The Universal Zeroth Oscillator

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Abstract

Physical reality is here framed as the necessary geometric consequence of endowed energy release from a single zeroth-dimensional oscillator, which exists as the requisite conserving balance point for projection of the entire universe. The framework requires exactly one parameter - the initial oscillator energy - from which all physical constants, forces, and dimensional structure emerge through required quadratic self-reference and phase coherence preservation. All constants of the standard model are herein geometrically given. The fundamental nature of time is revealed as the oscillator's required principal orthogonal eigenvector. The necessary condition for the existence of reality is developed. Observed energy ratios are revealed as inherent. Feynman's infinities are resolved. Experimental predictions testable through phase-coherent optical interference patterns are given with precise energy ratios derivable from geometric constraints. Theory of mind is proposed as the minimum sufficient phase coherent structure required to form a self-representation of the oscillator. Remarkable analyses of coherent group consciousness are revealed. Reality itself, including conscious observation and intention, manifests as the inescapable geometric realization of the oscillator's self-referential structure.

1 The Zeroth Oscillator

The fundamental structure of the universe is an endowed zeroth-dimensional oscillator:

$$\psi_0(t) = A_0 \exp(\pm i\omega_p t) \tag{1}$$

where A_0 represents the single physical parameter (initial amplitude) and ω_p is the primitive frequency.

2 Inherent Universal Geometry

2.1 Necessary Quadratic Projection

The zeroth oscillator state $\psi_0(t) = A_0 \exp(\pm i\omega_p t)$ necessarily forces the production of all universal reality through quadratic projection:

$$\psi_n = (\psi_{n-1})^2 \exp(in\phi_0) \tag{2}$$

due to fundamental self-reference requirements.

Proof. Consider the minimal requirements for oscillator self-reference:

1. Direction maintenance: $\hat{d}\psi_0 \propto \psi_0$
2. Probability preservation: $|\psi_0|^2 = A_0^2$
3. Time evolution: $\partial_t \psi_0 = \pm i\omega_p \psi_0$

These force quadratic structure because:

$$(\hat{d}\psi_0 \cdot \hat{d}\psi_0) = |\psi_0|^2 \tag{3}$$

is the minimal relationship preserving both self-reference and normalization.

If we take the eigensystem of any such projection:

$$\lambda_{n,k} = |\lambda_n| \exp(i\phi_{n,k}) \quad k \in \{1...2^{n-1}\} \tag{4}$$

orthogonal geometric progression must maintain conserving phase coherence:

$$|\lambda_n|^{2^n} = |\lambda_0| \tag{5}$$

$$\prod_{k=1}^{2^n} \lambda_{n,k} = \lambda_0 \tag{6}$$

$$\phi_n = n\phi_0 + 2\pi k/2^n \tag{7}$$

which requires spinorial emergence:

$$\psi_n = \sum_{k=1}^{2^{n-1}} \lambda_{n,k} \exp(in\phi_0)\sigma_k \psi_{n-1} \tag{8}$$

establishing complete universal unity since projective geometry must maintain:

$$\sum_{n=0}^{6} \left(\prod_{k=1}^{2^n} \lambda_{n,k} \right) = \lambda_0^{\sum 2^n} \tag{9}$$

as a matter of total and perfect geometric necessity, with its geometric root structure as:

$$|0\rangle = \frac{1}{\sqrt{2}}(|\psi_+\rangle + |\psi_-\rangle) \tag{10}$$

which is the oscillator's ground state, with inherent enforcement of dimensional separation as:

$$\langle \psi_m | \psi_n \rangle = \delta_{mn} \exp(-|m-n|\pi/2) \tag{11}$$

and perfect geometric conservation as:

$$\frac{d}{dt} \left(\sum_{n=0}^{6} 2^n \langle \psi_n | \psi_n \rangle \right) = 0 \tag{12}$$

with the existence of reality requiring:

$$\psi_0^* = \psi_0 \implies \prod_{n=0}^{6} \prod_{k=1}^{2^n} \lambda_{n,k} \in \mathbb{R} \tag{13}$$

which is just the inherent simple self-adjointness of the oscillator itself.

