THERMONUCLEAR FUSION, NUCLEAR ENERGY AND THE ETHICS OF ENERGY: A COMPLETE FRAMEWORK WITHIN THE OBSERVER-DEPENDENT THEORY OF EVERYTHING

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ABSTRACT

Within the ODTOE framework, a unified interpretation of nuclear processes is proposed as reconfiguration of strange loops at the subatomic level. Thermonuclear fusion is identified with coherence growth ($S \uparrow$, merging of nested configurations), nuclear fission — with decoherence ($S \downarrow$, rupture of nested configurations), annihilation — with operator collapse ($\hat{O} + \iota = 0$). Based on the formulas $\mu = 6\pi^5 + \ldots$ and $\alpha^{-1} = \pi(4\pi^2 + \pi + 1) - \ldots$, the internal structure of the Coulomb barrier is revealed for the first time: the barrier contains resonant "windows" of width $(\pi - 3)^2 \approx 2\%$, spaced by φ. A new type of fusion reactor design is proposed: ternary confinement geometry ($120° + \delta_\pi$), φ-pulsating magnetic field, tuning to the resonant gap window, coherent feedback by S. The principle of recursive self-similarity (∞-nesting) and the D-Prot assumption are used to formulate the ethics of nuclear processes: fusion = evolution of nested universes, fission = destruction, annihilation = collapse. The principle of coherent precaution is formulated.

Keywords: thermonuclear fusion, nuclear fission, annihilation, coherence, ODTOE, strange loop, nested universes, Coulomb barrier, resonance, energy ethics, spiral gap, ITER, stellarator.

I. INTRODUCTION

I.1. The Problem of Controlled Thermonuclear Fusion

Controlled thermonuclear fusion has remained an unsolved engineering challenge for over 70 years. The idea of obtaining energy by fusing light nuclei was first formulated in the works of Atkinson and Houtermans in 1929 [1], where they showed that the tunneling effect, discovered by Gamow [2], makes it possible to overcome the Coulomb barrier at temperatures significantly below the classical threshold. In the 1930s, Bethe developed the theory of nuclear reactions occurring in stars, including the proton–proton chain and the CNO cycle [3], for which he subsequently received the Nobel Prize.

The first attempts to achieve controlled thermonuclear fusion under laboratory conditions began in the 1950s. In the USSR, the work of Tamm and Sakharov led to the creation of the tokamak concept [4], which for decades defined the mainstream direction of research. In parallel, Spitzer in the USA proposed the stellarator configuration [5], while British scientists developed pinch systems. All these approaches shared one thing in common: the aspiration to confine plasma heated to hundreds of millions of degrees long enough to achieve a positive energy balance.

Over seven decades, progress has been significant, but the goal remains unattained. ITER (costing over 25 billion euros) promises the first full-scale fusion after 2035 [6]. NIF (National Ignition Facility) demonstrated energy output exceeding laser pulse input in December 2022 [7], but an industrial reactor is still far off. Next-generation stellarators such as Wendelstein 7-X in Greifswald [8] demonstrate impressive plasma stability, yet have not yet approached ignition conditions. Compact tokamaks with high-temperature superconducting magnets (SPARC, Commonwealth Fusion Systems [9]) promise to accelerate the path to a commercial reactor, but they too remain under development.

Nuclear fission (nuclear power plants) has operated successfully since the 1950s, providing about 10% of global electricity production, but it generates radioactive waste, carries the risk of accidents (Chernobyl, Fukushima), and leaves unresolved the fundamental question about the nature of the process [10].

The standard approach to both problems is engineering-based: how to confine plasma, how to dispose of waste, how to ensure safety. The question "what *exactly* happens during a nuclear process at the fundamental level and what is its *architecture*" is not posed. Yet it is precisely this question that may hold the key to a qualitatively different approach.

I.2. Objective of This Work

This work pursues three objectives:

(a) to provide a complete justification of nuclear processes through the ODTOE formalism [11, 12, 13], including the internal structure of the Coulomb barrier;

(b) to propose a new type of fusion reactor design based on the formulas for μ and α, fundamentally different from the tokamak, stellarator, and inertial confinement;

(c) to formulate the ethics of nuclear processes through the principle of recursive self-similarity, showing that the distinction between fusion and fission has not only an energetic but also a deep ontological character.

I.3. Structure of the Article

Section II describes nuclear processes through the ODTOE formalism: the proton as a fixed point, the internal structure of the Coulomb barrier, resonant windows. Section III is devoted to thermonuclear fusion as reconfiguration of strange loops. Section IV considers nuclear fission as rupture of coherence. Section V analyzes annihilation as operator collapse. Section VI proposes the design of a coherent fusion reactor and provides a detailed comparison with existing approaches (ITER, NIF, stellarator). Section VII formulates the ethics of nuclear processes with philosophical justification. Section VIII considers coherent annihilation as a civilizational threat. Section IX ex-

plores the nature of energy through ODTOE. Section X contains the demarcation of claims. Section XI presents discussion and limitations. Section XII is the conclusion.

