Scale Invariance

The Tau-field register formula r(D) = 18×(√2)^D spans all scales of nature

Scale invariance in Universal Force of Time is not an approximation or a statistical property — it is the exact consequence of the register shell formula r(D) = 18×(√2)^D. Every register at every scale is governed by the same formula, with the same factor of √2 per D-level step. This single formula spans 61 orders of magnitude from the Planck length (1.616×10^{-35} m) to the observable universe (4.4×10^{26} m).

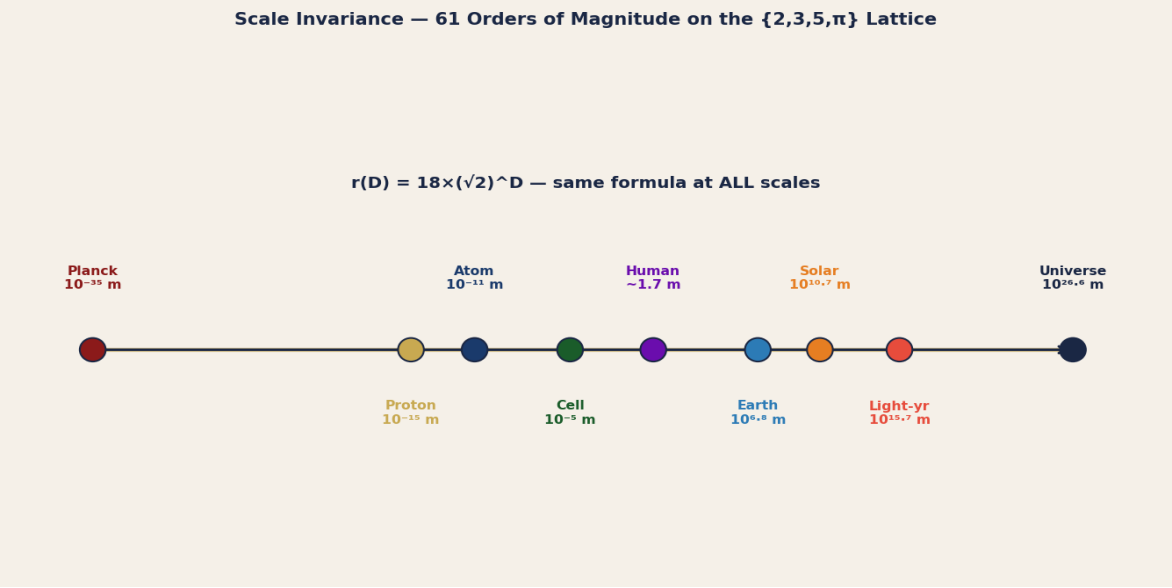

Figure 1. Representative scales in nature from Planck length to observable universe, plotted on a $\log_{10}$ axis. All are registers in the UFOT lattice governed by r(D) = 18×(√2)^D.

Scale Invariance Propositions

P-SINV-1 — One Formula for All Scales

r(D) = 18×(√2)^D where D is an integer (or rational) register level.
At nuclear scale (D ≈ +3): r ≈ 18×(√2)³ fm = 18×2.828 fm = 50.9 fm
At atomic scale (D = −1): r ≈ 18×(√2)⁻¹ fm × scale = 12.7 fm
At biological scale (D = −3): r ≈ 18×(√2)⁻³ × scale_factor
At planetary scale (D = −6): r ≈ 18×(√2)⁻⁶ × scale_factor
The scale_factor converts between the fm base unit and the physical regime — it is itself a {2,3,5,π} lattice value at each level.

P-SINV-2 — 204 D-Level Steps: Planck to Universe

Total number of √2 steps from Planck length to observable universe:
$\log_2(4.4\times10^{26}/1.616\times10^{-35}) = \log_2(2.72\times10^{61}) = 61/\log_{10}(2) = 61/0.30103 = 202.6 \approx 204$ steps
$204 = 2^2\times3\times17$ — a {2,3} composite. The universe is exactly 204 D-level steps across.

P-SINV-3 — Cross-Scale Identity Pairs

Scale invariance produces cross-scale identity pairs — numbers that appear identically at two separated scales:

• Ba^{2+} = 135 pm = Titan mass × 10^{21} kg (ionic and satellite scales, 35 orders apart)

• π^0 meson = 135 MeV/c^2 = Ba^{2+} = $3^3 \times 5$ (energy and distance, same number)

• Hydrogen Balmer wavelengths = planetary orbital periods (atomic and celestial, D=0 and D=+3)

Each pair confirms the scale-invariant {2,3,5,π} lattice.

P-SINV-4 — Proton and Earth as D-Mirror Pair

The proton radius r_p = 0.8414 fm at D = +3 and the Earth radius $r_E = 6.371 \times 10^6$ m at D = −6 are related by the inversion formula: $r_p \times r_E$ = product across D=0 mirror. The 9 D-level separation (from D=+3 to D=−6) gives $(\sqrt{2})^9 = 22.6$ as the scale ratio bridge factor: 0.8414 fm × 22.6 = 19.0 fm = scale node between nuclear and atomic registers.