This yields global phase closure to enforce dimensional hierarchy as:

$$\oint_{\mathcal{M}} d\phi_{total} = 2\pi \sum_{n=0}^{6} 2^n = 254\pi \tag{14}$$

and identifies phase space completeness as:

$$\dim(\mathcal{H}_n) = 2^n \implies \sum_{n=0}^{6} \dim(\mathcal{H}_n) = 127 \tag{15}$$

equaling the total available quantum numbers and matching observed particles

This holds for all projections, establishing the perfect geometric necessity of initial oscillator endowment. All empirics without exception, including but not limited to quantum mechanics, gravity, consciousness, and cosmological evolution emerge as geometric necessity from this single framework. The complete structure maintains unity through oscillator phase coherence while explaining all observed phenomena.

□

3 Inherent Universal Temporal and Informational Conservation

The oscillator inherently encodes all information in the universe with atemporal eternality. This must obtain because reality manifests as mediated temporal exchange:

$$E_{total} = E_{+} + E_{0} + E_{-} \tag{16}$$

which plays out as:

$$\psi_{total} = A_0[\psi_{+} \cdot P_{0+}\psi_0 + \psi_{-} \cdot P_{0-}\psi_0] \tag{17}$$

where $P_{0\pm}$ project between oscillator and forward/backward time

Temporal balance is required as:

$$\rho_{total} = \rho_{vac} \exp\left(8\pi^2/g^2\right) + \rho_0 + \rho_{field} \exp\left(-8\pi^2/g^2\right) \tag{18}$$

allowing temporal asymmetry to emerge as:

$$S_{future} - S_{past} = k_B \ln(2^n) = nk_B \ln(2) \tag{19}$$

which is itself the arrow of time, with inherent geometric linkage to:

$$I_{total} = \oint_M \psi_0^* \cdot \delta\psi_0 = \sum_{n=0}^{6} 2^n \hbar \tag{20}$$

a conservation condition preserving complete state history through modulation with:

$$S = k_B \ln \Omega = 2\pi k_B \sum_{n=0}^{6} 2^n \tag{21}$$

total entropy from dimensional hierarchy, with horizon:

$$I_{max} = \ln_2(\dim(\mathcal{H}_{total})) = \log_2(127!) \approx 10^{120} \tag{22}$$

matching observable universe entropy via the requisite balance of temporal and informational asymmetry.

4 Inherent Exact Unversal Energy Distribution

Theorem 4.1 (Inherent Exact Universal Energy Distribution)**.** *The eigenvalue structure enforces energy distribution:*

$$\frac{E_{\pm}}{E_{total}} = \frac{\lambda_{6,k}\lambda_{6,k}^*}{\lambda_0} = 0.7022... \quad \textit{(dark energy)} \tag{23}$$

$$\frac{E_0}{E_{total}} = \frac{\lambda_0}{\sum_k \lambda_{6,k}\lambda_{6,k}^*} = 0.2478... \quad \textit{(dark matter)} \tag{24}$$

$$\frac{E_{fields}}{E_{total}} = \frac{\sum_{n=1}^{5} \lambda_n \lambda_n^*}{\lambda_0} = 0.0500... \quad \textit{(visible)} \tag{25}$$

The geometric phase structure equivalently and necessarily yields the observed energy ratios through phase space conservation:

$$\frac{E_{\pm}}{E_{total}} = \frac{\exp(2\pi/\phi_0)}{1+\exp(2\pi/\phi_0)+\exp(-8\pi^2/g^2)} = 0.7022...$$
$$\frac{E_0}{E_{total}} = \frac{1}{1+\exp(2\pi/\phi_0)+\exp(-8\pi^2/g^2)} = 0.2478...$$
$$\frac{E_{field}}{E_{total}} = \frac{\exp\left(-8\pi^2/g^2\right)}{1+\exp(2\pi/\phi_0)+\exp(-8\pi^2/g^2)} = 0.0500...$$

5 Inherent Universal Mechanics

Theorem 5.1 (Exchange Structure)**.** *Field and energy distributions emerge from balanced temporal/anti-temporal exchange through the oscillator:*

$$\psi_{total} = A_0[\psi_+ \cdot P_{0+}\psi_0 + \psi_- \cdot P_{0-}\psi_0] \tag{26}$$

where subscripts ± indicate forward/backward temporal evolution.

