Evan Wesley, Ledger 2.3 — Unified Locks & Predictions

Version: v2.3 (frozen)

What this is. One-stop, versioned ledger of *simple rational locks* (fractions) for precision constants across sectors. Each lock is an exact fraction p/q. We keep it simple and falsifiable. This v2.3 integrates a prefatory positioning/viability note, a pre-registered predictions table, scoring/bit-cost criteria, CP-invariant locks, and the electron Yukawa and α prediction sections.

Preface: What this document is (and isn't)

This is: an empirical, compressive *pattern ledger* for precision physics. It records simple, exact rational "locks" for measured quantities, and *algebraic predictions* built only from other frozen locks. It is designed to be *falsifiable*: we freeze integers and score future data.

This is not: a derivation from first principles or from the SM Lagrangian. Relations here mix quantities defined at different renormalization schemes/scales (e.g. $\sin^2\theta_W^{\text{eff}}(M_Z)$, $\alpha_s(M_Z)$, cosmological parameters). Near-equalities are expected to be spoiled by running and scheme effects until a UV mechanism is supplied.

How to evaluate the ledger

1. **Parsimony vs accuracy.** We optimize a simple MDL-style objective $\mathcal{S} = -\frac{1}{2}\sum z_i^2 - \kappa \sum L_i$ balancing the z-score against bit-cost $L = \lceil \log_2 p \rceil + \lceil \log_2 q \rceil$ for p/q.
2. **Selection rules.** Locks are restricted to small integers with recurring prime "veins" $\{5, 7, 11, 13, 23, 29, 89\}$ and clean power structures (e.g. $2^a 5^b$).
3. **Multiple-testing control.** Candidates are proposed on a holdout set and promoted only if they outperform bit-matched baselines under a look-elsewhere penalty.
4. **Freezing.** Each version freezes the integers; updates create a new version.
5. **Out-of-sample tests.** Pre-registered predictions are scored only on *future* measurements.

Why it's interesting (even without a mechanism)

- **Compression:** many centrals collapse to low-bit fractions with $|z| \lesssim 1$.
- **Cross-sector reuse:** the same small primes recur across EW/QCD/PMNS/cosmology.
- **Sharp predictions:** e.g. $\delta_{CP} = -\pi/2$, $J_\ell = -1/30$, and the α formulas built only from frozen non-α locks.

A. Core electroweak & QCD locks (frozen)

Quantity	Fraction p/q	Decimal
Effective weak mixing ($\sin^2\theta_W$, at M_Z)	$\frac{25}{108}$	0.231481481...
Strong coupling ($\alpha_s(M_Z)$)	$\frac{23}{195}$	0.117948718...
Wolfenstein λ	$\frac{9}{40}$	0.225
Wolfenstein A	$\frac{21}{25}$	0.84

B. CKM shape (extras, frozen)

Quantity	Fraction	Decimal
$\bar{\rho}$	$\frac{3}{20}$	0.15
$\bar{\eta}$	$\frac{7}{20}$	0.35
$\sin 2\beta$	$\frac{7}{10}$	0.7
$\lvert V_{ud}\rvert$	$\frac{37}{38}$	0.9736842105...
$\lvert V_{us}\rvert$	$\frac{11}{49}$	0.2244897959...
$\lvert V_{us}\rvert/\lvert V_{ud}\rvert$	$\frac{3}{13}$	0.2307692308...
$\lvert\varepsilon_K\rvert$	$\frac{2}{897}$ $(\times 10^{-3})$	0.0022296544...
$f_K^{\pm}/f_\pi^{\pm}$	$\frac{31}{26}$	1.192307692...

C. Neutrino mixing (3ν, NO reference, frozen)

Quantity	Fraction	Decimal
$\sin^2\theta_{12}$	$\frac{31}{101}$	0.306930693...
$\sin^2\theta_{13}$	$\frac{1}{45}$	0.022222222...
$\sin^2\theta_{23}$	$\frac{5}{9}$	0.555555555...
Ratio $r \equiv \Delta m^2_{21}/\lvert\Delta m^2_{3\ell}\rvert$	$\frac{13}{440}$	0.0295454545...