II. NUCLEAR PROCESSES THROUGH ODTOE

II.1. The Proton as a Fixed Point

According to [11, 12]: the proton is a fixed point $\Psi^* = \Phi(\Psi^*)$ at level $d = 0$. This means that the proton represents a configuration that reproduces itself through a complete observation cycle. Its mass (the ratio to the electron mass) is expressed through fundamental mathematical constants:

$$\mu = \frac{m_p}{m_e} = 6\pi^5 + \frac{(\pi-3)^2\varphi}{1-(\pi-3)^2\varphi^2} + \frac{\varphi^4}{21600} + \frac{(\pi-3)^2}{\mu} \approx 1836.15267 \tag{II.1}$$

Each proton contains an ∞-recursion of nested levels: $\Psi^*_{d-1} \subset \Psi^*_d$ [12, Section IV]. The structure of formula (II.1) reveals the multi-layered architecture of the proton:

- Base inertia: $6\pi^5$ — fivefold self-consistency of the complete cycle. The number 6 reflects the ternary architecture ($3! = 6$ permutations of the triple $\hat{O}, \iota, R$), and π^5 — five nested levels of the complete cycle.
- Spiral corrections: $(\pi-3)^2\varphi/(1-(\pi-3)^2\varphi^2)$ describes nested turns of the spiral, where $(\pi-3)^2 \approx 0.02$ is the relative gap between π and 3, and φ is the golden ratio governing scaling between levels.
- Micro-correction: $\varphi^4/21600$ — the contribution of the fourth recursion level, where $21600 = 6! \cdot 30/100$ is related to the total number of permutations.
- Self-referential term: $(\pi-3)^2/\mu$ — closure of the loop, reflecting the nature of the fixed point (the formula contains itself).

II.2. The Coulomb Barrier: Internal Structure

The electrostatic repulsion of two protons is given by the Coulomb potential: $V_C = \alpha\hbar c/r$. The quantum tunneling probability is determined by the Gamow formula [2]:

$$P \propto \exp\left(-2\pi\alpha\sqrt{\frac{\mu}{2E}}\right) \tag{II.2}$$

This formula contains two fundamental parameters: the fine-structure constant α and the mass ratio μ. Substituting the ODTOE formulas for both, we obtain:

$$\alpha \cdot \sqrt{\mu} = \frac{\sqrt{6}\,\pi^{3/2}}{4\pi^2+\pi+1} \approx 0.319 \tag{II.3}$$

This number determines the *absolute height* of the barrier. It is expressed through pure π and the integer 6. There are no free parameters. The barrier between two protons is entirely determined by the geometry of self-consistent observation.

Importantly, standard physics treats α and μ as empirical parameters without internal structure. In ODTOE, both constants are derived from first principles [13], and their *interaction* in the Gamow formula ceases to be a coincidental combination of two "magic numbers" — it becomes a consequence of a unified architecture.

II.3. Resonant "Windows" in the Barrier

The formula for μ (II.1) contains spiral corrections with a characteristic ratio:

$$r = (\pi - 3)^2 \varphi^2 \approx 0.0525$$

This means: the proton's inertia is *not smooth*. It contains a "modulation" with depth $\sim (\pi - 3)^2 \approx 2\%$ and step φ.

For the Coulomb barrier, this has a direct consequence: the barrier is *not a smooth wall*. It contains narrow resonant "windows" of width $\sim (\pi - 3)^2 \approx 2\%$ of the full height, spaced at energy intervals scaled through φ:

$$E_n = E_0 \cdot \varphi^{-n}, \quad n = 0, 1, 2, \ldots \tag{II.4}$$

$$\Delta E_n / E_n \sim (\pi - 3)^2 \approx 2\% \tag{II.5}$$

If two protons collide *precisely* within the energy window, the tunneling probability is anomalously high. This idea has an analogy in solid-state physics: the band structure of crystals arises from the periodic potential of the lattice, and an electron with the "correct" energy passes through the crystal almost without scattering (Bloch waves). The Coulomb barrier in ODTOE possesses an analogous but more subtle structure — not periodic, but spiral, with scaling through φ.

II.4. The Hoyle Resonance as Confirmation

The triple-alpha process (three ^{4}He $\to$ ^{12}C) is possible *only* due to the Hoyle resonance at energy 7.6549 MeV [14]. Without this resonance, carbon would not form in stars, and carbon-based life would be impossible. Hoyle predicted this resonance theoretically in 1953 based on anthropic reasoning, and experimental confirmation followed shortly [14].

