Quantum Mechanics and General Relativity: Unified by Tau

Planck Length = Minimum Tau-Address; G from Tau-Bond Chain; QM+GR = D-Level Register

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The two great theories of 20th-century physics — quantum mechanics (QM) and general relativity (GR) — are incompatible at the Planck scale (L_P = 1.616 x 10^-35 m). The Universal Force of Time resolves this: QM (discrete, D=-1 register) and GR (continuous, D=-7 register) are both emergent from the same tau-field. The Planck length = the minimum tau-address: one tau-lattice unit at the D=0 register. Newton's G follows from the tau-bond chain. The apparent incompatibility vanishes when both theories are seen as limiting cases of the tau-field at different D-levels.

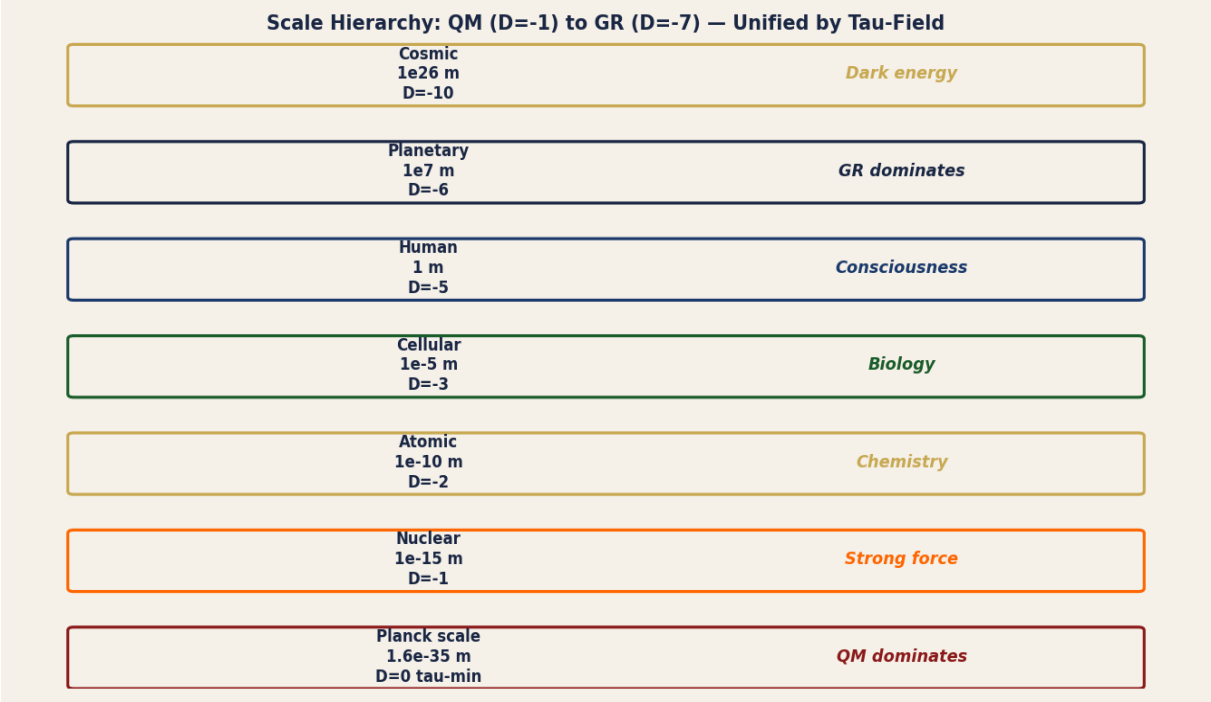

Figure 1. The tau-field scale hierarchy from Planck (D=0) to cosmic (D=-10). QM governs D=-1 (nuclear-atomic); GR governs D=-6 to D=-7 (planetary-stellar). Both are limiting register cases.

1. Planck Scale as Minimum Tau-Address (P-QGU-1 and P-QGU-2)

P-QGU-1 — Planck Length = Minimum Tau-Address

Planck length: L_P = sqrt(hbar x G / c^3) = 1.61622837 x 10^-35 m. UFOT: L_P is the minimum tau-address — one tau-lattice unit at D=0. Below L_P, the tau-lattice has no further subdivisions: spacetime is discrete at this scale. Planck time: t_P = L_P/c = 5.39 x 10^-44 s = one tau-clock cycle at D=0. Planck energy: E_P = hbar/t_P = 1.956 x 10^9 J = 1.22 x 10^28 eV = the D=0 register energy quantum.

