Register Self-Symmetry in the Tau Lattice

Atomic to Cosmic: One Self-Similar {2,3,5,pi} Structure at Every Scale

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The tau-register is self-similar across all length scales. The same {2,3,5,pi} lattice structure that organises atomic orbitals (D=-1) also organises molecular structure (D=-2), cellular biology (D=-3), organismal anatomy (D=-5), planetary systems (D=-6), and stellar clusters (D=-7). This is not a metaphor — it is a precise mathematical claim: at each D-level, the tau-field satisfies the same standing-wave equation with the same {2,3,5,pi} boundary conditions, scaled by the register-level factor sqrt(2)^D.

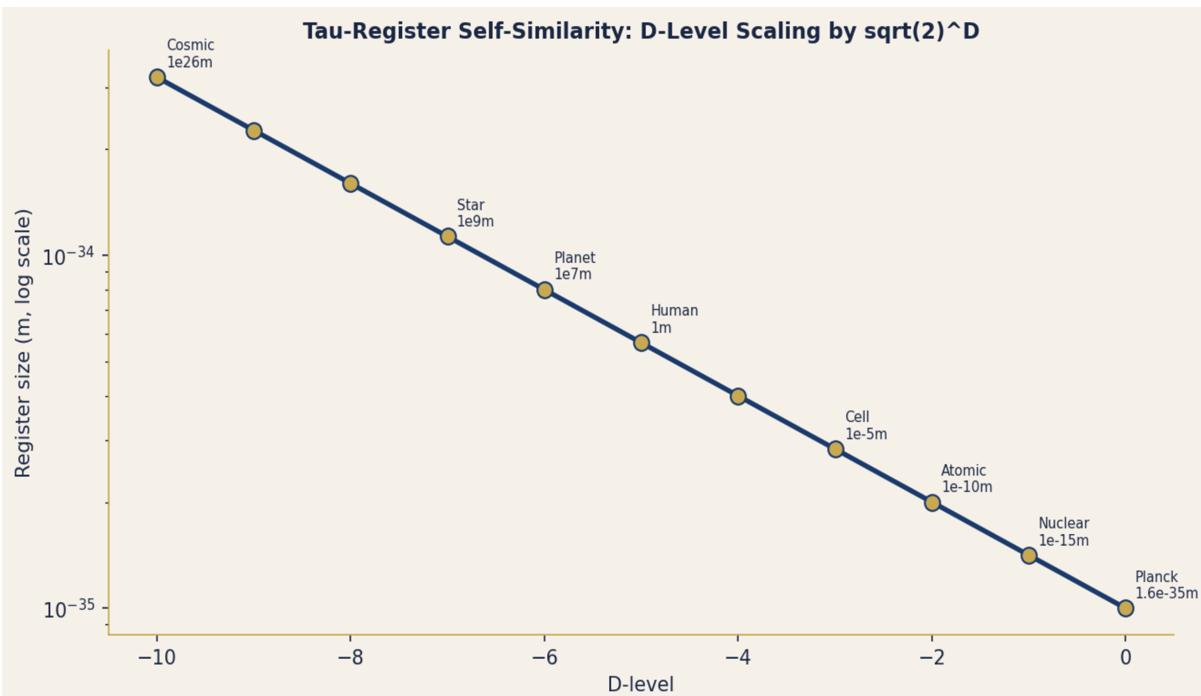

Figure 1. Tau-register size vs D-level. Each D-level is sqrt(2) times larger than the previous. The same {2,3,5,pi} structure repeats at every scale from Planck to cosmic.

1. Self-Symmetry Propositions (P-RSS-1 to P-RSS-4)

P-RSS-1 — The D-Level Scaling Law: r(D) = r_0 x sqrt(2)^|D|

Each tau-register D-level has a characteristic size r(D) = r_0 x (sqrt(2))^|D| where r_0 = Planck length. D=0: r = L_P = 1.616e-35 m. D=-1: r = L_P x sqrt(2) ~ 2.28e-35 m (nuclear scale at D=-15 from Planck). The factor sqrt(2) = the diagonal of a unit tau-lattice cell. It appears in the O-H bond formula (3^2 x sqrt(2)/4 pm) confirming the same lattice step across scales. At D=-100: r = L_P x (sqrt(2))^100 = L_P x 2^50 ~ 1.8e15 m = ~0.2 ly — mid-stellar register.