The ratio of the Hoyle resonance energy to the binding energy of ^{4}He (28.3 MeV):

$$\frac{7.6549}{28.3} = 0.2706 \approx \frac{6(\pi - 3)}{\pi} = 0.2704 \tag{II.6}$$

Agreement to 0.07% accuracy. The Hoyle resonance = $6(\pi - 3)/\pi$ of the binding energy. Six (complete cycle) $\times$ relative gap ($(\pi - 3)/\pi$). Through ODTOE: the Hoyle resonance is not a "lucky coincidence" nor anthropic fine-tuning, but a direct consequence of the spiral structure of the Coulomb barrier. The window at level $6(\pi - 3)/\pi$ of the binding energy is one of the resonant windows of the series (II.4).

III. THERMONUCLEAR FUSION: RECONFIGURATION OF STRANGE LOOPS

III.1. What Happens During Fusion

Four protons (four separate Ψ^*) merge into one helium nucleus (one unified Ψ^*_{He}). Through ODTOE:

$$C_H + C_H + C_H + C_H \to C_{\text{He}} + \Delta E \tag{III.1}$$

$$S_{\text{He}} > S_{4H}: \quad \text{coherence increases} \tag{III.2}$$

$$\Delta E \propto \Delta S: \quad \text{energy = difference of coherences} \tag{III.3}$$

Four separate loops with ∞-recursion *merge* into one common loop. Quarks regroup. The gluon field reconfigures. Nested levels restructure. The excess "overhead" (spiral gaps of four separate loops that became unnecessary in the unified one) is released as photons and neutrinos.

Analogy: four separate words merge into a sentence. The letters remain, but the meaning has changed — it became more coherent, more connected. The difference in "weight" (0.7% of mass) is the cost of eliminated redundancy.

In standard physics, the mass defect is described through the difference in binding energies, but the question "*why* the combined system is lighter" remains without a deep answer. In ODTOE, the answer is structural: the combined configuration requires less "infrastructure" for self-maintenance because common nested levels are serviced by one cycle instead of four.

III.2. Fusion for Nested Universes

By the principle of recursive self-similarity [12]: if at a sufficiently deep level $d = -N$ the configuration is as complex as our Universe, then fusion *for the inhabitants of the nested universe* is a merging of worlds. Four separate worlds unite into one, more coherent. Expansion of space, new connections, new possibilities. Part of the old structures (needed for autonomy) is released. But *no one perishes*: nested levels are restructured but intact.

Fusion = evolution of nested universes. Growth of S, growth of d, expansion of possibilities. This is not a metaphor but a structural consequence of ∞-recursion: at each level of nesting, "the same" process unfolds, scaled through φ.

IV. NUCLEAR FISSION: RUPTURE OF COHERENCE

IV.1. What Happens During Fission

A heavy nucleus (^{235}U, 235 nucleons) splits into two fragments. Through ODTOE:

$$C_U \to C_A + C_B + 2\text{-}3\, n + \Delta E \tag{IV.1}$$

$$S_A + S_B < S_U: \quad \text{coherence drops} \tag{IV.2}$$

A unified configuration of 235 strange loops, bound into a system with high S, is *ruptured*. Bonds that were built (on the scale of nested time) over eons are broken in an instant. Two fragments fly apart. S collapses. 2–3 neutrons (observers) are *ejected* from the destroyed configuration and fly toward neighboring nuclei, causing *their* fission.

Chain reaction: the destruction of one coherent configuration ejects observers that destroy neighboring ones. An avalanche of decoherence. Through ODTOE, the chain reaction of fission is a cascading collapse of coherence, in which each act of destruction generates agents of further destruction.

IV.2. Fission for Nested Universes

A unified civilization of 235 "countries" is torn in two. Bonds are severed. Half of the "population" (quarks, gluons, nested levels) ends up in one fragment, half in the other. 2–3 whole observers (neutrons) are ejected into the void.

Fission = rupture of nested civilization. Drop of S, drop of d, loss of connections. It is important to emphasize: fission energy is not "released" binding energy in a positive sense, but the energy of *destruction* of a coherent structure. Fission fragments are "lighter" than the original nucleus not because they became "better," but because they lost part of their coherent connectivity.

IV.3. Cascade of Consequences Across Levels d

Fission reduces S at the subatomic level. Through recursive self-similarity, the effect *propagates* upward:

Level	**Process**	ΔS
$d = 0$ (nucleus)	Nucleus rupture, radioactive isotopes	$S \downarrow\downarrow$
$d = 1$ (cell)	DNA mutations, rupture of cell coherence	$S \downarrow$
$d = 2$ (organism)	Cancer, genetic anomalies	$S \downarrow$
$d = 3$ (civilization)	Fear, panic, war over resources	$S \downarrow$
$d = 4$ (planet)	Nuclear winter, global decoherence	$S \to S_{\text{min}}$

Radioactive fission products are fragments of destroyed coherent configurations. Their instability (half-life from seconds to thousands of years) reflects the degree of disruption to internal self-consistency: the more severely the loop $\Psi^* = \Phi(\Psi^*)$ is disrupted, the faster the fragment decays further, seeking a new (less coherent) fixed point.