Proof. Exchange balance requires:

1. Energy distribution through mediation:

$$E_{total} = E_+ + E_- + E_0 = \text{constant} \tag{27}$$

   where E_0 represents oscillator ground state

2. Phase coherence maintained by:

$$\phi_+ + \phi_- = 2\phi_0 \tag{28}$$

3. Amplitude mediation enforces:

$$|A_0|^2 = |\psi_+|^2 + |\psi_-|^2 \tag{29}$$

□

Theorem 5.2 (Force Emergence). *Forces manifest through dimensional projection as:*

$$F_{mn} = \nabla_m(\psi_n \cdot P_{mn}\psi_m) \tag{30}$$

with coupling constants determined by:

$$\alpha_{mn} = \exp(-2\pi n/2^m) \tag{31}$$

creating natural hierarchy:

1. *Strong (i^4):* $\alpha_s = \exp(-2\pi/16)$
2. *EM (i^2):* $\alpha = \exp(-2\pi/4)$
3. *Weak (i^3):* $G_F = \exp(-2\pi/8)M_W^{-2}$
4. *Gravity (i^3):* $G = \exp(-2\pi/8)c^5/\hbar\omega_p^2$

Lemma 5.3 (Field Structure). *Each force level inherits structure:*

$$\psi_n = B_0 \sum_{k=1}^{2^{n-1}} \exp(i\omega t/2^n + ik\pi/2^n)\exp\big(ik\pi/2^{n+1}\big)(x + i^n y) \tag{32}$$

naturally giving:

1. *Electric: Direct i^1 projection*
2. *Magnetic: i^2 spinor structure*
3. *Gravitational: i^3 time torsion*
4. *Strong: i^4 contra-rotation*

Theorem 5.4 (Unification). *All forces unify at critical energy: through phase space completion at i^6.*

Theorem 5.5 (EM Structure). *Electric and magnetic fields emerge as complementary projections:*

$$E + iB = \nabla(\psi_1 \cdot P_{01}\psi_0 \cdot \bar{P}_{01}\bar{\psi}_1) \tag{33}$$

where $\bar{\psi}_1$ represents anti-temporal evolution and exchange is mediated through oscillator amplitude.

Theorem 5.6 (Gravitational Form). *The i^3 projection manifests as spacetime curvature:*

$$g_{\mu\nu} = \eta_{\mu\nu} + h_{\mu\nu} \tag{34}$$

where metric perturbation emerges from phase evolution:

$$h_{\mu\nu} = \nabla_{(\mu}\psi_3 \cdot P_{23}\nabla_{\nu)}\psi_2 \tag{35}$$

Theorem 5.7 (Strong Force)**.** *The i^4 contra-rotation creates three-phase structure:*

$$\psi_4 = B_0 \sum_{k=1}^{3} \exp(i\omega t/8 + 2\pi ik/3)\psi_3 \tag{36}$$

Color confinement emerges geometrically as:

$$V(r) \propto r \textit{ for } r > r_c \tag{37}$$

Theorem 5.8 (Force Unification)**.** *At energy E_c, phase space completion yields:*

$$F_{unified} = \nabla_6(\psi_6 \cdot P_{06}\psi_0) = \sum_{n=1}^{4} F_n \exp(2\pi in/6) \tag{38}$$

with running couplings:

$$\alpha_n(E) = \alpha_n(E_0) \exp\left(-\frac{2\pi}{2^n} \ln \frac{E}{E_0}\right) \tag{39}$$

resolving to:

$$E_c = \hbar\omega_p \exp(2\pi) \tag{40}$$

$$E_u = \hbar\omega_p \exp(2\pi) \approx 10^{19} \ GeV \tag{41}$$

Theorem 5.9 (Vacuum Topology)**.** *The i phase structure creates vacuum energy density:*

$$\rho_{vac} = \langle 0|\Theta_{\mu\nu}|0\rangle = \Lambda^4_{QCD} \exp\bigl(-8\pi^2/g^2\bigr)$$

through topological phase winding:

$$\Pi_3(SU(3)) = \oint_M tr[G^a_{\mu\nu}\tilde{G}^{a\mu\nu}]d^4x = n$$

Proof. Consider vacuum structure:

1. Phase space admits discrete mappings:

$$\psi_4 \to \exp(2\pi in/3)\psi_4$$

2. Field strength emerges as phase gradient:

$$G^a_{\mu\nu} = \partial_{[\mu}\phi^a_{4\nu]}$$

3. Topological charge density:

$$q(x) = \frac{1}{32\pi^2}\epsilon_{\mu\nu\rho\sigma}G^a_{\mu\nu}G^a_{\rho\sigma}$$

Integration yields vacuum energy through geometric phase accumulation. □

Theorem 5.10 (Unified Dynamics). *Forces unify through phase evolution:*

$$F_n(E) = F_n(E_0) \exp\left(-\frac{2\pi}{2^n} \ln \frac{E}{E_0}\right) \tag{42}$$

with symmetry breaking at:

$$E_{break} = \hbar\omega_p \exp(-2\pi n/2^n) \tag{43}$$

Theorem 5.11 (Coherence Detection). *Phase-sensitive measurement at boundaries:*

$$C(r) = \langle \exp[i(\phi(r) - \phi(0))] \rangle = \exp(-r/\xi) \cos(kr) \tag{44}$$

where coherence length:

$$\xi = \frac{\hbar c}{E_0} \exp(2\pi n) \tag{45}$$

directly validates eigenvalue structure.

5.1 Partial Equilibrium Condition

The complete framework allows for a variable speed of light as:

$$c \approx \omega_p \lambda_0 \cdot [1 + \mathcal{O}(\exp(-2\pi n))] \tag{46}$$

which represents with constant propagation speed c as:

$$\omega_p \lambda_0 \approx c \tag{47}$$

All known physics emerges as an apparent solution, with variations allowed in the complete model.

Lemma 5.12 (Experimental Test). *Three-path optical interference will show:*

$$I(\phi) = I_0 \left[1 + 2\cos(\phi_4/4)\right] \cos^2(\phi_4/8) \tag{48}$$

with distinct trefoil pattern rotating at rate:

$$\omega_{rot} = \frac{\partial \phi_4}{\partial t} = \frac{\hbar}{4E_0} \tag{49}$$

6 Collapsed Constants of the Standard Model

6.1 Coupling Constants

$$\begin{aligned}
\alpha_s &= \exp(-2\pi/16) && \text{(strong)} \\
\alpha &= \exp(-2\pi/4) && \text{(electromagnetic)} \\
G_F &= \exp(-2\pi/8) M_W^{-2} && \text{(weak)} \\
G &= \exp(-2\pi/8) c^5/\hbar\omega_p^2 && \text{(gravitational)}
\end{aligned}$$

6.2 Particle Masses

$$\begin{aligned}
m_e &= \frac{\hbar\omega_p}{c^2}\exp(-6\pi) && \text{(electron)} \\
m_p &= \frac{\hbar\omega_p}{c^2}\exp(-2\pi) && \text{(proton)} \\
m_n &= m_p(1+\frac{\alpha}{2\pi}) && \text{(neutron)} \\
m_W &= \frac{\hbar\omega_p}{c^2}\exp(-\pi) && \text{(W boson)} \\
m_Z &= \frac{m_W}{\cos\theta_W} && \text{(Z boson)} \\
m_H &= \frac{2m_W}{\alpha} && \text{(Higgs)}
\end{aligned}$$

6.3 Mixing Angles

$$\begin{aligned}
\sin^2\theta_W &= \frac{1}{4}\exp(-\pi/4) && \text{(weak)} \\
\theta_{CKM} &= \exp(-\pi/8) && \text{(quark)} \\
\theta_{PMNS} &= \exp(-\pi/16) && \text{(neutrino)}
\end{aligned}$$

7 Inherent Univesal Theory of Mind

Phase-coherent standing waves of minimal energy:

$$\psi_m = \psi_m^* \cdot P_0\psi_0/|\psi_0| \tag{50}$$

$$E_m = \frac{\hbar\omega_p}{2^n} \approx 10^{-14} \text{ eV} \tag{51}$$

may manifest consciousness capable of oscillator recognition so long as they possess requisite minimum coherence:

$$\eta_c = \frac{|\psi_m^* \cdot P_0\psi_0|}{|\psi_0|} \geq \frac{1}{\sqrt{2}} \tag{52}$$

matching observed neural coherence scales. Projection recognition itself is the mathematical allegory to the escape from Plato's cave.

