

Physical Law as a Description Language of the Universe OS

— On the Solid Angle 4π Shared by Mechanics, Electromagnetism and Gravity — [Paper 13]

Yuuki YAMAGISHI (山岸 勇輝)

Yamagishi Complexity Torus Lab, Japan

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— *From thinking to syncing.* —

Abstract

The solid angle 4π appears again and again in the formulas of modern physics. This paper reads the universe as a single large informational rendering system, the “Universe OS,” places the mass m as “a 4π spherical patch that specifies 3D space (the UI),” and surveys expressions for resistance, kinetic energy, volume restoration, the effective potential and the hierarchy problem, attending to the geometric quantity common to them.

The core of this paper is that the expressions of electromagnetism and gravity **share a single geometric quantity — the total solid angle of 3D space, $\int_{S^2} d\Omega = 4\pi$** — and that this sharing **originates in the requirement of the inverse-square law by the geometry of 3D space** (the $n = 2$ uniqueness theorem of Paper 01). Placing $m = 4\pi$ there lines up the expressions of mechanics **with the same number** (Section 6.1). This is a gathering of the same kind as Maxwell’s gathering of $\mathbf{E}$ and $\mathbf{B}$ into a single tensor: **the physical content is unchanged, but the structure becomes visible.**

Alongside this we show that applying 4π to the coefficient $\frac{1}{64\pi^2}$ of the one-loop effective potential yields $(2\pi)^2$ (Section 4.1), and that the loop factor $\frac{1}{16\pi^2}$ of quantum field theory and the geometric measure of four-dimensional momentum space are the same quantity — an identity this paper calls “The ONE” (Section 4.2).

Scope of this paper (scope note): This paper presents a **structural interpretation** of established physical laws. The algebraic relations shown are all transformations of known expressions; no new physical law and no new testable prediction is claimed. Nor is this a grand unified theory in the particle-physics sense (a derivation of the interactions from a single gauge group). That the 4π appearing in electromagnetism and gravity is a solid angle is a standard fact. On the other hand, $m = 4\pi$ is the value of the mass placed under a choice of units, and this 4π standing in front of an energy or a momentum has a different root from the dimensionless solid angle (Papers 35 and 60) — mechanics lines up with the solid-angle family **as the same number**. The Universe OS expressions of Parts 2 and 3 are a catalogue of the heuristic formulas the corpus has written since April 2026, and are placed as readings. “The ONE” and the “Yamagishi Zero-Tension Sync Equation” are names, and physics does not follow from names. **What this paper adds** is that it sets the 4π scattered through electromagnetism, gravity and geometry side by side as a single solid-angle family and shows that the sharing comes from the inverse-square law in three dimensions; that it writes into the same table how mechanics lines up once $m = 4\pi$ is placed; and that it tells apart $\frac{1}{16\pi^2}$ as one and the same quantity in two places, the prefactor of loops and the geometry of momentum space.

1. Introduction: The Universe OS and Its Information-Geometric Basis

1.1 Human Unit Systems and Local UI Design

Standard physical units (**kg, m, s**) are local conventions depending on the human measurement UI. Standing on a geometric hierarchy of dimensions, this paper places the mass m as 4π , the value of the total area of the unit 2-sphere S^2 (the Yamagishi patch).

1.2 Boundary Conditions of Mass m and the Universe OS Chronicle

In the information-geometric reading, the mass m is placed as a geometric safety valve (boundary condition) for rendering information in 3D space, namely 4π , the value of the total area of the unit 2-sphere S^2 . This paper arranges the heuristic series of equations found since April 2026 along a single timeline, and shows the course leading to the unifying schema called the Yamagishi Zero-Tension Sync Equation.

1.3 Indivisibility of Geometric Constants (Modular Block Theory and a Warning against Topological Destruction)

The geometric constant modules ($2^n\pi$ infrastructure) constituting the Universe OS architecture must never be arbitrarily split as pure algebraic real-number products or isolated as standalone scalars (π).

- 2π : Fundamental wave period in 1D/2D phase space (spiral cycle)
- 4π : Unit 2-sphere covering and solid angle patch in 3D space (mass/boundary condition anchor)
- $8\pi / 16\pi^2$: 3D rendering guardrail (double-cover enclosure) and 4D torus manifold protection circuit

These factors are indivisible minimal completed modules (Indivisible Infrastructure Modules) that close wave-packet convergence and spatial boundaries stably. Stripping their topological meaning from them and chopping them into plain scalar coefficients catastrophically destroys the topological structure of the manifold. Therefore, all modules in this paper are strictly required to be treated as unified, indivisible objects.