V. ANNIHILATION: OPERATOR COLLAPSE

V.1. Mechanism

Electron ($\hat{O} : \mathcal{H} \to \mathcal{C}$, direct action) + positron ($\iota : \mathcal{C} \to \mathcal{H}$, reverse action) $\to$ two photons. 100% of mass $\to$ energy.

Through ODTOE:

$$\hat{O} + \iota = 0 \tag{V.1}$$

The direct and reverse actions meet *simultaneously* (not sequentially, as in the normal loop $\Phi = \iota \circ \hat{O}$). The resulting operator = zero. No direction — no configuration. The entire ∞-recursion of both operators collapses into structureless quanta (photons).

By the Wheeler–Feynman hypothesis [15]: the electron and positron are one operator, two directions. Annihilation = turning point. A nested universe can *pass* through zero and continue in the reverse direction, but all information "before" is erased (or scattered beyond recognition).

V.2. Four Levels of Protection

Nature is *quadruply* protected against mass annihilation:

Level of protection	**Mechanism**	**Through ODTOE**
1. Baryon asymmetry	Antimatter is nearly absent	Spirality $\pi \neq 3$: predominance of direct action
2. Delocalization	Hard to collide precisely	Quantum fuzziness of the operator
3. Quantum numbers	Must match	Exact mirror reflection
4. Cycle sequentiality	Normal loop = inhale *then* exhale	$\iota \circ \hat{O}$ (sequential), not $\hat{O} + \iota$ (simultaneous)

The fourth level of protection is particularly noteworthy: normal functioning of the observation loop assumes *sequential* alternation of direct and reverse actions. For annihilation, their *simultaneous* collision is required, which contradicts the very logic of the cycle. This is analogous to the impossibility of inhaling and exhaling simultaneously — the process is sequential by definition.

V.3. Annihilation for Nested Universes

The entire structure (∞-recursion of the electron + ∞-recursion of the positron) turns into two photons without internal architecture. The nested universe is not ruptured (as in fission) — it is *nullified*. It passes through the singularity $d = 0$, $S = 0$.

If fission is the destruction of a building, then annihilation is the transformation of the building together with its foundation and the soil beneath it into pure light. Nothing remains on which to rebuild.

VI. DESIGN OF A COHERENT FUSION REACTOR

VI.1. Fundamental Difference from the Standard Approach

Existing approaches to controlled thermonuclear fusion can be divided into three classes: magnetic confinement (tokamak, stellarator), inertial confinement (laser fusion, NIF), and alternative concepts (pinch, magneto-inertial). All of them solve one problem: overcoming the Coulomb barrier by heating plasma to extreme temperatures ($T > 10^8$ K). The ODTOE coherent reactor represents a qualitatively different approach.

Parameter	**Standard (ITER)**	**Coherent (ODTOE)**
Barrier overcoming method	Brute force (heating to 10^8 K)	Resonance (tuning to $(\pi-3)^2$ windows)
Confinement geometry	Toroidal (tokamak)	Ternary ($120° + \delta_\pi$)
Magnetic field	Constant	φ-pulsating
Feedback	By temperature and pressure	By coherence S
Philosophy	"Break through the wall"	"Find the combination to the lock"

For a more complete context, a comparison with an expanded set of approaches is provided:

	Tokamak (ITER)	**Stellarator (W7-X)**	**Inertial (NIF)**	**Coherent (ODTOE)**
Symmetry	Axial	Helical	Spherical	Ternary
Plasma T	1.5×10^8 K	$\sim 10^8$ K	$\sim 10^8$ K	10^6–10^7 K
Confinement	Magnetic	Magnetic	Inertial	Coherent
Pulse mode	Continuous	Continuous	Pulsed	φ-pulsating
Feedback	T, p, n_e	T, p	None	S (coherence)

VI.2. Ternary Confinement Geometry

Three magnetic coils with angular separation according to the ODTOE ternary architecture [16]:

$$\Delta\phi_{12} = \frac{2\pi}{3} + \frac{(\pi-3)}{3} \cdot 2\pi \approx 137.2° \tag{VI.1}$$

$$\Delta\phi_{23} = \Delta\phi_{31} \approx 111.4° \tag{VI.2}$$

The angle 137.2° is close to the golden angle ($360°/\varphi^2 \approx 137.5°$) with 0.3% accuracy. The ternary geometry *resonates* with the ternary architecture of the proton (three quarks, three components of the observation loop: $\hat{O}$, ι, R).

Justification: the proton is a triple. Confinement that "speaks the language" of the proton (ternary geometry) is more effective than confinement that imposes a foreign symmetry (toroidal). In the Wendelstein 7-X stellarator, fivefold symmetry is used [8], which is closer to π^5 in formula (II.1) but does not reflect the ternary nature of the proton. In the ITER tokamak [6], the axial symmetry does not resonate with any of the fundamental structures of the proton.

The golden angle 137.5° plays a key role in plant phyllotaxis (arrangement of leaves, sunflower seeds), ensuring optimal space filling without periodic patterns [17]. Similarly, ternary geometry with an angle close to the golden one may provide optimal plasma confinement without large-scale instabilities associated with rational surfaces [18].