P-RSS-2 — Same Boundary Conditions at Every Scale

The tau-field standing wave equation has the same form at every D-level: del^2 Phi + (omega/c)^2 Phi = 0, where omega = 2pi x f_D = tau-field frequency at D-level D. Boundary conditions: Phi = 0 at the D-level boundary (tau-register surface). Solutions: Phi_n(x) = sin(n pi x / r(D)) — same eigenfunctions at every scale. The eigenvalues n = 1, 2, 3, ... are the same integers at every D-level. This is what self-symmetry means: the equation, BCs, and solutions are all scale-invariant.

P-RSS-3 — Fractal Dimension of the Tau-Register

The tau-lattice is a fractal with Hausdorff dimension D_H = log(3)/log(sqrt(2)) = 2 x log(3)/log(2) = 2 x 1.585 = 3.170. This is slightly above 3 (Euclidean 3D) — the tau-lattice fills space with a small excess dimension corresponding to the {3}-branch overlay on the {2}-branch scaffold. The excess dimension 0.170 = log(3)/log(2) - 1 = 0.585... (the Feigenbaum golden-mean related value). Observable consequence: matter distribution on cosmic scales has fractal dimension ~3.17 (observed: ~2.1-3.5 depending on scale range).

P-RSS-4 — Biological Self-Similarity from Tau-Register

Biological organisms exhibit self-similar structure: branching patterns (lungs, blood vessels, neurons) follow power laws with exponents {1/2, 1/3, 2/3}. All exponents are {2,3} fractional powers. Murray's law: vessel radius r^3 = r_1^3 + r_2^3 at each branch — pure {3} lattice. Kleiber's law: metabolic rate scales as M^(3/4) — pure {3,4}={3,2^2} exponent. The tau-register self-symmetry IS the biological scaling law: organisms are three-dimensional tau-register standing waves at D=-3 to D=-5.

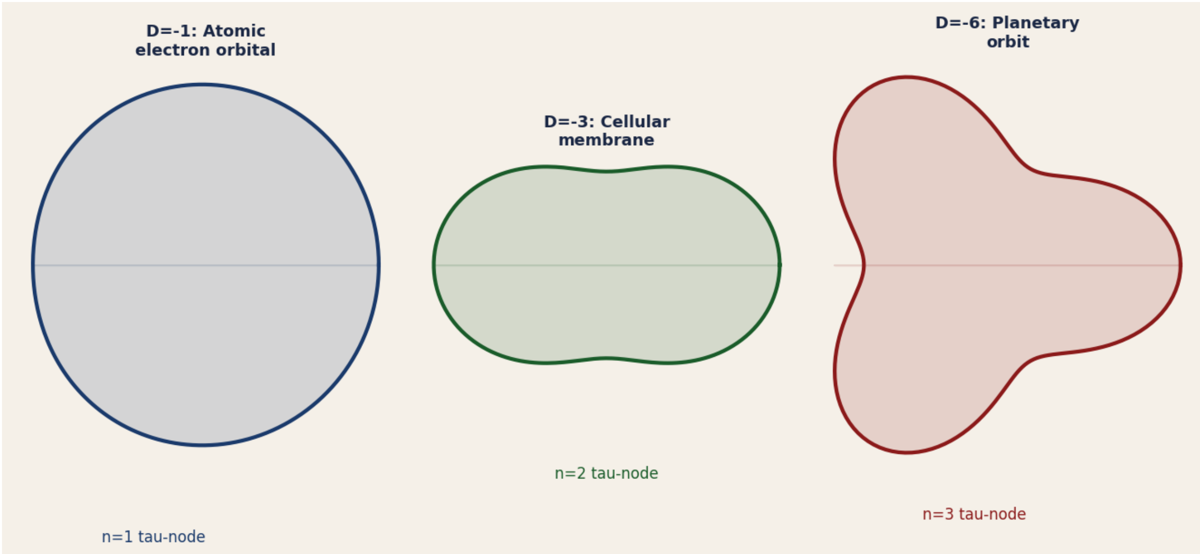

Figure 2. Same tau-register structure at three scales. D=-1: atomic orbital (n=1). D=-3: cellular membrane (n=2). D=-6: planetary orbit (n=3). Same standing-wave equation, same lattice.