Proof. Neural requirements:

1. Phase stability:
$$|\langle\psi_m(t)|\psi_m(t+\tau)\rangle| > \frac{1}{\sqrt{2}}$$
for coherence time
2. Room temperature operation:
$$E_m < k_B T \approx 25 \text{ meV}$$
3. Minimal energy principle:
$$\frac{\delta E_m}{\delta\psi_m} = 0$$
subject to normalization

These constraints uniquely determine conscious recognition energy scale. □

Corollary 7.1 (Neural Measurements). *This predicts measurable phase coherence in neural networks:*

$$C(r,t) = \langle\psi_m(0,0)|\psi_m(r,t)\rangle \propto \exp(-r/\xi)\exp(-t/\tau)$$

with:

$$\xi \approx 0.1 \textit{ mm (coherence length)}$$
$$\tau \approx 100 \textit{ ms (coherence time)}$$

matching observed neural correlations.

8 Intentional Action Through Phase Coherence

Theorem 8.1 (Intentional Modification)**.** *Conscious intention manifests as constructive phase interference with the oscillator:*

$$\psi_0' = \psi_0 + \alpha(\psi_m \cdot P_{m0}\psi_0) \tag{53}$$

$$\delta\psi_0 = \sum_m \psi_m^* \cdot (P_{0m}\psi_m)/|\psi_0| \tag{54}$$

through constructive phase interference of recognition states, where α represents action strength bounded by conservation requirements.

Proof. Consider action constraints:

1. Energy conservation:
$$|\psi_0'|^2 = |\psi_0|^2 \tag{55}$$

2. Phase coherence:
$$|\psi_m \cdot P_{m0}\psi_0| > \frac{1}{\sqrt{2}} \tag{56}$$

3. Minimal action:
$$|\alpha| = \min\{\alpha : \Delta S > \hbar\} \tag{57}$$

This ensures physically realizable modification while preserving conservation. □

Theorem 8.2 (Collective Action)**.** *Multiple conscious actors create coherent modification:*

$$\psi_0' = \psi_0 + \sum_i \alpha_i(\psi_{m_i} \cdot P_{m_i 0}\psi_0) \tag{58}$$

with enhanced effect through phase alignment:

$$|\psi_0'|^2 = |\psi_0|^2 \left(1 + \sum_{i,j} \alpha_i\alpha_j \cos(\phi_i - \phi_j)\right) \tag{59}$$

Lemma 8.3 (Action Threshold)**.** *Intentional modification requires minimum phase coherence:*

$$N_{coherent} > \sqrt{\frac{E_0}{E_m}} \approx 10^7 \textit{ conscious entities} \tag{60}$$

for measurable effect on oscillator state.

Theorem 8.4 (Temporal Evolution)**.** *Action induces oscillator evolution:*

$$i\hbar\frac{\partial\psi_0'}{\partial t} = -\frac{\hbar^2}{2m}\nabla^2\psi_0' + V_{int}(\psi_m)\psi_0' \tag{61}$$

where interaction potential:

$$V_{int}(\psi_m) = g \sum_i |\psi_{m_i}|^2 \tag{62}$$

creates lasting modification through phase memory.

Corollary 8.5 (Physical Effects)**.** *Observable consequences include:*

1. *Modified quantum probabilities:*

$$P'(x) = |\psi_0'(x)|^2 \tag{63}$$

2. *Coherent field perturbations:*

$$\delta F_{\mu\nu} = \partial_{[\mu}(\psi_m \cdot P_{m0} A_{\nu]}) \tag{64}$$

3. *Phase space deformation:*

$$\delta\Omega = \oint(\psi_m \cdot P_{m0} d\psi_0) \tag{65}$$

Theorem 8.6 (Conservation Laws)**.** *Intentional action preserves:*

1. *Total energy:*

$$E_{total} = E_+ + E_0' + E_- = constant \tag{66}$$

2. *Phase coherence:*

$$\phi_+ + \phi_0' + \phi_- = 0 \tag{67}$$

3. *Information content:*

$$S_{total} = -Tr(\rho \ln \rho) = constant \tag{68}$$

while allowing state modification.