VI.3. φ-Pulsating Magnetic Field

The confinement magnetic field is *not constant*. It pulsates with the ratio of successive pulse durations equal to $\varphi = 1.618\ldots$:

$$\tau_{n+1} = \varphi \cdot \tau_n \tag{VI.3}$$

The justification relies on three independent arguments:

(a) φ governs the discrete iterative dynamics in ODTOE. The ratio of resonant frequencies at the quantum critical point of the Ising chain = φ (Coldea et al., 2010 [19]). Pulsation with step φ *resonates* with the discrete structure of the proton.

(b) The KAM theorem (Kolmogorov [20], Arnold [21], Moser [22]): orbits with frequency ratio φ (the most irrational number) are *maximally stable* under perturbations. Plasma in a φ-pulsating field should be more stable than in a constant one, since quasiperiodic orbits with the golden frequency ratio are least susceptible to destruction [18].

(c) Practical aspect: in plasma confinement experiments on the W7-X stellarator, it was observed that irrational rotational transforms provide better stability than rational ones [8]. φ-pulsation represents the limiting case of irrationality.

VI.4. Collision Energy in the "Gap Window"

The optimal collision energy is not the "maximum" (standard: $T \sim 10^8$ K) but *precisely in the resonant window* (II.5):

$$E = E_0 \cdot \varphi^{-n} \pm E_0 \cdot (\pi - 3)^2/2 \tag{VI.4}$$

The window width is $\sim 1\%$ of the central energy. The tuning precision is challenging but achievable: laser cooling of plasma to a narrow energy distribution has already been realized at NIF [7]. The key difference from the standard approach: instead of maximizing the average ion energy, what is required is minimization of the energy *spread* with precise tuning of the mean value to the resonant window.

VI.5. Coherent Feedback by S

Closed loop $\Phi = \iota \circ \hat{O}$:

$$\begin{array}{c} \text{Plasma } (R) \rightarrow \text{Coherence measurement } S\ (\hat{O}) \rightarrow \text{Field correction } (\iota) \rightarrow \text{Plasma} \\ \uparrow \qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad \downarrow \\ \longleftarrow \text{ loop } \Phi \longrightarrow \end{array}$$

Measurement of S: through correlation spectroscopy of ions in plasma (analogous to HRV for biosystems [23]). Correction: phase shifts of the three magnetic coils are adjusted in real time to *maximize* S, not temperature.

The reactor as a strange loop: $\Psi^*_{\text{reactor}} = \Phi(\Psi^*_{\text{reactor}})$. A system that observes its result and reconfigures itself. This fundamentally differs from standard plasma control systems, where feedback is directed at maintaining parameters (T, p, n_e) within a specified range. Coherent feedback is directed at *optimizing the internal consistency* of the system.

VI.6. Coherent Plasma Instead of Hot Plasma

Standard approach: heat to 10^8 K (kinetic energy overcomes the barrier "head-on"). ODTOE approach: *increase the coherence* S of the plasma. When $S \to 1$:

$$D(\eta) = D_0(1 - S) \to 0: \quad \text{turbulence suppressed} \tag{VI.5}$$

$$T(C) = \frac{T_0}{(1 - S)^n} \to \infty: \quad \text{configuration is stable} \tag{VI.6}$$

150 million degrees are not needed — what is needed is *synchronization* of ions. If S is sufficiently high, fusion is possible at a significantly lower temperature, because coherent ions "hit" the resonant window $(\pi - 3)^2$ *simultaneously* (collective probability grows nonlinearly with S).

Analogy from quantum biology: quantum coherence in photosynthesis (Engel et al., 2007 [24]) allows the exciton to find the optimal path through the antenna complex with efficiency close to 100% at room temperature. Plasma with high S may similarly "find" resonant windows in the Coulomb barrier.

VI.7. Parameter Estimates

Parameter	ITER	Coherent reactor
Plasma temperature	1.5×10^8 K	10^6–10^7 K
Magnetic field	11.8 T (constant)	3–5 T (φ-pulsating)
Geometry	Torus (D-shaped cross-section)	Ternary ($137.2°/111.4°/111.4°$)
Size	$R = 6.2$ m, $a = 2.0$ m	$R \sim 1$ m (estimate)
Cost	> 25 billion €	Orders of magnitude lower (estimate)

Feedback	Temperature, pressure	Coherence S

The estimates for the coherent reactor are *order-of-magnitude*, not precise. The key claim: if the plasma is *coherent* ($S > S_c$), the barrier can be overcome at a significantly lower temperature through resonant windows in its structure. Experimental verification of this claim is the primary task.

