Readiness Review: The Quark World — Auditing the Octonion Papers Against the Foundation

It Is All One series — companion analysis

July 2026

1. What Was Reviewed

Three documents in StrongForce, all April 2026, all written *before* the foundation existed: **Paper 4** (The Strong Force as Geometric Necessity), **Paper 5 v3** (Neutron Decay as Octonion Algebra), and the working paper **What Happens When You Fire an Electron at a Proton**. They were audited twice: internally (every checkable number recomputed) and against the foundation built since — the Postulates, the family law, the winding quantization, the frame field equations, Matter Meets Space, and the Schrödinger note.

2. The Numerics: Verified

An independent implementation of octonion multiplication reproduces Paper 5's results from its six printed presets and $\Lambda = 310$ MeV alone:

quantity
proton closure angle
neutron closure angle
$\lvert\mathrm{Im}((AB)C)\rvert^2$
spring constant k
n–p mass difference
escape toll (Coulomb route)
proton radius $(4/3)\hbar c/\Lambda$
tunnelling action

The results are real computations, not typography. **One reproducibility flag:** the recomputation used the paper's own Cayley–Dickson rule (Eq. 3), and the *intermediate* product AB does not match Appendix B's printed AB — the appendix was evidently produced with a different seven-triple convention (the "Lazarus" table). The final angles agree because closure angles are invariant under relabeling, but the paper's Eq. (3) and its Appendix B currently contradict each other at the intermediate step. Fix: print the actual triple table used.

3. Paper 4 — The Strong Force as Geometric Necessity

What stands. The Cayley–Dickson architecture (octonion = two nested quaternions), the embedding theorem (electron physics untouched, exactly), the identification of the e_4 scalar as confinement energy (99% of the proton's mass), the 1.47 GeV resolution threshold (consistent with the foundation's ladder door at 1474 MeV — the papers derived it independently before the ladder existed, a genuine convergence), and the reading of SLAC 1968 as "the proton's second quaternion." The alternativity of $\mathbb{O}$ (any two elements generate an associative subalgebra) correctly underlies the claim that non-associativity needs both quaternions active.

One theorem mis-stated — and the correction is a gift. Section 5.2 claims the stabilizer of the spatial quaternion subalgebra $\{1, e_1, e_2, e_3\}$ inside G_2 is $SU(3)$, citing Cartan. That is not the theorem: the stabilizer of a quaternion *subalgebra* in G_2 is $SO(4)$. **$SU(3)$ is the stabilizer of a single imaginary unit** (Baez §4.2; the Günaydin–Gürsey construction). The natural unit to fix is e_4 — the colour scalar, the confinement-energy axis. And here the foundation hands the papers something better than what they lose: the Schrödinger note showed that complex quantum mechanics is the quaternion algebra with one axis nailed down — the shutter e_3 — and the symmetry that survives the nailing is $U(1)$, electromagnetism's phase. The same move, one rung down: nail down the colour shutter e_4 in $\mathrm{Aut}(\mathbb{O}) = G_2$, and what survives is $SU(3)$. **The gauge group of each rung is the stabilizer of that rung's shutter axis.** $U(1)$ for the Compton shutter, $SU(3)$ for the colour shutter, with the weak $SU(2)$ as the (double cover of the) full automorphism group of the quaternion rung itself. The gluon count then needs no hand-waving: $\dim SU(3) = 8$, full stop, with G_2's $14 = 8 + 6$ splitting off the coset. Rewrite §5.2 accordingly; it becomes stronger, not weaker.

One overclaim to soften. Confinement is presented as a theorem; as written it is a compelling *conjecture* resting on an unproven premise (that observability requires associative triple products) and an asserted cancellation (that singlet combinations cancel the cross-couplings — shown by construction for the given states, not in general). Keep the argument, label it honestly, and see §6 below for the route to promoting it.

One dictionary tension. Section 10 assigns quantum numbers to components: charge on e_1, spin on e_2, orbital momentum on e_3. The foundation speaks a different dictionary: energy is the shutter *rate*, spin is the double cover of rotations, charge is the winding of the circle fiber (EM-rung note). Both dictionaries do honest work — the component ledger beautifully organizes the conservation bookkeeping (§10's eight-axis balance and the conjugate-twins theorem are correct and worth keeping) — but a reader of the whole corpus will ask which is the physics. Recommendation: name §10's usage explicitly as the *ledger convention* (components as conserved-charge slots), distinct from the *dynamical convention* (axes as rotation planes), and add one paragraph mapping between them. This is the largest structural edit the descent owes.

Small flags. Gluon momentum fraction is 41% in Paper 4 §9.3 but 46% in the electron–proton paper §6 (with sea quarks absorbed differently); pick one bookkeeping. The seven-

triples table and octonion multiplication table are image-only — print them as text for reproducibility.

4. Paper 5 — Neutron Decay as Octonion Algebra

What stands. The closure angle is well-defined (the equality of the two imaginary magnitudes follows from the composition-algebra norm — verified exactly), the tetrahedral reading of proton (1.1° under) versus neutron (6.5° over) is arresting, and the headline numbers reproduce. Most striking on audit: the paper's decomposition — bare difference 2.51 MeV, geometric relaxation 1.31 MeV, electromagnetic toll 1.22 MeV carrying the *only* factor of α in the paper — structurally mirrors the lattice-QCD decomposition of the n–p difference (strong-isospin ≈ +2.5 MeV, QED ≈ −1.0 MeV; BMW 2015). The framework put α exactly where QED sits. That parallel deserves a sentence in the paper; it is currently invisible.

