Frozen Locks: Neutrino Set, Neutrino Mass Rows & Water Rows (v2)

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Purpose

This note freezes three seed groups:

1. **Neutrino mixing (canonical set, v2)** — exact rational locks for the three angles and a CP phase.
2. **Neutrino mass rows (v1)** — a small-denominator rational for the mass-splitting ratio in normal ordering.
3. **Water rows (benchmark, v1)** — exact rational/identity anchors for solvent resonance and bioelectrochemistry knobs in EKTL/engine tests.

We report $\mathrm{MDL}[[]\, p/q] = \lceil \log_2 p \rceil + \lceil \log_2 q \rceil$. Transcendentals (e.g. $\pi, \ln 2$) carry zero MDL charge in this program.

1 Frozen Neutrino Mixing Set (v2)

Canonical locks (as in the CKM/PMNS double-ledger):

$$\boxed{\sin^2\theta_{12} = \tfrac{7}{23}, \quad \sin^2\theta_{13} = \tfrac{2}{89}, \quad \sin^2\theta_{23} = \tfrac{9}{16}, \quad \delta_{\mathrm{PMNS}} = -\tfrac{\pi}{2}}$$

Derived, zero-cost consequences. First-row probabilities are exact rationals:

$$|U_{e1}|^2 = \frac{1392}{2047}, \quad |U_{e2}|^2 = \frac{609}{2047}, \quad |U_{e3}|^2 = \frac{2}{89}.$$

No extra parameters beyond the seeds above.

Audit Table (Neutrino Mixing)

#	Quantity	Exact value	p	q	MDL[$[]\, p/q$]	Status/Notes
N1	$\sin^2\theta_{12}$	7/23	7	23	$3+5=8$ bits	**FROZEN** (v2)
N2	$\sin^2\theta_{13}$	2/89	2	89	$1+7=8$ bits	**FROZEN** (v2)
N3	$\sin^2\theta_{23}$	9/16	9	16	$4+4=8$ bits	**FROZEN** (v2)
N4	δ_{PMNS}	$-\pi/2$	–	–	0 bits	**FROZEN** (phase; transcendental)
D1	$\lvert U_{e1}\rvert^2$	1392/2047	1392	2047	$11+11=22$ bits	*Derived (0 model bits)*
D2	$\lvert U_{e2}\rvert^2$	609/2047	609	2047	$10+11=21$ bits	*Derived (0 model bits)*
D3	$\lvert U_{e3}\rvert^2$	2/89	2	89	$1+7=8$ bits	*Derived (0 model bits)*

MDL subtotal (Neutrino mixing seeds). $\mathrm{MDL}[]\,\mathrm{mix} = 8+8+8+0 = \boxed{24 \text{ bits}}$.

2 Frozen Neutrino Mass Rows (v1)

We freeze normal ordering and a compact rational for the *splitting ratio*; the absolute mass scale remains unfrozen (set by external priors, e.g. cosmology) to avoid unnecessary MDL.

Definition

Let

$$\Delta m^2_{21} \equiv m_2^2 - m_1^2, \qquad \Delta m^2_{31} \equiv m_3^2 - m_1^2, \qquad \text{NO: } \Delta m^2_{21} > 0,\ \Delta m^2_{31} > 0.$$

Frozen rational ratio (small denominator):

$$\boxed{R_{21/31} \;\equiv\; \frac{\Delta m^2_{21}}{\Delta m^2_{31}} \;=\; \frac{2}{65}}$$

This choice ($2/65 \approx 0.030769$) is a tight small-denominator fit to the standard-normal-ordering ratio and keeps the registry compact.

Audit Table (Neutrino Mass)

#	Quantity	Exact value	p	q	MDL[$[]\, p/q$]	Status/Notes
M0	Ordering	NO	–	–	0 bits	**FROZEN** (symbolic)
M1	$\Delta m^2_{21}/\Delta m^2_{31}$	2/65	2	65	$1+6=7$ bits	**FROZEN** (v1)
B0	m_1^{bench}	1/1000 eV	1	1000	$0+10=10$ bits	*Benchmark only; non-parametric*

Consequences. Given any lightest mass m_1, the spectrum is

$$m_2 = \sqrt{m_1^2 + \Delta m^2_{21}}, \qquad m_3 = \sqrt{m_1^2 + \Delta m^2_{31}}, \qquad \frac{\Delta m^2_{21}}{\Delta m^2_{31}} = \frac{2}{65}.$$

The laboratory observables

$$m_\beta = \sqrt{\sum_i |U_{ei}|^2 m_i^2}, \qquad m_{\beta\beta} = \Big|\ |U_{e1}|^2 m_1 + |U_{e2}|^2 m_2 e^{i\alpha_{21}} + |U_{e3}|^2 m_3 e^{i\alpha_{31}}\ \Big|$$

are then fully determined by the mixing seeds (Sec. 1), this rational $R_{21/31}$, the lightest mass m_1, and two Majorana phases $(\alpha_{21}, \alpha_{31})$ (no new seeds). A convenient non-parametric *benchmark* is $m_1 = 1\,\text{meV}$, for which one can print Σm_i, m_β, and the $m_{\beta\beta}$ envelope (min/max over phases) as in your one-cell script.

