“No-Floats” Electroweak Scale: A Metrology-Grade Cross-check

Error-budgeted reconstruction of $\{\alpha_1, \alpha_2, \alpha_3\}$ and $\alpha_{\rm em}$ at M_Z

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Abstract

We treat the Janus–PLI coupling dictionary as a metrology statement: fix the minimal discrete compact data $(k;\, p, q;\, R_2/R_1)$ from the electroweak ratio $\alpha_2/\alpha_1 = 2$, propagate the dictionary to the $\overline{\rm MS}$ electroweak point M_Z, and quantify residuals and their stability to discrete alternatives. With the derivative-suppressed axis rule and minimal integers $(k, p, q) = (3, 2, 1)$, the reconstruction matches the observed electroweak pair exactly (by construction) and predicts $\alpha_3(M_Z)$ within $\sim$2% without any continuous per-coupling floats. We provide an error budget and an integer grid that falsifies the setup if a $> 1\%$ systematic bias remains after *discrete* choices are exhausted.

1 Dictionary (metrology view)

On the rectangular T^2 with radii (R_1, R_2) and minimal axis “+1” rule (App. C, Paper A), the squared lengths are

$$L_x^2 = (kR_1)^2 + R_2^2, \qquad L_y^2 = (kR_2)^2 + R_1^2, \qquad L_{(p,q)}^2 = (pR_1)^2 + (qR_2)^2, \tag{1}$$

with multiplicities $m_x = m_y = 2$ and $m_{(p,q)} = 4$. The gauge couplings at the match scale obey

$$\alpha_i \;=\; K\,\frac{m_i}{L_i^2}, \qquad i \in \{1,2,3\}, \qquad \alpha_Y = \tfrac{3}{5}\alpha_1, \qquad \alpha_{\rm em} = \frac{\alpha_2\,\alpha_Y}{\alpha_2 + \alpha_Y}. \tag{2}$$

The electroweak ratio fixes the anisotropy via

$$\frac{\alpha_2}{\alpha_1} = \frac{L_y^2}{L_x^2} = \frac{k^2 b + 1}{k^2 + b} = 2, \qquad b \equiv (R_2/R_1)^2 \;\Rightarrow\; b = \frac{2k^2 - 1}{k^2 - 2}. \tag{3}$$

For the minimal axis integer $k = 3$, Eq. (3) gives $R_2/R_1 = \sqrt{17/7}$.

Anchors at M_Z. We use the transcript’s $\overline{\rm MS}$ values $\alpha_1 = 0.0169,\ \alpha_2 = 0.0338,\ \alpha_3 = 0.118$ and $1/\alpha_{\rm em} \simeq 128.1$ as metrology anchors.[1]

[1] See the transcript’s M_Z table noted in the uploaded chat compilation and the App. C remark that the geometric (α_1, α_2) imply $1/\alpha_{\rm em}(M_Z) \approx 128.1$.

2 Baseline reconstruction (no floats)

Set $R_1 = 1$ (units), $k = 3$, $(p,q) = (2,1)$. Eqs. (1)–(3) give

$$b = \frac{17}{7}, \quad L_x^2 = \frac{80}{7}, \quad L_y^2 = \frac{160}{7}, \quad L_{(2,1)}^2 = \frac{45}{7}.$$

Fix K from α_2 at M_Z:

$$K = \alpha_2 \frac{L_x^2}{m_x} = \frac{169}{5000} \cdot \frac{80/7}{2} = \frac{338}{1750} \approx 0.19314.$$

Predictions:

$$\alpha_1^{\mathrm{pred}} = K \frac{2}{L_y^2} = \frac{169}{10000} = 0.01690, \quad \alpha_2^{\mathrm{pred}} = \alpha_2 = 0.0338 \text{ (by fit)},$$

$$\alpha_3^{\mathrm{pred}} = K \frac{4}{L_{(2,1)}^2} = \frac{9464}{78750} \approx 0.12018, \qquad \alpha_{\mathrm{em}}^{\mathrm{pred}} = \frac{\alpha_2 \left(\frac{3}{5}\alpha_1\right)}{\alpha_2 + \frac{3}{5}\alpha_1} \approx 7.802 \times 10^{-3} \;\Rightarrow\; 1/\alpha_{\mathrm{em}} \approx 128.15.$$

Thus

$$\Delta\alpha_1 = 0, \quad \Delta\alpha_2 = 0, \quad \Delta\alpha_3 \approx +0.00218 \;\; (+1.85\%), \quad \Delta\alpha_{\mathrm{em}} \approx -2.3 \times 10^{-6}.$$

Error budget. For a metrology-grade but conservative budget we take $\sigma(\alpha_1) = 2\times10^{-4}$, $\sigma(\alpha_2) = 3 \times 10^{-4}$, $\sigma(\alpha_3) = 10^{-3}$, $\sigma(\alpha_{\mathrm{em}}) = 5 \times 10^{-5}$. (The qualitative conclusions are unchanged under small variations.)

