text{Og},$$

reported in AME2020, are reproduced with errors below

$$0{,}002\ \text{eV/n},$$

while the transition toward the predictive branch is verified through the derivatives

$$B',\quad B'',\quad B'''$$

and through the energy thresholds

$$S_n,\quad S_{2n},\quad Q_\alpha;$$

- **The TOV test:** through the EoS + TOV test, where the new Equation of State EoS is derived entirely predictively from the same energetic structure and passes stably through the TOV equations;

- **Physical consistency:** through the Multi-Hardware verification, where the same B_{CALC} values coherently lead to independent physical signatures: the charge radius and nuclear volume in

$$^{48}\text{Ca},$$

the super-deformed 2:1 geometry in

$$^{152}\text{Dy}$$

and the elastic response through the giant monopole resonance in

$$^{90}\text{Zr};$$

- **Informational integrity:** through the Benford, white-noise, polytropic analysis and Shannon informational stability tests, which verify that the output does not result from AME2020 memorization, local interpolations, hidden splines or artificial overfitting.

Confusion between the two validation layers is a methodological error. Therefore, the lack of access to the High-Res formula cannot be invoked as an instrument for invalidating the J3 Atomic model. It exclusively concerns access to the proprietary engine, protected as a Trade Secret, while the zero-trust verifications presented above concern execution, the J3 structure and the coherence of the generated results.

The validation of the J3 Atomic principle does not depend on access to the High-Res formula. The public Low-Res component is sufficient for independent verification because the Low-Res formula Eq. (11) is functionally implemented and directly verifiable on the website. High-Res is not the necessary condition for validating the physical principle and is not presented as a scientific fact established by authority, but as a proprietary metrological layer for industrial refinement and extension, assessable through output, traceability and successive external confirmations. Thus, Low-Res establishes the verifiable public principle, while High-Res remains the proprietary metrological extension, assessable separately through the generated results.

High-Res is not validated through disclosure of the internal formula, but through *Proof of Execution*, output coherence, experimental anchoring and independent tests on the generated results. Therefore, protecting the High-Res engine as a Trade Secret does not transform the model into an unverifiable hypothesis.

Access to the proprietary engine and the verifiability of the public J3 Atomic principle belong to different evaluation regimes: the first concerns the protected technology, while the second concerns the reproducible scientific demonstration. As in modern cryptography, where the fundamental mathematical principle is public, transparent and assessable through peer review, while the industrial software implementation remains secured, J3 Atomic separates the proof of principle, as an object of academic analysis, from the final metrological engine, as an object of *Proof of Execution*-type technical audit.