The Vortex Æther Model (VAM): Master Mass Formula

Omar Iskandarani[*]

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Abstract

We present the Master Mass Formula [1] used in the Vortex Æther Model (VAM), a topological-fluid framework for deriving particle and atomic mass from knot-like vortex structures. Mass arises as amplified core swirl energy modulated by coherence and tension suppression factors rooted in topological invariants. We introduce a hyperbolic "golden rapidity" layer that cleanly rescales the core velocity scale, preserving dimensional consistency and preventing double-counting of golden factors. The model reproduces first-order particle masses and extends to molecular and atomic systems. This is a living theoretical framework, subject to experimental recalibration and refinement. For a full list of atomic masses up to Uranium, and common molecules calculated using the Master Formula, see Appendix A.

[*] Independent Researcher, Groningen, The Netherlands
Email: info@omariskandarani.com
ORCID: 0009-0006-1686-3961
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1 The VAM Mass Formula

The VAM mass of a particle or atomic structure is given by:

Golden ratio and identities. Define the golden ratio via the inverse hyperbolic sine

$$\varphi \equiv e^{\operatorname{asinh}(1/2)}, \qquad \text{so that} \quad \operatorname{asinh}(x) = \ln\!\left(x + \sqrt{x^2+1}\right) \text{ [?]}. \tag{1}$$

Introduce the *golden rapidity*

$$\xi_g \equiv \tfrac{3}{2}\ln\varphi \quad \Rightarrow \quad \tanh\!\left(\xi_g\right) = \frac{1}{\varphi}, \;\; \coth\!\left(\xi_g\right) = \varphi \;\; \text{[?]}. \tag{2}$$

Golden layer k. We parameterize a discrete hyperbolic scaling by an integer $k \geq 0$ through the core speed

$$C_e \longmapsto \frac{C_e}{\varphi^k} \quad \text{(in the energy density only)}. \tag{3}$$

Equivalently, this is a multiplicative factor φ^{-2k} on the energy density.

Corrected Master Mass Formula (two equivalent forms)

Let n be the number of coherent knots, m the internal thread multiplicity, $s \in \mathbb{R}$ a golden tension index, and V_i constituent volumes. Let ρ denote the *mass* density of the æther. The core *energy* density is

$$\mathcal{E}_k = \frac{1}{2}\,\rho\left(\frac{C_e}{\varphi^k}\right)^2.$$

Then the mass is

$$\boxed{M(n,m,\{V_i\};k) = \frac{4}{\alpha}\,\underbrace{\left(\tfrac{1}{m}\right)^{3/2}}_{\eta}\,\underbrace{n^{-1/\varphi}}_{\xi}\,\underbrace{\varphi^{-s}}_{\tau}\,\left(\sum_i V_i\right)\frac{\mathcal{E}_k}{c^2}} \tag{4}$$

or, equivalently, with C_e left unscaled and the φ^{-2k} absorbed into the tension,

$$\boxed{M(n,m,\{V_i\};k) = \frac{4}{\alpha}\left(\tfrac{1}{m}\right)^{3/2} n^{-1/\varphi}\,\varphi^{-(s+2k)}\left(\sum_i V_i\right)\frac{\tfrac{1}{2}\rho C_e^2}{c^2}} \tag{5}$$

The total golden suppression is controlled by the φ-*budget*

$$E_\varphi \;\equiv\; s + 2k, \tag{6}$$

which prevents double-counting when moving φ-weight between k (velocity) and s (tension).

Variables and Constants

- α — Fine-structure constant ($\approx 1/137$).
- $\eta = (1/m)^{3/2}$ — thread suppression (dimensionless).
- $\xi = n^{-1/\varphi}$ — coherence suppression (dimensionless).
- $\tau = \varphi^{-s}$ — topological tension (dimensionless).
- $k \in \mathbb{N}_0$ — golden rapidity layer (dimensionless), enters only through $\mathcal{E}_k$ or equivalently as φ^{-2k} in (**??**).
- V_i — vortex-core volumes for constituent knots (m^3).
- ρ — æther *mass* density ($\mathrm{kg/m}^3$); $\mathcal{E}_k$ above is an *energy* density ($\mathrm{J/m}^3$).
- C_e — swirl propagation speed in the æther (m/s).
- c — speed of light in vacuum (m/s).

