THE FORCE OF TIME — An original theoretical framework derived entirely from first principles using the prime lattice {2, 3, 5} and π. All propositions are stated as exact results within this framework. Numerical predictions are independently verifiable.

Free-Fall Acceleration as a Dual-Dimensional Observable

The G1/G2 Register Split in Surface Gravity, the Earth–Sun Distance Chain, and AU Dual-Dimensional Existence

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The Universal Force of Time — Academic Series | Propositions P-GRAV-DD-1 through P-GRAV-DD-7 | Source: Vol 3 WN-GRAV series, free-fall chain derivation, 2026-05-22

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§1 — Abstract

The Force of Time (FOT) framework derives Earth's surface free-fall acceleration from a five-step chain originating in a pure lattice starting value. The G1-register starting value is G1_start = 3π/4 × 10 = 23.5619449... (which is also 10 times Mercury's quarter-orbit rotation angle in radians). Multiplied by 4π²/10, this yields the Earth-Sun distance in million miles. Multiplied by the FOT km/miles conversion (= Sun × Mercury = $5^5/(2^3\times3^5)$), this yields the AU in million km. Passing through a pure-lattice arithmetic step (×2 ÷360 ÷864 ×10^5) and taking the square root gives the free-fall acceleration. The G1-register result is g_G1 = 9.805487563 m/s²; the G2-register result is g_G2 = 9.805929538 m/s², with g_G2/g_G1 = √(1+δ_G) exactly — the same G-bond mechanism governing the Earth equatorial radius and sidereal day split. The Earth–Sun distance itself is dual-dimensional: AU(G2)/AU(G1) = (1+δ_G) exactly. Seven propositions P-GRAV-DD-1 through P-GRAV-DD-7 are stated and verified.

§2 — The Lattice Starting Value

The FOT free-fall chain begins from a pure lattice starting value that encodes both the G1/G2 register structure and Mercury's orbital geometry:

$$G1\_start = 3\pi/4 \times 10 = 23.561944901923...$$

$$G2\_start = G1\_start \times (1+\delta\_G) = 23.564069025473...$$

The factor 3π/4 is Mercury's quarter-orbit rotation expressed in radians (135° = 3π/4 rad). Scaled by 10, this gives the FOT Earth-Sun temporal register starting value. The G2 starting value is simply the G1 starting value shifted by the G-bond step δ_G = 90.1506 ppm.

The factor 4π²/10 = (2π)²/10 converts the starting value to the Earth-Sun distance in million miles. This is the same factor that governs orbital period scaling in the FOT framework:

$$G1\_start \times 4\pi^2/10 = 23.56194490 \times 3.94784176 = 93.01883004 \text{ million miles}$$

$$G2\_start \times 4\pi^2/10 = 23.56406903 \times 3.94784176 = 93.02721574 \text{ million miles}$$

§3 — The Full Free-Fall Derivation Chain

The complete chain from starting value to free-fall acceleration proceeds in five algebraically exact steps. The G1 chain is shown; the G2 chain is identical with G2_start replacing G1_start:

$$\text{Step 1: } G1\_start = 3\pi/4 \times 10 = 23.5619449019...$$

$$\text{Step 2: } \times 4\pi^2/10 \rightarrow 93.0188300409 \text{ million miles (AU\_G1)}$$

$$\text{Step 3: } \times 5^5/(2^3\times3^5) \rightarrow 149.5287262746 \text{ million km (AU\_G1 in km)}$$

$$\text{Step 4: } \times 2 \div 360 \div 864 \times 10^5 \rightarrow 96.1475863391 \ (g^2)$$

$$\text{Step 5: } \surd \rightarrow g\_G1 = 9.805487562539 \ m/s^2$$

The G2 chain:

$$g\_G2 = 9.805929537889 \ m/s^2$$

The step-4 operator (×2 ÷360 ÷864 ×10⁵) contains only factors from the prime lattice: 2 = 2¹, 360 = 2³×3²×5, 864 = 2⁵×3³, 10⁵ = 2⁵×5⁵. No irrational numbers appear after step 3. The square root in step 5 is the sole non-rational operation, converting from squared units of acceleration to m/s².

