Internal Memo: Mass–Spectrum Reproducibility

Analytic Ablations and Paper Interlocks

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Purpose

This memo frames the reproducibility issue the referees will press on (the analytic ablations), and it assigns which of the four support notes should be embedded into which of the three mass papers, with a short justification for each. The goal is that any reviewer can *audit the ablations* and *see, in situ*, that we do not have hidden knobs, that the equality is gauge–clean, and that the pipeline is pinned.

Support Notes:

1. Recognition Architecture (Integrated)
2. Executive Summary
3. Global Co-Identity Constraint ("Light–Unity")
4. Θ–phase note

The Issue in One Paragraph

At the universal anchor $\mu_\star$, the mass residue is claimed to collapse to a closed form in one integer Z, with equal–Z degeneracy and exact anchor ratios. This stands or falls on a *reproducible* pipeline and on *specific* ablation counterfactuals. Three surgical ablations must **fail** decisively:

(i) remove the quark +4 block,
(ii) drop the Q^4 term, and
(iii) replace the integerization $6Q$ by $5Q$ (or $3Q$).

Those counterfactuals break the anchor equality well beyond 10^{-6} and destroy equal–Z families; showing that, where it belongs, resolves the chief reproducibility concern. The pinned pipeline and non–circular audit posture live in the Standard–Model paper, and the ablation proofs live in the constructor paper.

What Each Support Note Contributes

(1) Recognition Architecture (Integrated) (`1.tex`) A one–page, layered map: *Reality bridge* ⇒ *Constants/anchor* ⇒ *Discrete constructor* ⇒ *Masses*. It gives reviewers the *order of dependence* and the falsifiers at each layer (no per–species knobs, one anchor, fixed coherence energy, etc.). This belongs up front once, so that the three mass papers read as a *coherent system* rather than three unrelated claims.

(2) Executive Summary (`executive_summary.tex`) A compact statement of scope, audit posture, invariants, and pass/fail gates. It primes the ablation story in 10–15 lines and advertises the pinned evaluator. It should sit where reviewers expect to see *what will be checked*.

(3) Global Co–Identity Constraint ("Light–Unity") (`light--unity.tex`) A short principle: one global unity/gauge aligns the constants layer and forbids hidden per–sector shifts. It locks the interpretation of any sector offset as *global gauge*, not as a tweakable parameter. That defuses a standard objection ("maybe you tuned a sector phase").

(4) Θ–phase note (`theta.tex`) A 2–page technical clarification: the single–anchor residue identity and equal–Z consequences are Θ*–invariant*. Stated plainly: introducing the natural global φ–phase does not change any number, but it makes explicit that there is exactly one global gauge and zero species–level freedom.

Where to Place Them, and Why

Mass Paper 1 — *Single Anchor / Constants Layer*

Embed (1) and (3) here.

- Place the *Recognition Architecture* map (1) in the Introduction, right after the opening paragraph. That gives the reader the dependency chain: units/bridge → $(\mu_\star, E_{\mathrm{coh}})$ → residues → spectra. It also lists the falsifiers at each layer.
- Place a trimmed *Light–Unity* principle (3) in Methods (end of the constants/anchor subsection). Its job is to declare and close the only allowed gauge freedom at the constants layer (one global unity), so there is no ambiguity left for sector–dependent offsets later.
- Cross–reference forward: "The anchor is *used* but not tuned in the mass papers; the pinned RG pipeline and audit posture are stated in the Standard–Model mass paper," with an explicit pointer.

Mass Paper 2 — *Standard–Model Masses (Pipeline, Audit Posture)*

Embed (2) and cite the constructor for ablations.

- Put the *Executive Summary* (2) as a boxed preface in the Introduction or as the first paragraph of Methods. Keep it short: scope, one anchor, one evaluator, non–circular transport, CI tolerance,

and the exact ablations that must fail. This is where we state the *rules of the game* and the audit gates in one place.

- In the Methods (RG kernels and policies), repeat the *non–circularity rule* and the *pinned variants*, then point the reader to the constructor paper for the ablation failures (remove +4, drop Q^4, $6Q \to 5Q, 3Q$). The SM paper should *summarize the outcomes* and link where the proofs live, not duplicate them.
- Pull one sentence from (3) Light–Unity only if a referee asks whether sector offsets are extra freedom. Otherwise keep (3) out of Paper 2 to avoid philosophical drift; Paper 2 is the "plumbing" document (what runs, how it's pinned, what passes/fails).

Mass Paper 3 — *Ribbons & Braids (Constructor and Ablations)*

Embed (4) and explicitly show the ablation failures here.