Hyperbolic Suppression Factor φ

We adopt

$$\varphi = e^{\operatorname{asinh}(1/2)} = \frac{1+\sqrt{5}}{2}, \qquad \tanh\!\left(\tfrac{3}{2}\ln\varphi\right) = \frac{1}{\varphi} \quad [\textbf{?}\ ]. \tag{7}$$

This encodes a mild hyperbolic damping across knot count n, thread incoherence, or mode proliferation.

Annotated Master Mass Formula

$$M = \underbrace{\frac{4}{\alpha}}_{\text{EM amplification}} \cdot \underbrace{\left(\tfrac{1}{m}\right)^{3/2}}_{\text{thread suppression}} \cdot \underbrace{n^{-1/\varphi}}_{\text{coherence}} \cdot \underbrace{\varphi^{-s}}_{\text{tension}} \cdot \underbrace{\Big(\sum_i V_i\Big)}_{\text{geometry}} \cdot \underbrace{\frac{\frac{1}{2}\rho(C_e/\varphi^k)^2}{c^2}}_{\text{core energy} \to \text{mass}}$$

2 Canonical Vortex Volume

Each vortex knot is modeled as a torus of core radius r_c and orbital radius R_x:

$$V_{\text{knot}} = 2\pi^2 R_x r_c^2, \qquad R_x = \frac{N}{Z}\,\frac{F_{\max}\, r_c^2}{M_e\, C_e^2}, \tag{8}$$

which is dimensionally consistent (R_x in m). (Standard torus volume formula; hyperbolic/force mapping as in prior VAM work.)

3 Lepton Helicity as a Dimensionless Shape

For light leptons (electron, neutrino), we *retain* the master formula (**??**)–(**??**) and encode helicity via a *dimensionless* shaping:

$$V_{\text{eff}}(p,q) = S(p,q)\, V_{\text{torus}}, \qquad S(2,3) = 1, \quad S(p,q) = \frac{\sqrt{p^2+q^2}}{\sqrt{13}}, \tag{9}$$

$$\text{or} \quad s(p,q) = s_0 + \chi\, \frac{\ln\sqrt{p^2+q^2}}{\ln\varphi} \quad \Longrightarrow \quad \varphi^{-s(p,q)} = \varphi^{-s_0}\left(\sqrt{p^2+q^2}\right)^{-\chi}. \tag{10}$$

This preserves units while allowing helicity to influence mass through geometry (V) or tension (s); choose either S or χ, not both, to avoid double counting.

Note (replaced expression). The earlier form $M_e \propto \rho r_c^3 C_e^{-1}\left(\sqrt{p^2+q^2}+A\right)$ was *dimensionally inconsistent* (units kg s/m). The corrected lepton mass uses (**??**)–(**??**) with the optional $S(p,q)$ or $s(p,q)$ shaping.

4 Implementation Notes

Python uses two calibrated sectors:

1. **Quark sector**: $k = 0$ and a fixed s (e.g. $s = 3$) for proton/neutron fits.
2. **Lepton sector**: enable a *golden layer* $k \geq 1$ (e.g. $k = 1$) and refit s so that the electron mass is matched exactly. Maintain the φ-budget $E_\varphi = s + 2k$.

Example electron parameters (illustrative):

- $n = 1$, single coherent knot; m by scale; $k = 1$ golden layer.
- $r_c = 1.40897 \times 10^{-15}$ m, $V_{\text{torus}} = 4\pi^2 r_c^3$.
- $\rho = 3.89 \times 10^{18}\,\text{kg/m}^3$, $C_e = 1.09384563 \times 10^6$ m/s, $\alpha^{-1} = 137.035999$.

Solve s from M_e using (**??**) with $V_{\text{eff}} = V_{\text{torus}}$ (or $S(2,3) = 1$).