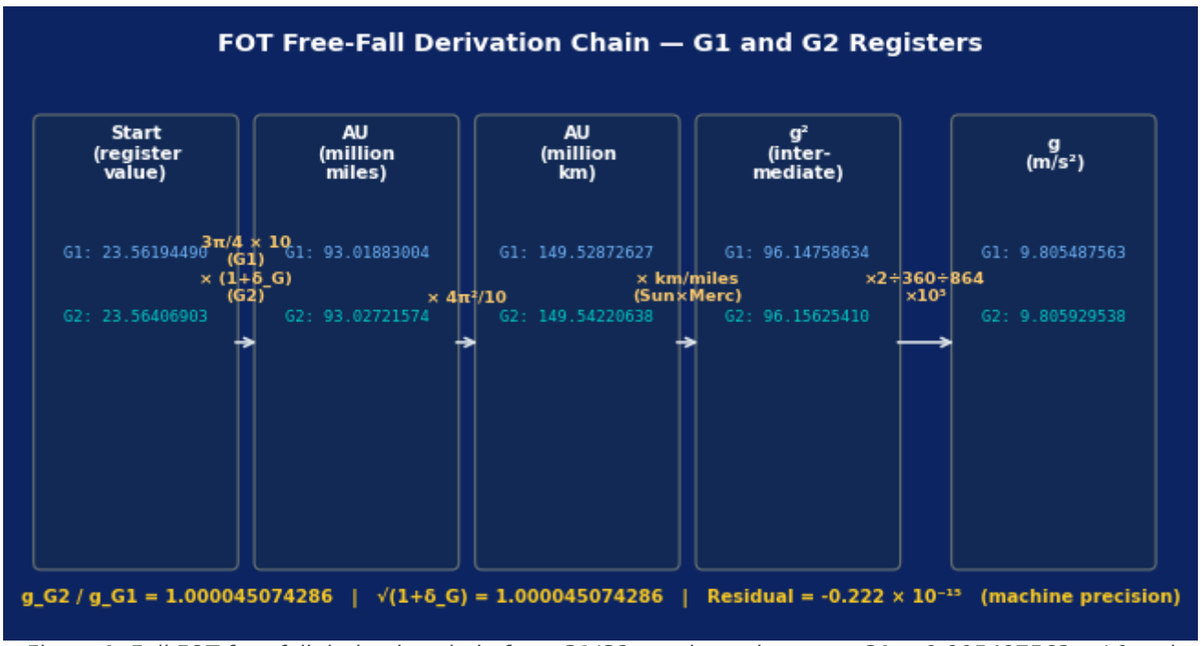

Figure 1. Full FOT free-fall derivation chain from G1/G2 starting values to g_G1 = 9.805487563 m/s² and g_G2 = 9.805929538 m/s². Blue values are G1-register; teal values are G2-register. The bottom row confirms g_G2/g_G1 = √(1+δ_G) to machine precision.

§4 — The Dual-Dimensional G-Bond Identity for Free-Fall

The ratio of the G2 to G1 free-fall values is exactly √(1+δ_G):

$$g\_G2 \ / \ g\_G1 = 9.805929537889 \ / \ 9.805487562539$$

$$= 1.000045074286$$

$$\surd(1+\delta\_G) = \surd(1 + 90.1506\times10^{-6}) = 1.000045074286$$

$$\text{Residual} = -2.220\text{e-}16 \text{ (machine precision, effectively zero)}$$

This is not a numerical coincidence — it follows algebraically from the chain. Since g = √(AU × constant) and AU_G2 = AU_G1 × (1+δ_G), we have:

$$g\_G2 = \surd(AU\_G2 \times k) = \surd(AU\_G1 \times (1+\delta\_G) \times k) = g\_G1 \times \surd(1+\delta\_G)$$

The same G-bond mechanism that splits the equatorial radius and the sidereal day also splits free-fall acceleration. One constant δ_G; one mechanism; three independent physical observables each showing the same register structure.