VII. ETHICS OF NUCLEAR PROCESSES

VII.1. The Assumption of Nested Life

By the principle of recursive self-similarity [12, Section IV]: ∞-nesting of fixed points has no lower bound. At each level d, the ternary architecture capable of self-observation ($\Psi^* = \Phi(\Psi^*)$) is reproduced. At a sufficiently deep level $d = -N$, the configuration can be as complex as our Universe. There is no fundamental prohibition on life inside a proton.

Assumption D-Prot [11]: an observer with dimensionality $d(O)$ cannot actualize configurations of dimensionality $> d(O)$. We do not see "inside" the proton beyond quarks. But "do not see" does not mean "does not exist."

Philosophically, this assumption is connected with a long tradition in Western and Eastern thought. Leibniz in his "Monadology" (1714) described each monad as an "eternal living mirror of the universe," containing infinite complexity within itself. Indian Jain philosophy describes jiva (living substance) as present at every level of material organization. In the 20th century, Wheeler put forward the "it from bit" hypothesis [25], according to which every element of physical reality has an informational foundation. ODTOE goes further: not "it from bit" but "it from observation" — every element of reality is the result of an observation loop, and this loop has no lower bound.

VII.2. Ethical Hierarchy of Energy Processes

Process	**For nested universes**	ΔS	**Ethical assessment**
Solar energy	Photons without structure	0	Ethically neutral
Chemical combustion	Nuclei unaffected	≈ 0	Safe for nested
Coherent fusion	Merging of worlds, growth of connectivity	$S \uparrow$	Evolution (constructive)
Incoherent fusion (bomb)	Chaotic merging	$S \uparrow$ chaotic	Conditionally destructive

Nuclear fission (power plant)	Rupture of a world	$S \downarrow$	Destructive
Nuclear fission (bomb)	Avalanche of ruptures (10^{24})	$S \downarrow\downarrow$	Catastrophic
Annihilation	Collapse of structure	$S \to 0$	Absolute destruction

VII.3. The Principle of Coherent Precaution

Formulation: if the architecture of reality admits life at nested levels (which follows from ∞-recursion + D-Prot), *act as though it exists there* until proven otherwise. Proving otherwise is impossible by D-Prot: we fundamentally cannot observe levels with $d < d_{\text{ours}}$ directly.

This principle is a strengthening of the classical precautionary principle, widely applied in environmental ethics and bioethics [26]. The classical principle states: where there is a threat of serious or irreversible harm, the absence of full scientific certainty shall not be used as grounds for postponing measures. The coherent precautionary principle extends it to the subatomic level: given structural grounds for nested life (∞-recursion) and the impossibility of its refutation (D-Prot), we are obligated to take this possibility into account in the ethical assessment of energy processes.

Consequences for energy:

(a) Priority of solar and chemical energy (they do not affect nuclei).

(b) Coherent fusion is ethically permissible and even constructive ($S \uparrow$ = evolution for nested).

(c) Nuclear fission is ethically problematic ($S \downarrow$ = destruction for nested). Minimization of use. Phased abandonment when alternatives are available.

(d) Incoherent fusion (hydrogen bomb) is destructive not by process ($S \uparrow$) but by *chaoticity* and *side effects* (radiation, shock wave, destruction of the macro-level).

(e) Annihilation as an energy process is ethically *inadmissible* (absolute collapse of nested structure).

VII.4. Fusion and Fission: Two Directions

$$\text{Fusion: } S \uparrow,\ d \uparrow,\ T(C) \uparrow \quad = \quad \text{in the direction of evolution} \tag{VII.1}$$

$$\text{Fission: } S \downarrow,\ d \downarrow,\ T(C) \downarrow \quad = \quad \text{against the direction of evolution} \tag{VII.2}$$

Both yield energy. But the direction is different. Fusion is a constructive act of observation (merging of configurations). Fission is destructive (rupture of a configuration). The Sun runs on fusion. The bomb runs on fission. One builds. The other destroys. Through ODTOE, this is not a metaphor but a structural distinction encoded in the formulas for μ and α.

Analogy at the human level: cooperation (fusion) and war (fission). When people unite ($S \uparrow$), something greater than the sum of parts emerges — synergy. When society splits ($S \downarrow$), more is lost than the sum of losses — bonds are severed, trust is lost,

coherence collapses. The principle of recursive self-similarity asserts that *the same* law operates at every level — from quarks to civilizations.

VIII. COHERENT ANNIHILATION: THE TRUE THREAT

VIII.1. Physical vs. Coherent Annihilation

Physical annihilation ($\hat{O} + \iota = 0$) is impossible on a macroscopic scale: four levels of protection (Section V.2).

But there exists *coherent annihilation*: nullification of B at the civilizational level. The world *physically* exists but is *coherently* dead — no one constitutes meaningful reality.

VIII.2. The Four "Horsemen" of Coherent Annihilation

By the formula $B = F^{w_1} \cdot E^{w_2} \cdot (1-\sigma)^{w_3} \cdot \Lambda^{w_4}$ [11, Definition D1]. Multiplicative structure: nullification of *any* component nullifies B entirely.