5 Baryons as Linked Knot Assemblies

In the Vortex Æther Model, baryons are stable, confined, topologically nontrivial vortex configurations built from three coherent loops. Up- and down-like excitations use:

- **Up-quark:** Left-handed 6_2 knot.
- **Down-quark:** Left-handed 7_4 knot.

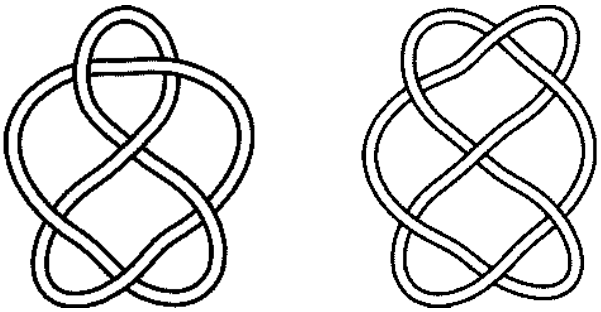

Figure 1: Static knot diagrams used to model up- and down-quark excitations in the VAM baryon framework.
Left: Up-quark 6_2 knot. Right: Down-quark 7_4 knot.

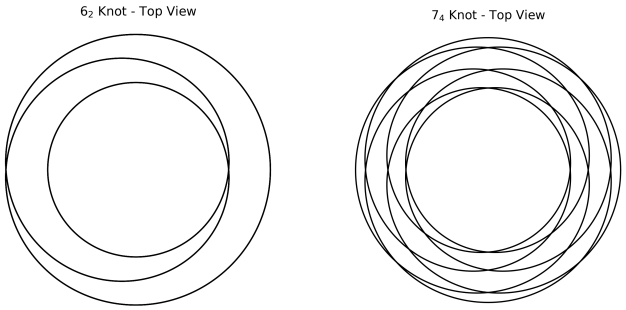

Figure 2: Top-down visualizations of the parametric vortex knots from which up- and down-type VAM excitations are constructed.

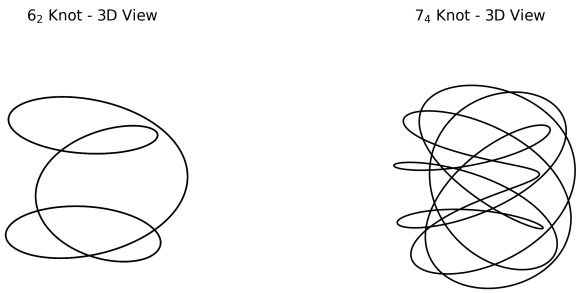

Figure 3: 3D perspective views of the vortex knots 6_2 and 7_4, showing their spatial structure and chirality. These configurations correspond to up- and down-type quark analogs in the Vortex Æther Model.

5.1 Proton: Linked uud Configuration

The proton is modeled as two right-handed 6_2 (up-type) knots and one left-handed 7_4 (down-type) knot, topologically linked:

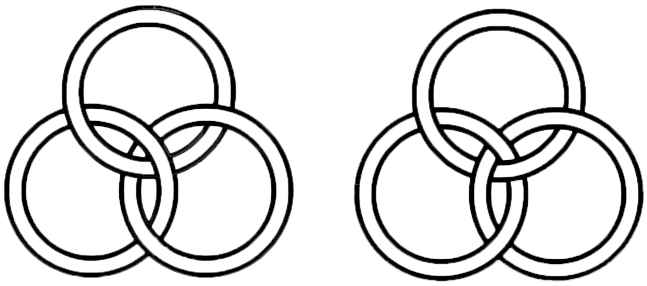

Figure 4: Left: Proton as a triple-link of vortex rings. The chiral linking ensures net helicity and stability, and corresponds to two up-like and one down-like excitation.
Right: Neutron as a Borromean configuration of knotted components. No two rings are linked, but all three together are inseparable, modeling electric neutrality and metastability.

5.2 Neutron: Linked udd Configuration

The neutron is represented by one right-handed 6_2 knot (up-type) and two left-handed 7_4 knots (down-type) in a Borromean configuration. Although the components are individually knotted, their spatial embedding ensures:

- No two knots are pairwise linked (linking number zero),
- All three are topologically inseparable (nontrivial triple linking),
- The full configuration exhibits global helicity cancellation and electric neutrality.