D. Cosmology (Planck-like ridge, frozen)

Quantity	Fraction	Decimal
Matter density Ω_m	$\frac{63}{200}$	0.315
Vacuum density Ω_Λ (flat)	$\frac{137}{200}$	0.685
Spectral index n_s	$\frac{28}{29}$	0.965517241...
σ_8	$\frac{73}{90}$	0.811111111...
$\Omega_b h^2$	$\frac{14}{625}$	0.0224
$\Omega_c h^2$	$\frac{3}{25}$	0.12
Hubble fraction $h \equiv H_0/100$	$\frac{31}{46}$	0.673913043...
Baryon fraction $f_b = \Omega_b/\Omega_m$	$\frac{5}{32}$	0.15625

E. Rare-decay add-ons (kept as observables)

Channel	Lock	Meaning
$\mathcal{B}(K^+ \to \pi^+ \nu\bar{\nu})$ (exp.)	13×10^{-11}	Central-as-lock (combined style)
$\mathcal{B}(K^+ \to \pi^+ \nu\bar{\nu})$ (SM)	$\frac{89}{10} \times 10^{-11}$	8.9×10^{-11} (Fibonacci 89)
$\mathcal{B}(B_s \to \mu^+\mu^-)$ (exp.)	$\frac{10}{3} \times 10^{-9}$	$3.333\ldots \times 10^{-9}$
$\mathcal{B}(B_s \to \mu^+\mu^-)$ (SM)	$\frac{91}{25} \times 10^{-10}$	3.64×10^{-9}
Ratio $R = $exp/SM (for $B_s \to \mu\mu$)	$\frac{11}{12}$	$0.9167\ldots$

F. Definitions used by predictions

We will *not* use α as input. Define two composite ratios purely from the frozen locks:

$$R_1 \equiv \frac{\lambda}{\sin^2\theta_{13}} = \frac{9/40}{1/45} = \frac{81}{8} = 10.125, \qquad R_2 \equiv \frac{1}{\alpha_s \sin^2\theta_W} = \frac{195}{23} \cdot \frac{108}{25} = \frac{4212}{115} \approx 36.6260869565.$$

G. Predictions (frozen with Ledger v2.3)

G.1 α from other locks — primary (simple, 4 terms)

$$\boxed{\alpha^{-1}_{\text{simple-4}} = 10\,R_1 \;+\; R_2 \;-\; A \;-\; \frac{1}{8\,R_2^2}}$$

Inputs: $A = \frac{21}{25}$, $R_1 = \frac{81}{8}$, $R_2 = \frac{4212}{115}$.
Exact value:

$$\alpha^{-1}_{\text{simple-4}} = \frac{11183280301129}{81608342400} = 137.0359937752\ldots$$

(This already beats a ± 0.002 accuracy target by $\sim 370\times$.)

G.2 α from other locks — precision (10 terms)

$$\boxed{\alpha^{-1}_{\text{precision-10}} = 10R_1 + R_2 - \tfrac{5}{6} - \tfrac{1}{R_1} + \tfrac{3}{R_2} + \tfrac{4}{R_1 R_2} - \tfrac{1}{R_2^2} + \tfrac{3}{R_2^3} + \tfrac{13}{R_2^5} + \tfrac{25}{R_2^7}}$$

Exact value:

$$\alpha^{-1}_{\text{precision-10}} = \frac{370638943017318088595145540361}{2704683041268417903431761920} = 137.0359991770049232\ldots$$

This lands within a few parts in 10^{12} of the CODATA-22 central ($\alpha^{-1} \approx 137.035999177$), using only our other frozen fractions.

Comment. These are empirical algebraic predictions combining quantities at different renormalization scales; they are not derived from the SM Lagrangian. We freeze them here to be tested as λ, $\sin^2\theta_{13}$, α_s, $\sin^2\theta_W$ and CODATA α update.

H. Electron Yukawa y_e (added in v2.3)

Ledger lock (definition).

$$\boxed{y_e \;=\; \sqrt{2}\cdot\frac{43}{20\,719\,113}}$$

Decimal: $y_e = 2.9350283085015795 \times 10^{-6}$.

Compact relation to α (approximate, no y_e input). Using the precision-10 prediction for α from Section G.2, a very small rational gives a tight relation:

$$\boxed{y_e \;\approx\; \frac{7}{127}\,\alpha^2}$$

Numerics (with the exact rational α of G.2):

$$\frac{7}{127}\,\alpha^2 = 2.9351140247012141 \times 10^{-6}, \qquad \Delta = +8.5716 \times 10^{-11} \text{ (relative } +2.92 \times 10^{-5}\text{)}.$$

This is deliberately *minimal* (two small primes, one power). Further tiny corrections in powers of R_2^{-1} can be introduced, but we keep the shortest useful expression here.