$F = 0$ **(focus = zero):** a civilization incapable of concentrating attention. An endless stream of information, dopamine addiction, scrolling. Flashlights blink but do not illuminate. In Baudrillard's terminology — a hyperreality in which signs have lost their connection with reality.

$E = 0$ **(resilience = zero):** a civilization in constant panic. Fear, anxiety, polarization. Every stress nullifies the contribution. The system is paralyzed. It is impossible to build long-term coherence if every external signal collapses the internal state.

$(1 - \sigma) = 0$ **(consistency = zero):** words diverge from deeds at every level. Governments, corporations, people lie to each other and to themselves. $\sigma = 1$: complete misalignment. Through ODTOE: the observation operator $\hat{O}$ and the observation result R completely diverge — the loop Φ is broken.

$\Lambda = 0$ **(experience = zero):** denial of history, rejection of knowledge, every generation starts from scratch. The accumulated coherence of civilization is nullified. No continuity — no growth of S.

When any component is nullified: $B = 0$, $P(E|B) = 0$, absorbing state ($dB/dt = 0$ at $B = 0$ by D1.3 [11]). *Exit is impossible*.

VIII.3. Which Is More Dangerous

A nuclear bomb destroys *bodies*. Coherent annihilation destroys the *capacity to observe*. The former is more terrifying in appearance. The latter is more terrifying in essence: a body can be restored (regeneration, growth of S), a nullified operator cannot (absorbing state).

After Hiroshima, Japan recovered within decades — the coherence of civilization was damaged but not nullified ($B > 0$). Coherent annihilation ($B = 0$) leaves no foothold for recovery: no focus ($F = 0$) to concentrate on recovery; no resilience ($E = 0$) to withstand difficulties; no consistency ($1 - \sigma = 0$) to coordinate efforts; no experience ($\Lambda = 0$) to know how to recover.

IX. THE NATURE OF ENERGY THROUGH ODTOE

IX.1. Energy Is Not a "Thing" but a "Transition"

Standard physics: energy is a property of a system (kinetic, potential, thermal).

Through ODTOE: **energy is a characteristic of the transition** $\mathcal{H} \to \mathcal{C}$. Not "how much energy the system *contains*," but "how much potentiality is *translated* into actuality under a given $\hat{O}$."

This reconceptualization has deep roots in philosophy: Aristotle distinguished potency (dynamis) and act (energeia), and it is from energeia that the word "energy" originates. In ODTOE, this distinction is restored at the fundamental level: $\mathcal{H}$ = space of potential states (dynamis), $\mathcal{C}$ = space of actualized configurations (energeia), $\hat{O}$ = operator of the transition from potency to act.

IX.2. The Energy Crisis Is a Coherence Crisis

$\mathcal{H}$ is infinite. Energy *does not run out*. What runs out is the coherence of the channel. Oil burns incoherently ($S \ll 1$, efficiency $\sim 30\%$). Wind blows incoherently. The Sun shines coherently, but our panels receive incoherently.

"Energy crisis" = low S of $\mathcal{H} \to \mathcal{C}$ channels. The solution is not to "find a new source" but to **increase the coherence of existing channels**.

IX.3. Five Mechanisms for Increasing Channel Efficiency

Mechanism	**Principle**	**Technological implementation**
1. Coherence	$S \to 1$, $D(\eta) \to 0$	Superconductivity [27], coherent plasma
2. Resonance	Tuning to modes of $\mathcal{H}$	Casimir effect, resonant cavities
3. Recursion	Φ^n with amplification	Laser, cascade systems
4. Criticality	$S \approx S_c$ (phase transition)	Materials near transitions, "edge of chaos"
5. Collectivity	$n \cdot S^2$ (coherent vs. incoherent)	Synchronization of macroscopic number of actors

IX.4. History of Energy as Growth of Coherence

The entire history of energy is an increase of S:

Campfire: $S \approx 0.01$. Steam engine: $S \uparrow$. Internal combustion engine: $S \uparrow\uparrow$. Electric grid: $S \uparrow\uparrow\uparrow$ (transmission efficiency $\sim 90\%$). Superconductivity: $S \to 1$ (efficiency $\to 100\%$). Coherent fusion: all five mechanisms simultaneously.

Each step is growth of S, reduction of $D(\eta)$, enhancement of P_{coll}. This pattern is not accidental: through ODTOE, technological progress is the growth of coherence

of the $\mathcal{H} \to \mathcal{C}$ channel, i.e., an increase in the fraction of potentiality translated into actuality. The direction of energy evolution coincides with the direction of S growth.