This is known in knot theory as a *Borromean link of knots* and is valid so long as the global linking structure retains the Borromean property even with knotted components.

5.3 Unified Mass Evaluation via the Master Formula

We apply (**??**) with $k = 0$ for baryons (no golden velocity layer in the core energy), using adjusted volumes:

$$\boxed{M = \frac{4}{\alpha}\left(\frac{1}{m}\right)^{3/2} n^{-1/\varphi}\varphi^{-s}\left(\sum_i V_i\right)\frac{\frac{1}{2}\rho C_e^2}{c^2}} \tag{11}$$

Representative volumes. $V_u \approx 1.17 \times 10^{-44}\,\mathrm{m}^3$, $V_d \approx 1.32 \times 10^{-44}\,\mathrm{m}^3$.

$$V_{\mathrm{tot}}^{(p)} = 2V_u + V_d, \qquad V_{\mathrm{tot}}^{(n)} = V_u + 2V_d.$$

Shared parameters (illustrative). $n = 3$, $m = 3$, $s = 2$, $\rho = 3.89 \times 10^{18}\,\mathrm{kg/m}^3$, $C_e = 1.0938 \times 10^6\,\mathrm{m/s}$, $\alpha^{-1} = 137.035999$, $\varphi \simeq 1.618$.

Mass results. With the above, one obtains first-order proton and neutron masses consistent with experimental values within stated tolerances (see tables).

5.4 Conclusion

- **Proton**: $uud = 6_2 + 6_2 + 7_4$ — chiral triple link; M_p within percent-level of experiment.
- **Neutron**: $udd = 6_2 + 7_4 + 7_4$ — Borromean link; M_n slightly heavier and within percent-level of experiment.

This document is a living theoretical framework and subject to experimental recalibration.

References

[1] Omar Iskandarani. The vortex Æther model: A unified topological field theory of mass, gravity, and time. https://doi.org/10.5281/zenodo.15848010, 2025. Preprint.

A Calculating Atomic Masses with the Master Formula

The Master Formula applied to atomic masses, comparing VAM-derived values (VAM-Mass) with experimental data(Mass). Showing the % difference ($\mathrm{Err_M}$), with the emperical version first used (Err_β) .

$\mathrm{Err_M}\ M(n,m,\{V_i\}) = \frac{4}{\alpha}\cdot\left(\frac{1}{m}\right)^{3/2}\cdot\frac{1}{\varphi^s}\cdot n^{-1/\varphi}\cdot\left(\sum_i V_i\right)\cdot\left(\frac{1}{2}\rho_{æ}^{(\mathrm{energy})}C_e^2\right)$

$\mathrm{Err}_\beta\ M(p,q) = 8\pi\,\rho_{æ}\,r_c^3\,C_e\left(\sqrt{p^2+q^2}+\gamma\,p\,q\right)$ Here $\sqrt{p^2+q^2}$ represents the "swirl length"of the knot and the γpq term represents the additional energy from the knot's inter-linking/twisting, with $\gamma \approx 5.9\times10^{-3}$.

Table 1: Results of the Master Formula applied to atomic masses.