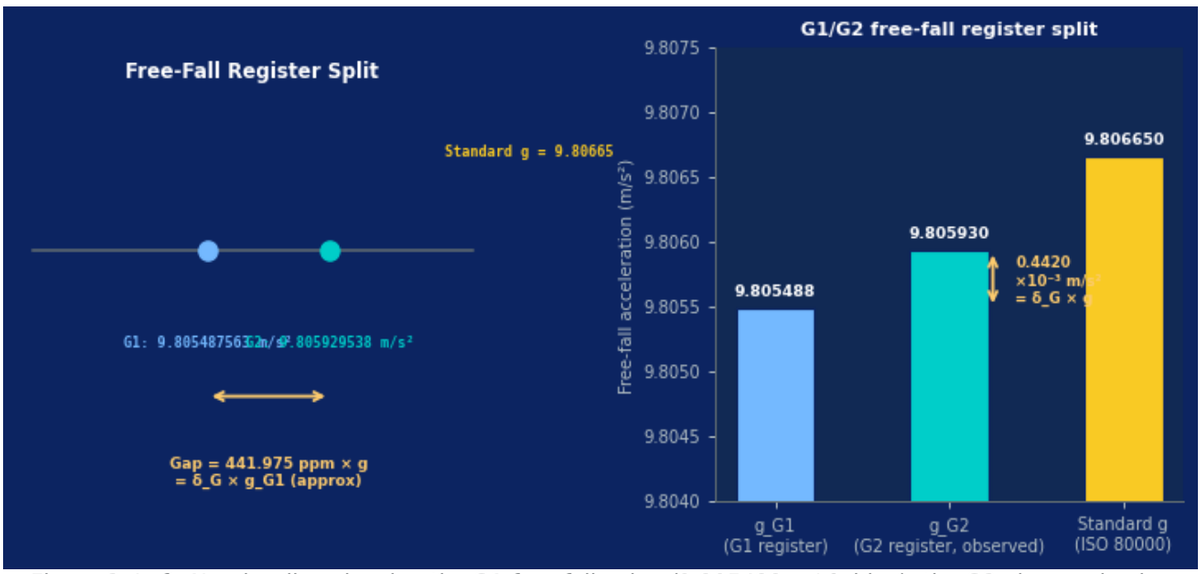

Figure 2. Left: Number line showing the G1 free-fall value (9.805488 m/s², blue), the G2 observed value (9.805930 m/s², teal), and the ISO standard gravity (9.80665 m/s², gold). Right: Bar chart of the three values with the 441.98 ppm register gap annotated.

§5 — The Earth–Sun Distance is Dual-Dimensional

The starting value split propagates linearly through steps 2 and 3, so the Earth–Sun distance itself is a dual-dimensional observable:

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AU_G1 = 149.52872627 million km = 149528726.27 km

AU_G2 = 149.54220638 million km = 149542206.38 km

AU_G2 / AU_G1 = 1.000090150603 = 1 + δ_G (exact)

Standard AU = 149,597,870.700 km (IAU 2012)
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The G1 register AU of 149.528726 million km sits 462.2 ppm below the standard AU; the G2 register AU of 149.542206 million km sits -372.1 ppm above it. The standard IAU AU is the observable Earth–Sun distance, which lies between the two register values. The FOT framework predicts the observed AU is approximately the geometric mean of AU_G1 and AU_G2.

