RS Force–Ladder Tilt for $\cos\theta_W(\mu)$ (No Empirical Inputs)

Internal Note — Recognition Science

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Goal. Provide a parameter–free, monotone map for the weak mixing angle $\cos\theta_W(\mu)$ used by the internal Z/W anchor, derived solely from the ledger gap series and the RS recognition energy. This removes all empirical low–energy inputs from the tilt curve while preserving the Z/W consistency identity that fixes the absolute unit s.

Construction. Let $\varphi = \frac{1+\sqrt{5}}{2}$ and $g_m = \dfrac{(-1)^{m+1}}{m\,\varphi^m}$. Define the recognition length $\lambda_{\rm rec} = \sqrt{\hbar G/(\pi c^3)}$ and $E_{\rm rec} = \hbar c/\lambda_{\rm rec}$. For a physical scale μ (GeV), set

$$x(\mu) \;=\; \frac{\ln\!\big((\mu\,\mathrm{GeV}) \times 10^9\,\mathrm{eV/GeV}\,/\,E_{\rm rec}\big)}{2\,\ln\varphi}\,.$$

Define complementary ladder proxies via a smoothed alternating sum

$$a_Y(x) \;=\; \sum_{m\geq 1} g_m\,\tanh\!\Big(\frac{x}{m}\Big), \qquad a_2(x) \;=\; \sum_{m\geq 1} g_m\,\tanh\!\Big(-\frac{x}{m}\Big),$$

and map them to positive quantities $\hat\alpha_1 = e^{a_Y}$ and $\hat\alpha_2 = e^{a_2}$. Using the GUT group factor $g'^2 = \frac{3}{5}g_1^2$, we set

$$\boxed{\cos\theta_W^{\rm RS}(\mu) \;=\; \frac{\sqrt{\hat\alpha_2(\mu)}}{\sqrt{\frac{3}{5}\,\hat\alpha_1(\mu) + \hat\alpha_2(\mu)}}}\,.$$

This map is smooth, monotone on the relevant interval (tens–hundreds of GeV), and contains no empirical inputs.

Use in the anchor. The internal Z/W anchor solves

$$F(\mu) \;=\; \frac{m_Z^{(\varphi)}}{m_W^{(\varphi)}}\,\cos\theta_W^{\rm RS}(\mu) \;-\; 1 \;=\; 0\,, \qquad s \;=\; \frac{\mu_\star}{m_W^{(\varphi)}}\,.$$

With $m_W^{(\varphi)}$ and $m_Z^{(\varphi)}$ the *dimensionless* ladder outputs, this determines the global absolute unit s internally. All sector absolutes follow as $m_i = s\,m_i^{(\varphi)}$.

Remarks.

- The tanh smoothing implements a stable, scale–equivariant interpolation across ladder steps, with rapid convergence from the harmonic–geometric decay of $|g_m|$.

- The recognition energy E_{rec} provides a natural RS reference; reporting s/E_{rec} yields a dimensionless bridge constant.
- A full force–invariants derivation can replace the proxy exponents a_Y, a_2; the present form is a minimal, parameter–free realization consistent with the ledger structure.