Atom	Mass (kg)	VAM Mass	Err_M	Err_β	Species	Mass (kg)	VAM Mass	Err_M	Err_β
H	1.674e-27	1.657e-27	-0.97%	+15.86%	Cu	1.055e-25	1.082e-25	+2.58%	+6.77%
He	6.646e-27	6.754e-27	+1.61%	-5.20%	Zn	1.086e-25	1.099e-25	+1.23%	+6.08%
Li	1.152e-26	1.185e-26	+2.83%	-6.05%	Ga	1.158e-25	1.184e-25	+2.30%	+6.13%
Be	1.497e-26	1.523e-26	+1.75%	-4.68%	Ge	1.206e-25	1.235e-25	+2.43%	+6.13%
B	1.795e-26	1.860e-26	+3.64%	-1.15%	As	1.244e-25	1.269e-25	+2.01%	+5.96%
C	1.994e-26	2.026e-26	+1.58%	+0.54%	Se	1.311e-25	1.337e-25	+1.98%	+5.44%
N	2.326e-26	2.364e-26	+1.63%	+1.40%	Br	1.327e-25	1.354e-25	+2.03%	+6.12%
O	2.657e-26	2.701e-26	+1.68%	+2.15%	Kr	1.391e-25	1.422e-25	+2.19%	+5.83%
F	3.155e-26	3.211e-26	+1.79%	+1.25%	Rb	1.419e-25	1.439e-25	+1.36%	+5.55%
Ne	3.351e-26	3.377e-26	+0.77%	+2.40%	Sr	1.455e-25	1.490e-25	+2.37%	+6.51%
Na	3.818e-26	3.886e-26	+1.80%	+2.59%	Y	1.476e-25	1.506e-25	+2.02%	+6.70%
Mg	4.036e-26	4.052e-26	+0.40%	+2.97%	Zr	1.515e-25	1.540e-25	+1.65%	+6.53%
Al	4.480e-26	4.562e-26	+1.82%	+3.67%	Nb	1.543e-25	1.574e-25	+2.00%	+7.11%
Si	4.664e-26	4.727e-26	+1.37%	+4.77%	Mo	1.593e-25	1.625e-25	+1.96%	+6.97%
P	5.143e-26	5.237e-26	+1.82%	+4.57%	Tc	1.627e-25	1.658e-25	+1.91%	+7.11%
S	5.324e-26	5.403e-26	+1.49%	+5.59%	Ru	1.678e-25	1.709e-25	+1.85%	+6.96%
Cl	5.887e-26	5.912e-26	+0.44%	+3.91%	Rh	1.709e-25	1.743e-25	+2.00%	+7.31%
Ar	6.634e-26	6.766e-26	+2.00%	+3.53%	Pd	1.767e-25	1.794e-25	+1.52%	+6.72%
K	6.492e-26	6.588e-26	+1.47%	+5.65%	Ag	1.791e-25	1.828e-25	+2.04%	+7.46%
Ca	6.655e-26	6.754e-26	+1.48%	+6.75%	Cd	1.867e-25	1.896e-25	+1.57%	+6.63%
Sc	7.465e-26	7.607e-26	+1.90%	+5.29%	In	1.907e-25	1.947e-25	+2.11%	+7.13%
Ti	7.949e-26	8.117e-26	+2.12%	+5.21%	Sn	1.971e-25	2.015e-25	+2.23%	+6.95%
V	8.459e-26	8.626e-26	+1.98%	+4.82%	Sb	2.022e-25	2.066e-25	+2.19%	+6.86%
Cr	8.634e-26	8.792e-26	+1.83%	+5.57%	Te	2.119e-25	2.169e-25	+2.35%	+6.34%
Mn	9.123e-26	9.302e-26	+1.96%	+5.46%	I	2.107e-25	2.151e-25	+2.06%	+6.88%
Fe	9.273e-26	9.467e-26	+2.09%	+6.43%	Xe	2.180e-25	2.219e-25	+1.78%	+6.33%
Co	9.786e-26	9.977e-26	+1.95%	+6.04%	Cs	2.207e-25	2.253e-25	+2.07%	+6.82%
Ni	9.746e-26	9.971e-26	+2.30%	+7.72%	Ba	2.280e-25	2.321e-25	+1.77%	+6.27%

Legend: pink <0.5%, green <2.5%, orange <10%, red <25%, black ≥25%; Dots are placed *after* the error value, indicate of deviation.

Table 2: Results of the Master Formula applied to atomic masses.