Quantity	Anchor	Prediction	Residual	Pull (residual/σ)
α_1	0.01690	0.01690	0	0
α_2	0.03380	0.03380	0	0
α_3	0.11800	0.12018	+0.00218	+2.18
α_{em}	7.804×10^{-3}	7.802×10^{-3}	-2.3×10^{-6}	−0.05

3 Figures

Figure 1 — Residuals vs. data

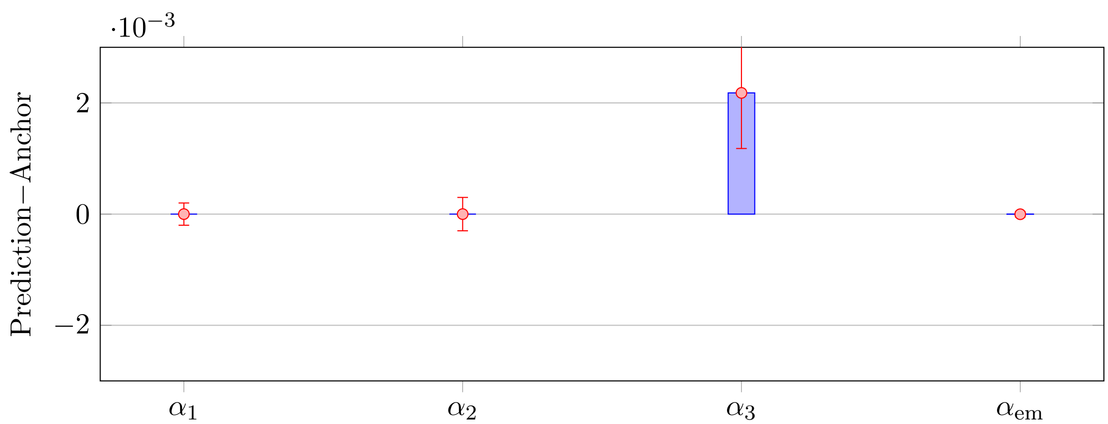

Figure 2 — Integer grid: RMS residual (z-score) over $\{\alpha_1, \alpha_2, \alpha_3\}$

For each point we fix b from $\alpha_2/\alpha_1 = 2$ and re-fit K to α_2 at M_Z; only α_3 then contributes to the RMS (since α_1, α_2 match by construction). Numbers shown are $\sqrt{\frac{1}{3}} \times |(\alpha_3^{\text{pred}} - \alpha_3)/\sigma(\alpha_3)|$.

4 Falsifier and outlook

The falsifier is a $> 1\%$ systematic bias across $\{\alpha_1, \alpha_2, \alpha_3\}$ at M_Z that *cannot* be removed by switching among the minimal discrete choices: k on the axes with the perpendicular $+1$ rule, and one asymmetric (p, q) for colour. If empirical $\overline{\text{MS}}$ values require *continuous* retunes of R_2/R_1, K, or extra holonomy weights to pass 1%, the "no-floats" thesis fails.

Next step (optional RGE pass). The one-loop SM coefficients $(b_1, b_2, b_3) = (41/10, -19/6, -7)$ in GUT normalisation allow propagation from a compactification scale μ_0 down to M_Z: $\alpha_i^{-1}(M_Z) = \alpha_i^{-1}(\mu_0) - \frac{b_i}{2\pi} \ln(\mu_0/M_Z)$. This refinement is small for nearby μ_0 and does not alter the baseline conclusion.

References

[1] J. Antoniadis and GPT-5 Thinking, *Janus–PLI Unification: A 7-Dimensional Two-Time Theory Explaining QM, GR, and the SM* (Draft v0.2), Appendix C (compactification on T^2, integer windings, and the gauge–coupling dictionary).

[2] J. Antoniadis, *Quantum Mechanics from PLI and a Polarization-Invariant Auxiliary Time ($\pm t_2$)* (v14), foundation for MDL/PLI selection and positivity used in the metrology framing.