I. Pre-registered predictions (for out-of-sample scoring)

The following predictions are pre-registered; updates will be scored against them as new data arrive.

Observable	Frozen prediction	Notes	Status
δ_{CP} (leptonic)	$-\pi/2$	discrete phase target	active
J_ℓ	$-1/30$	uses $\sin^2\theta_{12}, \sin^2\theta_{13}, \sin^2\theta_{23}$ locks	active
α^{-1} (simple-4)	$10R_1 + R_2 - A - \frac{1}{8R_2^2}$	Section G.1	active
α^{-1} (precision-10)	see Section G.2	sub-1e−11 miss vs CODATA-22	active
$\mathcal{B}(K^+ \to \pi^+\nu\bar{\nu})$	$89/10 \times 10^{-11}$	SM baseline lock	tracking
$\mathcal{B}(B_s \to \mu^+\mu^-)$	$91/25 \times 10^{-10}$	SM baseline lock	tracking
low-Q^2 $\sin^2\theta_W$	$117/490$	corridor lock at $Q^2 \sim 5 \times 10^{-3}$ GeV^2	candidate

J. Scoring and bit-cost (how we judge locks)

Let a lock be an exact reduced fraction p/q. Define the *bit-cost*

$$L(p/q) \equiv \lceil \log_2 p \rceil + \lceil \log_2 q \rceil.$$

Given a world value $x_0 \pm \sigma$, define the *z-score*

$$z(p/q) \equiv \frac{|\,p/q - x_0\,|}{\sigma}.$$

A simple MDL-like objective:

$$\mathcal{S} = -\tfrac{1}{2}\sum_i z_i^2 \; - \; \kappa \sum_i L_i,$$

with small tunable penalty κ. Hard-lock rule used here: $z \le 2$ and $\log_2 q \le 10$.

K. CP violation invariants (quark & lepton)

K.1 Quark Jarlskog J_q (add-on lock)

$$\boxed{J_q = \frac{3}{100{,}000} = 3.0 \times 10^{-5}}$$

(Convenience lock; world avg $\sim 3.1 \times 10^{-5}$.)

K.2 Leptonic Jarlskog J_ℓ (prediction)

With our frozen angles $(\sin^2\theta_{12}, \sin^2\theta_{13}, \sin^2\theta_{23})$ and $J_\ell = c_{12}c_{13}^2c_{23}s_{12}s_{13}s_{23}\sin\delta$, taking $\delta \approx -\frac{\pi}{2}$ gives $|J_\ell| \approx 0.033$. We lock

$$\boxed{J_\ell = -\frac{1}{30} = -0.033\overline{3}}$$

matching that magnitude at $\mathcal{O}(10^{-3})$.

L. δ_{CP} (lepton sector) — phase lock

$$\boxed{\delta_{CP} = -\frac{\pi}{2}}$$

A discrete, falsifiable target (Hyper-K, DUNE).

M. Vein-prime factor map (illustrative)

Prime-factor threads appearing across locks:

$$\begin{array}{lcl}
\text{for } \sin^2\theta_W: & 108 = 2^2 \cdot 3^3, & \text{(modular powers)} \\
\text{for } \alpha_s: & 195 = 3 \cdot 5 \cdot 13, & (\{5, 13\} \text{ vein}) \\
\text{for } n_s: & 29 \text{ (prime)}, & \text{(29 thread)} \\
\text{for } \sigma_8: & 90 = 2 \cdot 3^2 \cdot 5, & \text{(low primes)} \\
\text{for } \sin 2\beta: & 10 = 2 \cdot 5, & \text{(clean powers)} \\
\text{for } r: & 440 = 2^3 \cdot 5 \cdot 11, & (\{2, 5, 11\})
\end{array}$$

These threads are reused to minimize code length and emphasize shared arithmetic structure.

N. Version & philosophy

Version. This document is frozen as **v2.3**. Any change (new lock or edit) becomes v2.4, v2.5, ...

Freeze & score. We never overwrite history; we publish a new version when promoting better locks. The point is to keep the integers tiny and the predictions falsifiable.

Vein primes. Many locks deliberately reuse the small-prime threads $\{5, 7, 11, 13, 23, 29, 89\}$ and simple power structures (e.g., $2^a 5^b$), echoing modular/partition "Ramanujan" patterns.