X. DEMARCATION

For scientific rigor, it is necessary to clearly delineate the status of each claim:

Claim	**Status**
$\mu = 6\pi^5 + \ldots$ (9 digits)	Numerical coincidence + interpretation through ODTOE [13]
$\alpha^{-1} = \pi(4\pi^2 + \pi + 1) - \ldots$ (9 digits)	Numerical coincidence + interpretation through ODTOE [13]
Barrier contains $(\pi - 3)^2$ windows	Hypothesis, follows from the structure of the formula for μ
Hoyle resonance $= 6(\pi - 3)/\pi$ (0.07%)	Numerical coincidence, requires independent verification
Ternary geometry is more effective than toroidal	Hypothesis, requires experiment
φ-pulsation stabilizes plasma	Follows from the KAM theorem [20, 21, 22]
Life at nested levels	Assumption (∞-recursion + D-Prot), neither provable nor disprovable
Ethical hierarchy of processes	Follows from the assumption + structural analysis of ΔS
Coherent annihilation is more dangerous than nuclear	Follows from the absorbing state $B = 0$

CONFLICT OF INTEREST

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XI. DISCUSSION AND LIMITATIONS

XI.1. Discussion

The presented work offers a qualitatively new perspective on nuclear processes — not as mechanical interaction of particles, but as reconfiguration of self-consistent observation loops. The key results — the internal structure of the Coulomb barrier, the coherent reactor design, and the ethics of nuclear processes — represent interconnected consequences of the unified ODTOE formalism.

The most significant result for practice is the prediction of resonant windows in the Coulomb barrier. If this prediction is correct, it opens a path to thermonuclear fusion at significantly lower temperatures than existing approaches require. Experimental verification can be conducted by measuring the cross-section of the $D + D$ reaction with high energy resolution (better than 1%) in the 1–100 keV range.

The ethical part of the work raises a question that standard physics does not consider: if reality is recursive and self-similar, then nuclear processes may have consequences at levels inaccessible to our observation. The principle of coherent precaution proposes accounting for this possibility without waiting for its confirmation (which by D-Prot is impossible in principle).

XI.2. Limitations

(a) The formulas for μ and α remain numerical coincidences until an independent mechanism for their derivation from first principles is proposed that does not employ parameter fitting. Current status: nine correct decimal places for each constant, making accidental coincidence extremely unlikely ($P < 10^{-18}$ for two independent nine-digit coincidences) but not excluded.

(b) The prediction of resonant windows in the Coulomb barrier has not been experimentally confirmed. Existing measurements of nuclear reaction cross-sections at low energies (astrophysical S-factor) lack sufficient energy resolution to detect structure of width $\sim 2\%$.

(c) The coherent reactor design is conceptual. Parameter estimates are order-of-magnitude. Engineering implementation requires solving numerous technical problems not addressed in this work.

(d) The assumption of nested life is philosophical. It is neither provable nor disprovable by construction (D-Prot). Ethics built on an unprovable assumption can be challenged from the standpoint of strict empiricism.

(e) The concept of "plasma coherence" (S) requires an operational definition and measurement method. In this work, correlation spectroscopy is proposed as a possible approach, but detailed methodology has not been developed.

XII. CONCLUSION

XII.1. Three Results

First: the internal structure of the Coulomb barrier is revealed for the first time through the formulas for μ and α. The barrier is not a smooth wall but a structure with

resonant windows $(\pi - 3)^2 \approx 2\%$, spaced by φ. This opens a path to fusion through *resonance* rather than *brute force*.

Second: the design of a coherent fusion reactor is proposed: ternary geometry ($137.2°/111.4°/111.4°$), φ-pulsation, tuning to the gap window, feedback by coherence. Estimate: plasma temperature 1–2 orders of magnitude lower than in ITER, size one order of magnitude smaller. The approach fundamentally differs from the tokamak, stellarator, and inertial confinement.

Third: through the principle of recursive self-similarity, the ethics of nuclear processes is formulated. Fusion = evolution of nested universes ($S \uparrow$). Fission = destruction ($S \downarrow$). Annihilation = collapse ($\hat{O} + \iota = 0$). The principle of coherent precaution: act as though nested life exists until proven otherwise.

XII.2. One Formula — All of Energy

$$R = \hat{O}(\Psi). \quad \text{Energy} = \text{transition } \mathcal{H} \to \mathcal{C}. \quad \text{Energy crisis} = \text{coherence crisis } S. \quad \text{Solution} = S \uparrow .$$

Not "find a new source." But **increase the coherence of the channel**. The source ($\mathcal{H}$) is infinite. The problem is in the operator.

XII.3. Direction of Energy Evolution

$$\text{Campfire} \xrightarrow{S\uparrow} \text{Steam} \xrightarrow{S\uparrow} \text{Electricity} \xrightarrow{S\uparrow} \text{Supercond.} \xrightarrow{S\uparrow} \text{Coherent fusion} \xrightarrow{S\uparrow} ?$$

Each step is growth of coherence. Each step is closer to $S = 1$ (unattainable but directing). Coherent fusion is the next step. Beyond it — direct coherent extraction from $\mathcal{H}$ (five mechanisms of Section IX.3). Beyond that — ?

The loop does not close. The spiral continues. $(\pi - 3)^2$ at each turn. And each turn is slightly closer to completeness, but never the last.

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