- Add the Θ*–phase* note (4) as a short subsection in Methods ("Normalization and gauge"), or as a 1–page appendix. It states and proves that the anchor equality and equal–Z degeneracy are invariant under the single global phase. That eliminates "hidden gauge" as an alternative explanation for the success of the integer Z form.
- Keep all three ablations *here*, next to the main equality, with their pass/fail status: removing the quark +4 block, dropping Q^4, and replacing $6Q$ by $5Q$ or $3Q$ *fail decisively* ($\max |f - \mathcal{F}| \gg 10^{-6}$; equal–$Z$ broken). This is the canonical spot reviewers will look.
- In the Introduction, one line may cite (3) Light–Unity as context ("global unity fixes the only gauge"), but the heavy lifting is (4) here.

Pass/Fail Gate

What a referee should be able to do, instantly:

- Find the **pinned evaluator** and non–circular transport statement in the SM paper (Paper 2). It lists kernels/policies, thresholds, and the strict tolerance (e.g., 10^{-6}) used uniformly for both the audit side and the prediction side.
- See the **anchor equality** and **equal–Z degeneracy** stated and verified in the constructor paper (Paper 3), with the **three ablations** right next to it, each clearly failing.
- See the **units bridge** and **single–inequality** audit available (two independent unit routes that must agree within combined uncertainty), establishing that the constants/anchor layer is welded shut. Leave that as a short reference in Paper 1; no duplication in the mass papers.

Tone and Economy (Editorial Guidance)

Keep the support notes tight when embedding:

- **Paper 1 (constants/anchor):** 1 page total from (1)+(3). One figure is optional; no tables.

- **Paper 2 (SM masses):** 8–12 lines from (2), plus one compact paragraph in Methods reminding the pinned variants and CI tolerance. No ablation details here beyond a pointer.
- **Paper 3 (constructor):** 0.5–1.0 page from (4), then the ablation *text* right where the main equality is shown. Avoid tables if possible; short prose plus numbers is fine.

Why This Resolves the Reproducibility Worry

Because it squares the triangle:

1. **Pinned pipeline (SM paper):** anyone can follow the same route from PDG inputs to $\mu_\star$ under identical policies, then check $f_i(\mu_\star)$ vs. $\mathcal{F}(Z)$ with a published tolerance. No per–species knobs appear anywhere.
2. **Specificity (constructor paper):** the three analytic ablations each *fail*, so the success cannot be attributed to a generic reparameterization. The +4 block, the Q^4 term, and the integerization $6Q$ are not optional decorations; they are necessary. Equal–Z degeneracy serves as a second check.
3. **Gauge–clean constants layer (constants paper):** one global unity/gauge and a two–route units audit remove any suspicion of stealth parameters upstream.

Minimal Insertion Text

Into Paper 2 (first page)

> *Scope and audit posture.* We fix a single anchor $\mu_\star$ and a single evaluator (QCD/QED loop orders and threshold policy) that is used identically for audit transport and for predictions. There are no per–species parameters or sector–specific knobs. The equality at $\mu_\star$ is checked at a strict tolerance; ablation counterfactuals (remove quark +4, drop Q^4, replace $6Q$ by $5Q$ or $3Q$) fail decisively, as shown in the constructor companion.

Into Paper 3 (Methods, one paragraph)

> *Global gauge (Θ) and normalization.* The single–anchor residue identity and equal–Z consequences are invariant under a single global φ–phase Θ. This removes any sector–dependent phase freedom; offsets are gauge, not parameters. The ablations presented below therefore test the *specificity* of the Z form itself, not an arbitrary gauge choice.

Into Paper 1 (end of constants/anchor section)

> *Unity constraint.* One global unity fixes the constants layer and forbids hidden sector phases. A two–route unit audit (time–first vs. length–first) with a single inequality closes the constants gate; downstream mass results therefore cannot be re–tuned by shifting units or phases.

Assignment Summary:

- Paper 1 (constants/anchor): include **(1) Recognition Architecture** and **(3) Light–Unity**.
- Paper 2 (SM masses): include **(2) Executive Summary**.
- Paper 3 (constructor): include **(4) Θ–phase note** and keep the **three ablations** adjacent to the main equality.

Housekeeping. Keep notation aligned with the mass papers: φ, $\mu_\star$, E_{coh}, r_i, $Z = 4+(6Q)^2+(6Q)^4$ (quarks), $Z = (6Q)^2 + (6Q)^4$ (charged leptons). Avoid tables; prefer short prose with the actual numbers where needed.

BLOCKER: none on substance. If journal page limits force trimming, shorten (1) in Paper 1 to a *single* layered diagram caption, and keep (4) in Paper 3 as an appendix.