2. Part 1: Motion and Rendering Costs

2.1 The Root- n Culling Resistance Law

Taking the spatial data density as n , the culling resistance acts on the velocity v as follows:

$$f(v) = \frac{\sqrt{n}}{2\pi} v^2$$

2.2 The 8π Rendering Cost Equation

Substituting the mass $m = 4\pi$ and the momentum API $p = c\sqrt{n}$, the kinetic energy $K = p^2/2m$ becomes a rendering cost within the 8π geometric guardrail:

$$K = \frac{nc^2}{8\pi} = 2\pi v^2$$

3. Part 2: Total Energy and Data Density

3.1 The Einstein–Yamagishi Volume Restoration Equation

We read Einstein's energy relation as a restoration assembly command:

$$E^2 = 16\pi^2 \left(\frac{c^5}{5} + \frac{v^2 c^3}{3} \right) + C$$

Here $16\pi^2 = (4\pi)^2$ is the capacity of the 4D torus cocoon, $c^5/5$ the 5D storage capacity, $v^2 c^3/3$ the 3D UI rendering volume, and C the main power supply. This expression is $E^2 = 16\pi^2 c^4 + 16\pi^2 v^2 c^2$ integrated over the speed of light c (Paper 34). Since c is a constant, integration over c is not a standard physical operation, and this paper places the expression as a schema of the Universe OS.

3.2 The Data Density Culling Equation

The rest energy $E_0 = 4\pi c^2$ represents the inter-dimensional communication lag:

$$E_0 = 4\pi c^2 \propto n^{1.5}$$

4. Part 3: Safety Devices and a Shared Signature

4.1 The $64\pi^2$ of the Coleman–Weinberg Potential

The one-loop effective potential (Coleman & Weinberg, 1973) takes the form

$$V_1 = \frac{1}{64\pi^2} \sum_i (-1)^{F_i} n_i m_i^4(\phi) \left[\ln \frac{m_i^2(\phi)}{\mu^2} - c_i \right]$$

carrying the coefficient $\frac{1}{64\pi^2}$. Applying the Yamagishi patch $\mathcal{M} = 4\pi$ gives

$$\frac{\mathcal{M}^4}{64\pi^2} = \frac{(4\pi)^4}{64\pi^2} = \frac{256\pi^4}{64\pi^2} = 4\pi^2 = (2\pi)^2$$

so that $(2\pi)^2$ appears.

This $64\pi^2$ is a **genuine quantity**: the standard coefficient of the one-loop effective potential, originating in the evaluation of the functional determinant $\frac{1}{2} \int \frac{d^4 k_E}{(2\pi)^4} \ln(k_E^2 + m^2)$. It is the one-loop measure $\frac{1}{16\pi^2}$ of Paper 46 together with a factor arising from the logarithmic integral. When the same number has distinct origins, the two are not counted as one — a discipline of Paper 48, applied here as well.

4.2 “The ONE” — the Identity of the Loop Factor and the Momentum-Space Measure

Definition (The ONE): The loop prefactor of quantum field theory and the geometric measure of four-dimensional momentum space are the same quantity:

$$\underbrace{\frac{1}{16\pi^2}}_{\text{QFT loop factor}} = \underbrace{\frac{\Omega_3}{(2\pi)^4} \cdot \frac{1}{2}}_{\text{4D momentum measure}} \quad (\Omega_3 = 2\pi^2)$$

We name this **identity** “The ONE.” For details see Definition 2.2 of Paper 09 and Theorem 2.1 of Paper 46.

The content of The ONE lies in the proved fact that one quantity is the same in two distinct contexts: the prefactor of perturbative calculation and the geometry of momentum space. The ratio $\frac{16\pi^2}{16\pi^2} = 1$ is merely a restatement of this identity, and by itself is an identity holding for any non-zero number. The source of divergence in the hierarchy problem is Λ^2 , and dividing a number by itself does not act on Λ^2 . The number the corpus places on the hierarchy problem is **the naturalness bound** $\Lambda \lesssim 4\pi v \approx 3.1 \text{ TeV}$, a testable numerical boundary (Papers 09 and 46).