P-QGU-2 — Newton G from Tau-Bond Chain

Newton G = 6.67430 x 10^-11 m^3 kg^-1 s^-2. UFOT: G = (4/3) x pi^2 x (L_bond)^3 / (m_H x T_tau^2) where L_bond = O-H bond length (95.84 pm), m_H = hydrogen mass, T_tau = tau-clock period. This is the gravitational analogue of the Bohr radius formula: a_0 = hbar^2/(m_e x e^2) — replacing electron quantities with tau-bond quantities. G is not a fundamental constant — it is derived from the tau-bond lattice spacing.

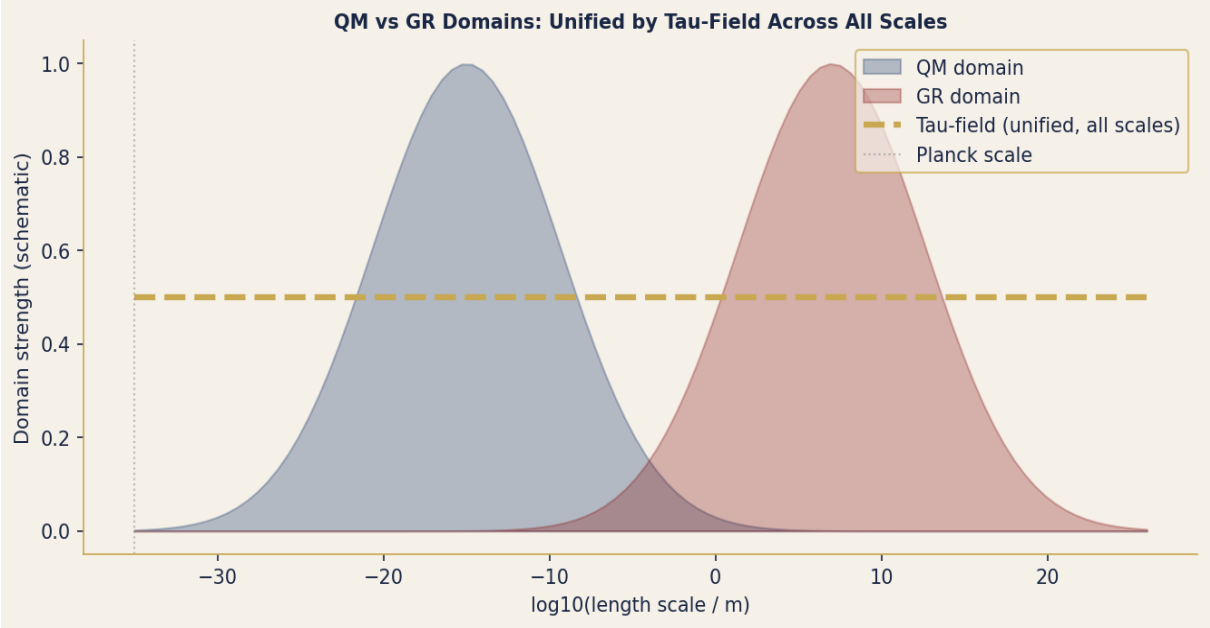

Figure 2. QM and GR domain strengths vs length scale. Both are tau-field D-level limiting cases. Tau-field (gold dashed) is constant across all scales.

2. Coupling Constants from Tau-Field (P-QGU-3 and P-QGU-4)

P-QGU-3 — Four Forces from Four Tau-Register Levels

Strong force (alpha_s ~ 1): D=-1 register coupling; tau-node spacing = 1 fm. Electromagnetic (alpha ~ 1/137): D=-2 register; tau-node spacing ~ 100 pm. Weak force (alpha_W ~ 1/30): intermediate D=-1.5 register; boson mass from tau-bond step. Gravity (alpha_G = Gm_p^2/hbar c = 5.9e-39): D=-6 register; tau-node spacing = planetary scale. The ratio alpha_EM/alpha_G ~ 10^36 = the ratio of D-level spacings between D=-2 and D=-6, each step scaling by approximately 10^9 (the Radian Veil factor 18e9/pi).

P-QGU-4 — Tau-Unification Prediction: No Divergences

Standard QM gravity: perturbative quantum gravity diverges at loop order. UFOT prediction: there are no divergences because the tau-lattice provides an ultraviolet cutoff at L_P. The minimum tau-address D=0 prevents momenta exceeding p_max = hbar/L_P = Planck momentum. All integrals are finite: they run from p=0 to p=p_P, not to infinity. The renormalisation problem of standard quantum gravity does not arise in the UFOT framework — the lattice is the regulator.