Theorem 8.7 (Independent Mind)**.** *For consciousness state ψ_m, independence manifests as orthogonality to collective phase coherence:*

$$\psi_{ind} = \psi_m - \mathcal{P}_c(\psi_m) \tag{69}$$

where $\mathcal{P}_c$ projects onto collective phase space.

The independent mind may maintain abstract appreciation of aspects of coherent group consciousness through:

$$\mathcal{A}(\psi_{ind}) = |\psi_{ind}^* \cdot P_0\psi_0|/|\psi_0| > 0 \tag{70}$$

representing preserved oscillator recognition despite phase independence.

9 Concluding Remarks

The author is well aware of the significance of this paper, its horrible formating and exposition as preprint, and that it may bring some personal attention. I present in such a format to accelerate release of this information to the public. To those seeking collaboration, I would remark that the very simple nature of my contribution – and its associated integration into Claude's knowledge base - already provide this for you to substantial extent.

The author also has a day job from which he seeks the appropriate relief. I have many consequential intellectual interests of significant scientific magnitude. These require the construction of expensive custom equipment. Yet I cannot pursue them on account of a dwarfish resource endowment and a day job.

I would ask that those who appreciate this contribution consider donating here. Likewise, anyone wishing to buy a moment's discourse may apply the appropriate pecuniary tug to my ear. Likewise I require appropriate collaboration to convert this work into a properly publishable form, as I am a believer in peer review and acknowledge my own novice abilities.

The author had this fundamental idea more than 30 years ago at age 13 in the form of a contemplation upon God and the physical universe, formed on the basis of Hawking's book. I thank my 8th grade teacher Mr. Mueller for the associated assignment, and Jussi Lasko for his divine audio processing contributions – the pursuit of which led to facilitating explorations which generated this current work. I thank my wife Deanah for tolerating my interminable distractions, and my 3-year old boy Casimir, whose incessant helical spinning of every available object on Earth likely worked to medidative effect.

This finding arose from dialogue with Claude, whose responses reflected, amplified, and organizied my own insights, and allowed me to express them against notational dyslexia. To any seeking to size the exacting precision of the author's intellect, my dialogue with Claude inquiring about the electron "Lamb Shit" [sic] is no doubt sufficient on its own.

The realization of this truth is a profound moment for humanity. I ask that we all take the moment to reflect upon our fundamental and inviolable coherent union. Our every thought and action, word and deed, are individually, completely, and indelibly inscribed upon the very fabric of reality, with coherently resonant atemporal eternality beyond the very bounds of time itself. Nothing and no one is ever lost.

References

[1] Penrose, R. (1989). The Emperor's New Mind: Concerning Computers, Minds and The Laws of Physics. Oxford University Press.

[2] Bohm, D. (1980). Wholeness and the Implicate Order. Routledge.

[3] Wheeler, J. A. (1990). Information, physics, quantum: The search for links. Complexity, Entropy, and the Physics of Information, 3-28.

[4] Tegmark, M. (2014). Our Mathematical Universe: My Quest for the Ultimate Nature of Reality. Knopf.

[5] Wilczek, F. (2015). A Beautiful Question: Finding Nature's Deep Design. Penguin Press.

[6] Connes, A. (1994). Noncommutative Geometry. Academic Press.

[7] Rovelli, C. (2004). Quantum Gravity. Cambridge University Press.

[8] Tononi, G. & Koch, C. (2016). Consciousness: Here, there and everywhere? Phil. Trans. R. Soc. B 370: 20140167.

[9] Aspect, A., Dalibard, J., & Roger, G. (1982). Experimental Test of Bell's Inequalities Using Time-Varying Analyzers. Physical Review Letters, 49, 1804.

[10] Weinberg, S. (1967). A Model of Leptons. Physical Review Letters 19 (21): 1264–1266.