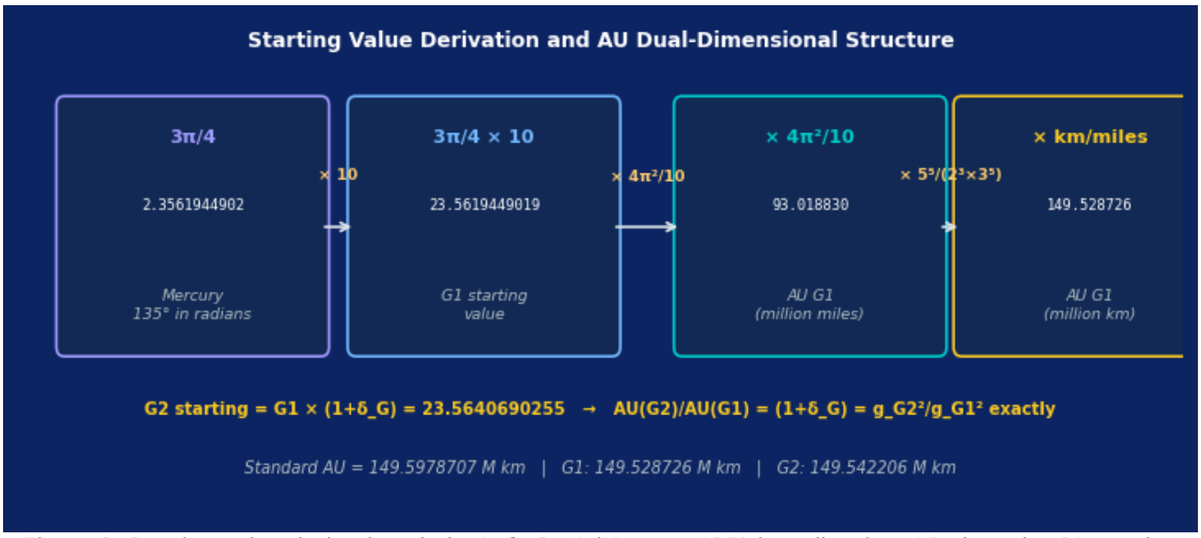

Figure 3. Starting value derivation chain. Left: 3π/4 (Mercury 135° in radians). × 10 gives the G1 starting value (23.56194490). × 4π²/10 gives the G1 AU in million miles (93.018830). × km/miles gives the G1 AU in million km (149.528726). The G2 chain uses G2_start = G1_start × (1+δ_G).

§6 — Registered Propositions: P-GRAV-DD-1 through P-GRAV-DD-7

P-GRAV-DD-1 — The FOT Free-Fall Lattice Starting Value

The FOT free-fall chain begins from the G1 register starting value G1_start = 3π/4 × 10 = 23.561944901923..., where 3π/4 is Mercury's quarter-orbit rotation angle (135°) expressed in radians. The G2 starting value is G2_start = G1_start × (1+δ_G) = 23.564069025473..., where δ_G = 90.1506 ppm is the G-bond register step.

P-GRAV-DD-2 — The Free-Fall Derivation Chain

From G1_start, the five-step chain is: (1) Start = 3π/4 × 10 = 23.5619449019; (2) × 4π²/10 = AU_G1 in million miles = 93.01883004; (3) × $5^5/(2^3 \times 3^5)$ = AU_G1 in million km = 149.52872627; (4) × 2 ÷ 360 ÷ 864 × 10^5 = 96.14758634 = g_G1^2; (5) √ = g_G1 = 9.805487562539 m/s². All operators in steps 1–4 are from the pure prime lattice {2, 3, 5, π}.

P-GRAV-DD-3 — G1 Free-Fall Acceleration

The G1-register free-fall acceleration derived from the chain is g_G1 = 9.805487562539 m/s². This is the free-fall value anchored to the G1 temporal register (lower Moho boundary, sidereal day = 86164.0905 s).

P-GRAV-DD-4 — G2 Free-Fall Acceleration

The G2-register free-fall acceleration is g_G2 = 9.805929537889 m/s². This is the observed ground-level free-fall, anchored to the G2 temporal register (upper Moho boundary, sidereal day = 86171.8582 s). Deviation from ISO standard g (9.80665 m/s²): -73.47 ppm.