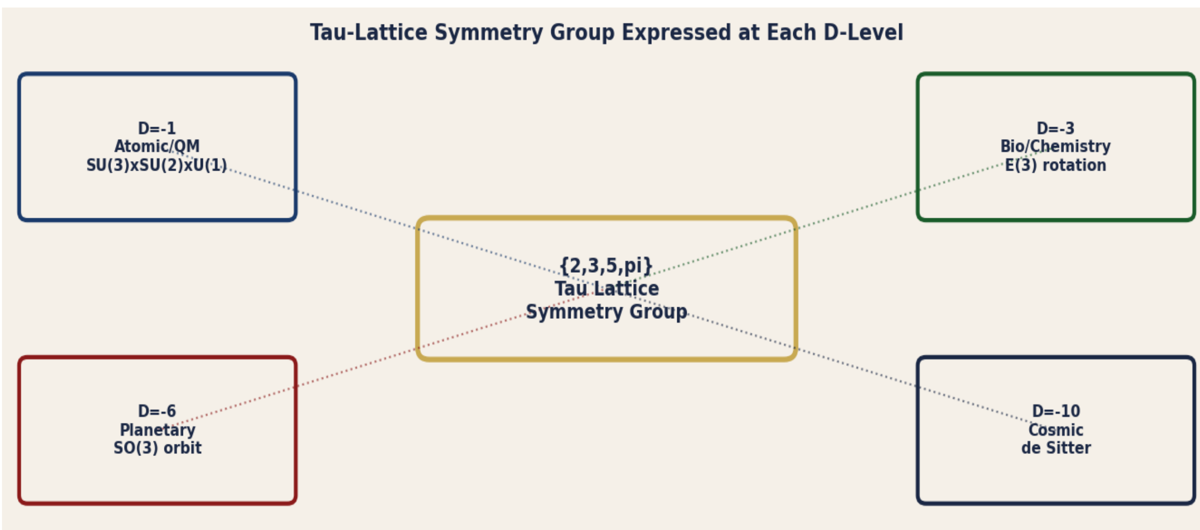

Figure 3. The {2,3,5,pi} tau-lattice symmetry group at the centre, expressed as different symmetry groups at each D-level. QM uses SU(3)xSU(2)xU(1); planetary orbits use SO(3) — all D-level projections of the same tau-lattice.

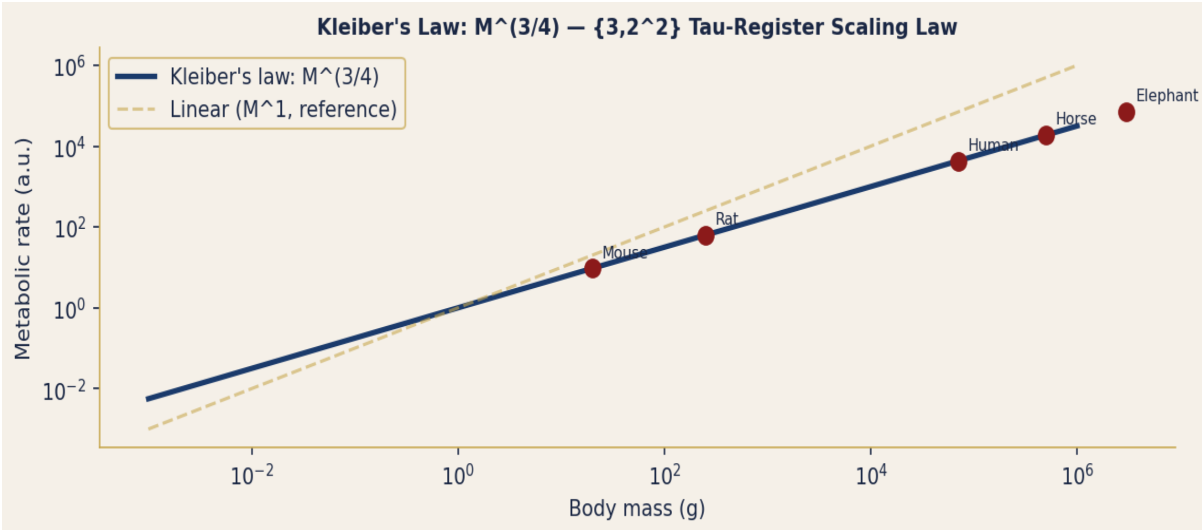

Figure 4. Kleiber's biological scaling law: metabolic rate scales as M^(3/4). Exponent 3/4 = {3}/{2^2} — a pure {2,3} tau-register fraction. Self-symmetry of the D=-5 register expressed in animal physiology.