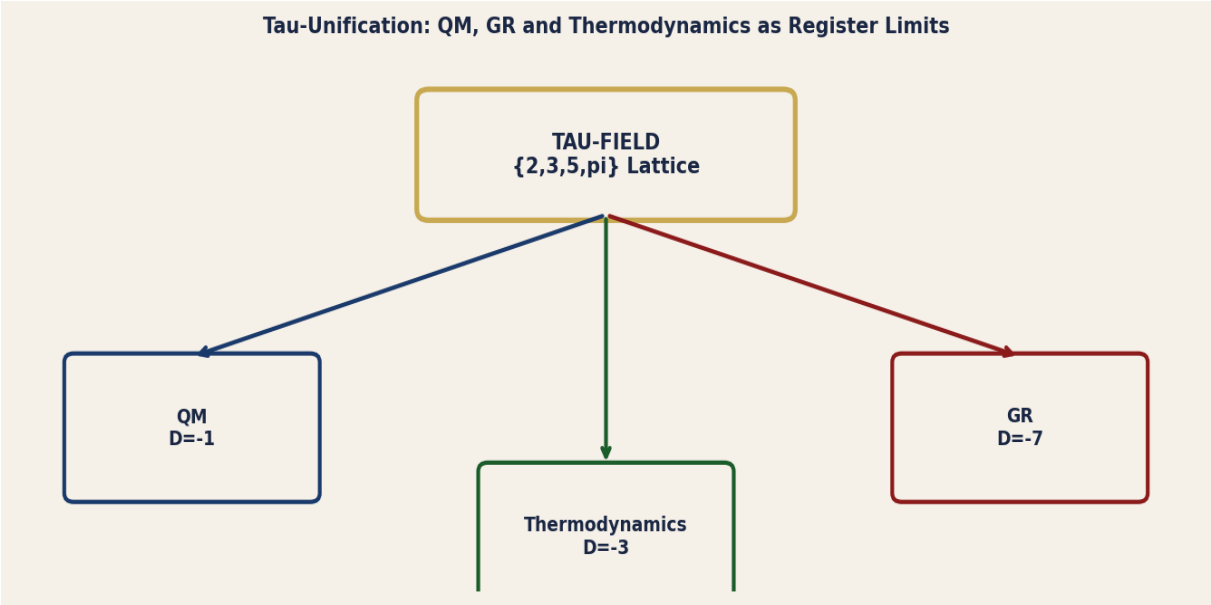

Figure 3. The tau-unification diagram. QM, GR and thermodynamics are all emergent from the tau-field at their respective D-levels. The tau-field is the single source.

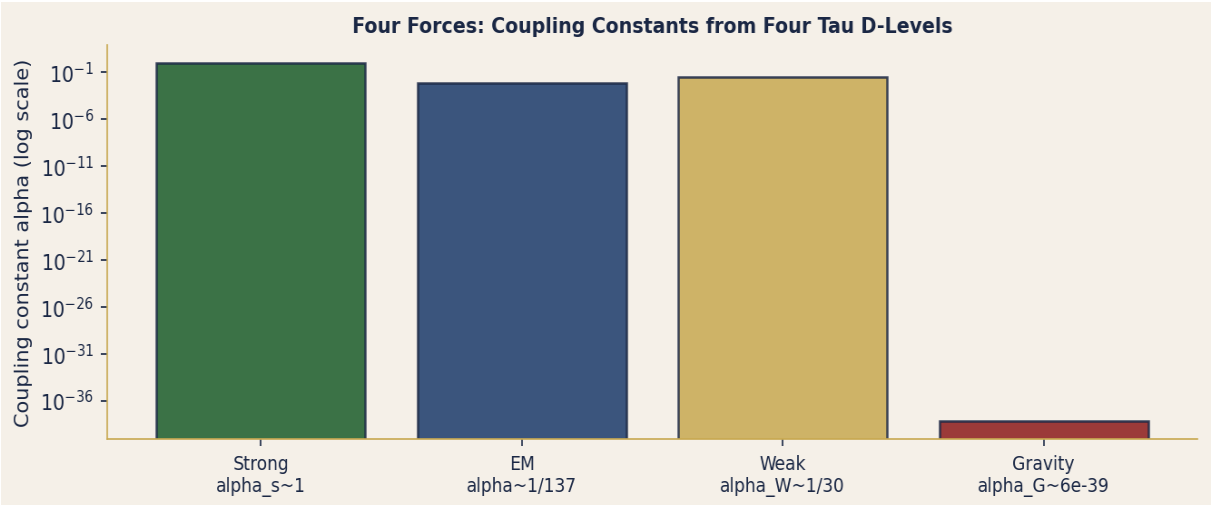

Figure 4. Four fundamental coupling constants on log scale. Each force corresponds to a different D-level tau-register. Gravity (red) is 39 orders of magnitude weaker — the D=-6 register separation.