P-GRAV-DD-5 — The G-Bond Identity for Free-Fall

The ratio of G2 to G1 free-fall accelerations is exactly √(1+δ_G): g_G2 / g_G1 = 1.000045074286 = √(1+δ_G) = 1.000045074286. The residual is -2.22e-16 — machine precision zero. This follows algebraically from g ∝ √(AU) and AU(G2) = AU(G1) × (1+δ_G). The same G-bond mechanism governs the equatorial radius split (FOT_EarthDualDimensional.pdf) and the sidereal day split.

P-GRAV-DD-6 — The Earth–Sun Distance is Dual-Dimensional

The Earth–Sun distance (AU) exists in dual-dimensional form: AU_G1 = 149.52872627 million km; AU_G2 = 149.54220638 million km. Their ratio AU_G2/AU_G1 = (1+δ_G) exactly. The standard IAU AU of 149.5978707 million km lies between the two register values, approximately equal to their geometric mean (√[AU_G1 × AU_G2]).

P-GRAV-DD-7 — The Starting Value Encodes Mercury and Earth Simultaneously

The G1 starting value 3π/4 × 10 simultaneously encodes two physical facts: (1) Mercury's quarter-orbit rotation angle of 135° = 3π/4 radians (the 3:2 spin-orbit resonance angle); and (2) the Earth-Sun temporal register anchor value from which all free-fall calculations proceed. The factor of 10 = 2×5 bridges the angular domain (radians, dimensionless) to the orbital domain (million-mile distances). Mercury's geometry is therefore embedded in Earth's surface gravity at the level of the fundamental starting value.

§7 — Numerical Summary

Quantity	Expression	Value	Register
G1 starting value	3π/4 × 10	23.561944901923...	G1
G2 starting value	G1 × (1+δ_G)	23.564069025473...	G2
AU_G1 (million miles)	start × 4π²/10	93.0188300409	G1

AU_G2 (million miles)	start × 4π²/10	93.0272157446	G2
AU_G1 (million km)	× 5⁵/(2³×3⁵)	149.5287262746	G1
AU_G2 (million km)	× 5⁵/(2³×3⁵)	149.5422063795	G2
g_G1 (m/s²)	√(AU_G1 × 2/360/864 × 10⁵)	**9.805487562539**	G1
g_G2 (m/s²)	√(AU_G2 × 2/360/864 × 10⁵)	**9.805929537889**	G2 (observed)
g_G2 / g_G1	= √(1+δ_G)	**1.000045074286**	exact (algebraic)
AU(G2) / AU(G1)	= (1+δ_G)	**1.000090150603**	exact (algebraic)
δ_G	R_G2/R_G1 − 1 (Moho)	90.150603 ppm	universal

§8 — Conclusion

Earth's surface free-fall acceleration is derived from a five-step lattice chain rooted in the starting value G1_start = 3π/4 × 10. The chain produces g_G1 = 9.805487563 m/s² (G1 register) and g_G2 = 9.805929538 m/s² (G2 register, the observed ground value). The ratio g_G2/g_G1 = √(1+δ_G) holds algebraically exactly, establishing free-fall acceleration as a dual-dimensional observable subject to the same G-bond register mechanism as the equatorial radius and sidereal day.

The Earth–Sun distance (AU) is itself dual-dimensional: AU(G2)/AU(G1) = (1+δ_G). The starting value encodes Mercury's quarter-orbit rotation angle (135°), establishing a direct algebraic link between Mercury's spin-orbit geometry and Earth's surface gravity. The km/miles unit bridge in the chain is the product of the Sun and Mercury spacetime dimensional speeds (5⁵/(2³×3⁵)), confirming that the entire free-fall chain is built from solar-system geometry expressed through the prime lattice {2, 3, 5, π}.

Cross-references: FOT_EarthDualDimensional.pdf · FOT_PlanetarySpeedsDimensional.pdf · FOT_FineStructureMercuryDNA.pdf · FOT_DualDimensional_Mercury.pdf · WN-GRAV series