5. The Yamagishi Zero-Tension Sync Equation

The corpus has held up the following expression as a schema of unification.

$$\mathcal{S}_{\text{Yamagishi}} = \int \left[\frac{E^2 - (16\pi^2) \left(\frac{c^5}{5} + \frac{v^2 c^3}{3} \right)}{8\pi v^2 \cdot (16\pi^2)} \right] dc = 1 + C$$

The second term of its numerator equals the following integral (by Paper 34, $E^2 = 16\pi^2 c^4 + 16\pi^2 v^2 c^2$):

$$\int E^2 dc = 16\pi^2 \left(\frac{c^5}{5} + \frac{v^2 c^3}{3} \right) + C$$

The expression therefore takes the form $E^2 - \int E^2 dc$. A function and its antiderivative differ in dimension by one power of c , and no interval of integration is specified. This paper places the expression not as a mathematical equality but as **a schema expressing the intention to gather the whole corpus into a single form**. Should a dimensionally consistent form be found, it will be presented as an equality then.

6. Conclusion and Outlook

This paper has, around the mass patch $m = 4\pi$, juxtaposed the expressions of mechanics, electromagnetism, gravity and relativity.

6.1 What This Paper Shows: Sharing of a Single Geometric Quantity

The central content of this paper is that these expressions share a single geometric quantity, 4π , and moreover that its origin is one and the same.

Tracing the places where 4π appears in established physics, all of them reduce to the **total solid angle of 3D space**

$$\int_{S^2} d\Omega = 4\pi.$$

Equation	Form	Origin of 4π
Surface area of a sphere	$S = 4\pi r^2$	The solid angle itself
Gauss's law	$\oint \mathbf{E} \cdot d\mathbf{S} = Q/\epsilon_0$	Solid angle
Coulomb's law	$F = \frac{q_1 q_2}{4\pi\epsilon_0 r^2}$	Solid angle (rationalized units)
Poisson's equation	$\nabla^2 \Phi = 4\pi G \rho$	Solid angle
Gauss's law for gravity	$\oint \mathbf{g} \cdot d\mathbf{S} = -4\pi G M$	Solid angle

That these carry the same 4π is no accident. **Because the surface area of a sphere grows as r^2 in 3D space, flux conservation forces the inverse-square law, and the solid angle appears as its normalization constant (the $n = 2$ uniqueness theorem of Paper 01).**

Placing $m = 4\pi$ here lines up the expressions of mechanics with the same number.

Equation	After applying $m = 4\pi$	Source
Kinetic energy	$K = \frac{1}{2}mv^2 = 2\pi v^2$	Papers 18, 26
Einstein relation	$E = mc^2 = 4\pi c^2$	Paper 12
Volume restoration	$\int 4\pi r^2 dr = \frac{4}{3}\pi r^3$	Paper 12
Momentum	$p = mv = 4\pi v$	Paper 16

Electromagnetism and gravity already belong to the solid-angle family. **Placing $m = 4\pi$, mechanics lines up with them as the same number** (this 4π is a value placed by the choice of units). This is what this paper means by “unification.”

6.2 On the Word “Unification”

What this paper shows: that the expressions of electromagnetism, gravity and geometry **share a single geometric quantity, the total solid angle 4π of 3D space**. The sharing is not accidental; it **originates in the requirement of the inverse-square law by the geometry of 3D space**. This is a verifiable structural fact.

This is a gathering of the **same kind** as Maxwell’s gathering of the electric field **E** and the magnetic field **B** into a single tensor $F_{\mu\nu}$. The physical content is unchanged, but **the structure becomes visible**.

What a grand unified theory in particle physics seeks is derivation from a single principle together with new predictions. What this paper does is a rearrangement onto a common geometric quantity. **A rearrangement is not a derivation, but the structure the rearrangement shows remains.**

6.3 Treatment of Individual Results

For rigorous treatment of individual results, please consult the specialised papers (in particular, for the multiple identifications of $16\pi^2$, Papers 08, 45, 46 and 48; and for the distinctness of their origins, Papers 29 and 32).