Input honesty. "Five inputs, five outputs" needs restating. The audit shows $e_0(u)\cdot\Lambda = 2.16$ MeV and $e_0(d)\cdot\Lambda = 4.67$ MeV — precisely the PDG current quark masses. So the presets *are* experimental inputs (m_u, m_d, M_p via Λ, plus the calibrated e_4 colour splitting), and the honest claim — still remarkable — is: **given the measured quark masses and the proton mass, the geometry splits the 2.51 MeV bare difference into 1.31 observed + 1.22 toll using only angles on S^7**, and independently produces the proton radius to 0.9%.

Flags, in order of weight. (i) The effective-charge factor $\theta\_tet/\theta\_p = 1.0103$ in the toll formula is asserted, not derived; without it the toll is 1.206 MeV, with it 1.218 — the 0.1% match to 1.217 rests entirely on an underived 1% factor. Derive it or quote the honest 1% agreement. (ii) The funnel potential $V(\theta) = -A/\sin^5\theta + B/\sin^2\theta$ is attributed to "sectional curvature of S^7" without derivation — the descent owes this calculation (the frame field equations note now provides the machinery: Cartan forms on S^7 with G_2 connection). (iii) The WKB action $S = 4\sqrt{(\Lambda k)} = 1024$ carries units of MeV, not ħ — dimensionally inconsistent as printed; the conclusion (absolute confinement) likely survives, the formula does not. (iv) The two toll routes (2.510 − 1.305 = 1.205 vs Coulomb 1.218) differ by 1% and the text glosses the gap. (v) The eight-axis conservation table asserts the antineutrino's entries without printing them; print the full ledger.

The W boson: reconcile, don't banish. Paper 5 says "no W needed." The foundation says the weak interaction is the curvature of the tightly wound weak space — door 80.4 GeV = $\hbar c/R\_W$, virtual-W as the *leak through the weak seal*. These are compatible, and the reconciliation sharpens both: Paper 5 computes the **energetics** of the decay (statics — mass difference, toll), which indeed never need an 80 GeV object. What Paper 5 does *not* compute is the **rate**: the neutron lives 879 seconds, and that enormous slowness is the weak seal's permeability — $G\_F \propto 1/M\_W^2$ in standard language, $e^{(-r/R\_W)}$ in the foundation's. The W is not banished; it is the door price of the rung where the flavour flip happens. **The neutron lifetime from seal permeability is the next stunning calculation this rung owes** — it would complete the paper: geometry for the energies, the seal for the clock.

5. The Electron–Proton Working Paper

Kinematics spot-checked and correct throughout (wavelengths, pion threshold 145 MeV, √s values, the DIS event at x = 0.487). It is the best pedagogical document in the corpus and needs only three touches: the pion-multiplicity formula contradicts its own output (0.5·ln(9.76) = 1.1, asserted "5–6"); the 46% vs 41% gluon bookkeeping (see §3); and the stray "ℏc" typography for ħc.

6. The Structural Question the Descent Must Answer

Every rung of the ladder so far seals exponentially: metric D's lapse, the hydrogen wavefunction, the Yukawa skin — all e^(−r/R), all *leaky* (Flimmer, tunnelling, virtual-W). The colour rung inverts the pattern: the force *grows* with distance (κ ≈ 0.9 GeV/fm), the funnel is bottomless, confinement is absolute. Why does the deepest rung confine instead of seal? The papers contain the candidate answer without stating it: **every leak mechanism in the ladder is an associative propagation — and the colour rung is the only non-associative one. A seal leaks by letting an amplitude walk out; a non-associative amplitude cannot walk out, because its value depends on the grouping of every step.** If that can be made precise (the promotion route for the confinement conjecture of §3), then absolute confinement is not an exception to the seal law but its limiting case: **a seal of zero permeability**, with S ≈ 10^3 as its quantitative face. This is the theorem the quark world owes the foundation.

Also owed to the family law: the colour rung already sits on the line (kT = 158 MeV at R = 0.2 fm — the QCD crossover, audited in the metrics note). New rows from this review: the S^7 radius 0.6365 fm sits at kT ≈ 50 MeV, and the proton radius at kT ≈ 38 MeV — unassigned; either they mean something (pion cloud? Λ_QCD/2π?) or they are honest blanks in the table.

7. The Descent Programme, In Order

(i) Paper 4 v5: correct the stabilizer theorem (SU(3) = Stab(e_4), the colour shutter), install the stabilizer-ladder unification, clean the gluon count. **(ii)** Add the dictionary-reconciliation paragraph (ledger convention vs dynamical convention) to Papers 4 and 5. **(iii)** Paper 5 v4: input-honesty restatement, print the antineutrino ledger and the triple table actually used, flag the Q_eff factor, fix the WKB dimensions, add the lattice-QCD structural parallel. **(iv)** Reconcile with Matter Meets Space: the W as weak-seal door; then compute the **neutron lifetime** from seal permeability — the rung's next great target. **(v)** Derive V(θ) from S^7 curvature with the frame-equation machinery. **(vi)** The zero-permeability-seal theorem (confinement from non-associativity of leaks). **(vii)** Extend the frame field equation to the octonion rung: G_2 connection, S^7 fiber — the field equation of the strong force. **(viii)** The three-generations question (ℂ, ℍ, 𝕆 stacked — Furey's territory) stays deferred but is now visibly adjacent.

8. Verdict

Ready. The papers were written before the foundation and yet agree with it where they overlap (the 1474 MeV door, the T_c audit, the confinement-energy scalar); the disagreements found are repairable and in two cases (the stabilizer correction, the W reconciliation) the repair *strengthens* the framework. The quark world is not virgin territory — it is a settlement awaiting connection to the capital. Items (i)–(iii) are editorial and should come first; items (iv)–(vii) are the physics of the descent.