MDL subtotal (Neutrino mass seeds). MDL[] mass $= 0+7 =$ $\boxed{7\text{ bits}}$. (If an absolute anchor like $\Delta m^2_{31} = 2453/10^6\,\text{eV}^2$ were ever frozen, it would add ≈ 32 bits; we leave it unfrozen here.)

3 Frozen Water Rows (Benchmark v1)

Instrument-facing anchors for solvent resonance and bioelectrochemical checks in EKTL/engine experiments. Exact rationals (or identities) keep MDL minimal while enabling reproducible tests.

Solvent Resonance Anchors

Primary dielectric relaxation (*Debye*) and a hydration tail; frequency drives are rational multiples of the center.

$$\boxed{\tau_\text{D} = \frac{83}{10}\ \text{ps}, \qquad \tau_\text{H} = 1\ \text{ns}, \qquad \mathcal{R} = \left\{\tfrac{1}{2},\ 1,\ 2,\ 3\right\}}$$

Angular resonance $\omega_0 = 1/\tau$, drive set $\omega = r\,\omega_0$ with $r \in \mathcal{R}$; linear frequency $f_0 = \omega_0/(2\pi)$ is allowed (explicit 2π costs zero MDL).

Bioelectrochemical Benchmarks

Reference membrane potential and pH gradient for Nernst gates; simple rationals/integers.

$$\boxed{\Delta\psi_\text{ref} = \frac{3}{20}\ \text{V}\ (= 150\ \text{mV}), \qquad \Delta\text{pH}_\text{ref} = 1}$$

At temperature T, the dimensionless proton chemical potential is

$$\ln a = \frac{q_e\,\Delta\psi}{k_B T} + (\ln 10)\,\Delta\text{pH}, \qquad \text{bit-normalized gate:}\quad \ln a/\ln 2.$$

Any fitted small rational approximation to $\ln a/\ln 2$ should be recorded as a separate *derived* line (no new seeds).

Audit Table (Water)

#	Quantity	Exact value	p	q	MDL[[] p/q]	Status/Notes
W1	τ_D/ps	83/10	83	10	$7+4 = 11$ bits	**FROZEN** (Debye center)
W2	τ_H/ns	1/1	1	1	$0+0 = 0$ bits	**FROZEN** (hydration center)
W3	r_1 (drive ratio)	1/2	1	2	$0+1 = 1$ bits	**FROZEN**
W4	r_2	1	1	1	$0+0 = 0$ bits	**FROZEN**
W5	r_3	2	2	1	$1+0 = 1$ bits	**FROZEN**
W6	r_4	3	3	1	$2+0 = 2$ bits	**FROZEN**
B1	$\Delta\psi_\text{ref}$ (V)	3/20	3	20	$2+5 = 7$ bits	**FROZEN**
B2	$\Delta\text{pH}_\text{ref}$	1	1	1	$0+0 = 0$ bits	**FROZEN**

MDL subtotal (Water seeds). $\mathrm{MDL}[]\,\mathrm{water} = 11 + 0 + 1 + 0 + 1 + 2 + 7 + 0 = \boxed{22\ \text{bits}}$.

4 Seed MDL Totals (this document)

$$\mathrm{MDL}[]\,\mathrm{mix} = 24\ \text{bits}, \qquad \mathrm{MDL}[]\,\mathrm{mass} = 7\ \text{bits}, \qquad \mathrm{MDL}[]\,\mathrm{water} = 22\ \text{bits}$$

$$\Rightarrow \quad \boxed{\mathrm{MDL}[]\,\text{seeds, total} = 53\ \text{bits.}}$$

For baseline comparison: encoding neutrino mixing (4 floats), a splitting ratio (1 float), and water anchors (8 floats) with 64-bit reals would cost $(4 + 1 + 8) \times 64 = 832$ bits. Thus these freezes yield a conservative net saving of $832 - 53 = \boxed{779\ \text{bits}}$ before counting any derived observables (which cost 0 model bits under this program).

5 Freeze Checklist & Provenance

- **Versioning.** This file is *Frozen v2 (mix)*, *v1 (mass)*, *v1 (water)*. Replacements should increment version tags and list superseded row IDs.
- **Scope.** Mass ordering and the ratio $R_{21/31}$ are frozen; the absolute mass scale remains unfrozen (external prior). If you later freeze an absolute anchor (e.g. Δm^2_{31} as a rational), add it here with a new row.
- **Benchmark link.** The non-parametric $m_1 = 1\,\text{meV}$ benchmark corresponds to your one-cell neutrino script; it does not add MDL.
- **Water provenance.** Debye $\sim 8.3\,\text{ps}$, hydration $\sim 1\,\text{ns}$; drive ratios $\{1/2, 1, 2, 3\}$; bioelectric knobs $\Delta\psi \approx 150\,\text{mV}$, $\Delta\text{pH} = 1$.