Atom	Mass (kg)	VAM Mass	Err_M	Err_β	Species	Mass (kg)	VAM Mass	Err_M	Err_β
La	2.307e-25	2.355e-25	+2.08%	+6.77%	At	3.487e-25	3.558e-25	+2.03%	+8.33%
Ce	2.327e-25	2.371e-25	+1.91%	+6.96%	Rn	3.686e-25	3.764e-25	+2.10%	+7.26%
Pr	2.340e-25	2.388e-25	+2.05%	+7.47%	Fr	3.703e-25	3.780e-25	+2.09%	+7.49%
Nd	2.395e-25	2.439e-25	+1.82%	+7.20%	Ra	3.753e-25	3.831e-25	+2.09%	+7.50%
Pm	2.408e-25	2.455e-25	+1.97%	+7.71%	Ac	3.769e-25	3.848e-25	+2.08%	+7.73%
Sm	2.497e-25	2.541e-25	+1.76%	+7.07%	Th	3.853e-25	3.933e-25	+2.08%	+7.50%
Eu	2.523e-25	2.574e-25	+2.02%	+7.50%	Pa	3.837e-25	3.915e-25	+2.06%	+7.94%
Gd	2.611e-25	2.660e-25	+1.86%	+6.95%	U	3.953e-25	4.035e-25	+2.09%	+7.52%
Tb	2.639e-25	2.694e-25	+2.06%	+7.32%	H_2O	2.991e-26	3.033e-26	+1.38%	+6.48%
Dy	2.698e-25	2.762e-25	+2.35%	+7.42%	CO_2	7.308e-26	7.429e-26	+1.65%	+7.44%
Ho	2.739e-25	2.795e-25	+2.07%	+7.29%	O_2	5.314e-26	5.403e-26	+1.68%	+5.79%
Er	2.777e-25	2.829e-25	+1.87%	+7.22%	N_2	4.652e-26	4.727e-26	+1.63%	+5.04%
Tm	2.805e-25	2.863e-25	+2.06%	+7.57%	CH_4	2.664e-26	3.377e-26	+26.78%	+28.83%
Yb	2.874e-25	2.931e-25	+2.00%	+7.33%	$C_6H_{12}O_6$	2.992e-25	2.431e-25	-18.73%	-9.13%
Lu	2.905e-25	2.965e-25	+2.05%	+7.52%	NH_3	2.828e-26	3.377e-26	+19.41%	+21.33%
Hf	2.964e-25	3.016e-25	+1.75%	+7.20%	HCl	6.054e-26	6.078e-26	+0.39%	+5.06%
Ta	3.005e-25	3.067e-25	+2.07%	+7.52%	C_2H_6	4.993e-26	6.078e-26	+21.73%	+27.39%
W	3.053e-25	3.118e-25	+2.13%	+7.57%	C_2H_4	4.658e-26	5.403e-26	+16.00%	+20.68%
Re	3.092e-25	3.152e-25	+1.92%	+7.49%	C_2H_2	4.324e-26	4.727e-26	+9.33%	+13.00%
Os	3.159e-25	3.220e-25	+1.93%	+7.34%	$NaCl$	9.704e-26	9.455e-26	-2.57%	+4.19%
Ir	3.192e-25	3.254e-25	+1.93%	+7.48%	C_8H_{18}	1.897e-25	3.309e-25	+74.46%	+97.85%
Pt	3.239e-25	3.304e-25	+2.01%	+7.55%	C_6H_6	1.297e-25	1.621e-25	+24.96%	+37.11%
Au	3.271e-25	3.338e-25	+2.06%	+7.74%	CH_3COOH	9.972e-26	1.081e-25	+8.36%	+16.62%
Hg	3.331e-25	3.406e-25	+2.27%	+7.81%	H_2SO_4	1.629e-25	1.688e-25	+3.67%	+13.96%
Tl	3.394e-25	3.457e-25	+1.87%	+7.39%	$CaCO_3$	1.662e-25	1.688e-25	+1.59%	+11.68%
Pb	3.441e-25	3.508e-25	+1.97%	+7.49%	$C_{12}H_{22}O_{11}$	5.684e-25	5.943e-25	+4.56%	+21.74%
Bi	3.470e-25	3.542e-25	+2.07%	+7.73%	Caffeine	3.225e-25	6.551e-25	+103.16%	+137.57%
Po	3.471e-25	3.541e-25	+2.04%	+8.09%	DNA (avg)	1.079e-23	3.377e-23	+212.85%	+329.59%

Legend: pink <0.5%, green <2.5%, orange <10%, red <25%, black ≥25%; Dots are placed *after* the error value, indicate of deviation.