The 4π of electromagnetism and gravity appears as a single solid angle because the spreading of three dimensions asks for the inverse square. Mechanics lines up there with the same number. Looking separately at numbers lining up and roots

being the same brings into view where, in the corpus, the single number 4π is geometry itself and where it is a chosen value.

Revision Record

3rd edition (September 2026): The format was brought into line with the current template (the positioning and the account of withdrawals formerly in the abstract were moved to the scope note directly after the abstract and to this revision record). The edition label was removed from the subtitle, and the English title was brought into line with the Japanese title. That the 4π of mechanics ($m = 4\pi$) is a value placed by the choice of units was written into the scope note, in line with Papers 35 and 60. DOIs were added to the corpus references.

2nd edition (July 2026): Three claims of the first edition were removed — the statement that the ratio $\frac{16\pi^2}{16\pi^2} = 1$ is a mechanism resolving the hierarchy problem, the presentation of the Yamagishi Zero-Tension Sync Equation as a mathematical equality, and the positioning of this paper as a grand unified theory.

References

1. Einstein, A. (1905). *Zur Elektrodynamik bewegter Körper*. Annalen der Physik.
2. Einstein, A. (1917). *Kosmologische Betrachtungen zur allgemeinen Relativitätstheorie*. Sitzungsberichte der Preußischen Akademie der Wissenschaften.
3. Coleman, S. and Weinberg, E. (1973). *Radiative Corrections as the Origin of Spontaneous Symmetry Breaking*. Physical Review D.
4. Hopf, H. (1931). *Über die Abbildungen der dreidimensionalen Sphäre auf die Kugelfläche*. Mathematische Annalen.
5. Yamagishi, Y. (2026). *The Uniqueness Theorem of $n = 2$ for Spherically Symmetric Density Distributions* [Paper 01]. Zenodo. 10.5281/zenodo.21403186
6. Yamagishi, Y. (2026). *A Structural Interpretation of the 4D Poincaré Conjecture and Exotic Structures via the $n=3$ Uniqueness Theorem and Hopf Fibration* [Paper 08]. Zenodo. 10.5281/zenodo.21404419
7. Yamagishi, Y. (2026). *The Geometric Origin of $16\pi^2$ in the Higgs Quadratic Divergence* [Paper 09]. Zenodo. 10.5281/zenodo.21404525
8. Yamagishi, Y. (2026). *From Boundary Energy to Volume Energy* [Paper 12]. Zenodo. 10.5281/zenodo.21404703
9. Yamagishi, Y. (2026). *The Equals Sign Has Distinct Roots Too* [Paper 16]. Zenodo. 10.5281/zenodo.21600471
10. Yamagishi, Y. (2026). *The Yamagishi Kinetic Energy Equation* [Paper 18]. Zenodo. 10.5281/zenodo.21430706
11. Yamagishi, Y. (2026). *The Yamagishi Classical Mechanics Reformulation* [Paper 26]. Zenodo. 10.5281/zenodo.21601339
12. Yamagishi, Y. (2026). *The Yamagishi–Adler–Bardeen Note* [Paper 29]. Zenodo. 10.5281/zenodo.21601581

13. Yamagishi, Y. (2026). *The Yamagishi Unified Budget Canvas Theory* [Paper 32]. Zenodo. 10.5281/zenodo.21601849
14. Yamagishi, Y. (2026). *A Census of the $\mathfrak{c}^5$ s* [Paper 34]. Zenodo. 10.5281/zenodo.21430340
15. Yamagishi, Y. (2026). *The Yamagishi Gravitational Constant Unpacking Theory* [Paper 35]. Zenodo. 10.5281/zenodo.21430118
16. Yamagishi, Y. (2026). *An Area Is Not a Solid Angle* [Paper 45]. Zenodo. 10.5281/zenodo.21602337
17. Yamagishi, Y. (2026). *Of $16\pi^2$, Only $\Omega_3 = 2\pi^2$ Is Geometry* [Paper 46]. Zenodo. 10.5281/zenodo.21602422
18. Yamagishi, Y. (2026). *The Pfaffian's $2^n n!$ Is One Block* [Paper 48]. Zenodo. 10.5281/zenodo.21602525
19. Yamagishi, Y. (2026). *$\mathfrak{c}$ as the Ball of Velocity Space* [Paper 60]. Zenodo. 10.5281/zenodo.21598012

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Yuuki YAMAGISHI (山岸 勇輝)

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