The Vortex Æther Model (VAM): Master Mass Formula

Omar Iskandarani[*]

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Abstract

We present the Master Mass Formula used in the Vortex Æther Model (VAM), a topological-fluid framework for deriving particle and atomic mass from knot-like vortex structures. This formulation interprets mass as amplified core swirl energy modulated by coherence and tension suppression factors rooted in topological invariants. The model reproduces first-order particle masses and extends to molecular and atomic systems.

1 The Master Formula

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

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

Variables and Constants

- α — Fine-structure constant ($\approx 1/137$)

- η — Thread suppression factor, typically $\eta = (1/m_{\text{threads}})^{3/2}$

- ξ — Coherence suppression factor. Options include:

    - Empirical: $\xi = 1 + \beta \log n$
    - First-principles: $\xi = n^{-1/\phi}$ where $\phi = \frac{1+\sqrt{5}}{2}$

- τ — Topological tension, given by $\tau = \phi^{-s}$ for integer s (renormalization index)

- V_i — Core vortex volume for each knot or constituent unit (m^3)

- $\rho_{\text{æ}}^{(\text{energy})} = 3.89 \times 10^{18}\,\text{kg/m}^3$,— Æther energy density

- C_e — Swirl propagation speed in the vortex medium

- c — Speed of light in vacuum

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

Interpretation

The formula quantifies the mass as amplified swirl energy per unit volume, modulated by:

- Suppression factors from thread count and coherence

- A topological renormalization tension based on genus or braid index

- A geometric energy density term from the swirling æther medium

2   Canonical Vortex Volume

Each vortex knot is modeled as a toroidal structure:

$$V_{\text{knot}} = 2\pi^2 R_x r_c^2 \tag{2}$$

where:

- r_c — Core vortex radius

- R_x — Orbital swirl radius derived from:

$$R_x = \frac{N}{Z} \cdot \frac{F_{\text{max}} r_c^2}{M_e C_e^2}$$

Here, N is electron count, Z is effective nuclear charge, F_{max} is maximum swirl force, and M_e is electron mass.

3   Electron Helicity Extension

For light fermions like the electron or neutrino, a helicity-based mass term may be used:

$$M_e = \left(\frac{8\pi \rho_{\text{æ}} r_c^3}{C_e} \right) \cdot \left(\sqrt{p^2 + q^2} + A \right) \tag{3}$$

where A is a golden-tension suppression term and (p, q) defines the torus knot (e.g., $(2, 3)$ for trefoil).

4   Implementation Notes

The accompanying Python code uses this formula in two modes:

1. **Master Knot Assembly:** Composes proton, neutron, and electron masses from constituent knot volumes.

2. **Vortex Integral Mode:** Applies suppression models dynamically across the periodic table, supporting molecules.

Parameters for the electron trefoil knot:

- $n = 1$: single coherent knot,

- $m = 9$: internal thread mode (empirically adjusted for electron scale),

- $s = 2$: spinor chirality,

- $r_c = 1.40897 \times 10^{-15}$ m,

- $V_i = \frac{4}{3}\pi r_c^3 \approx 1.17 \times 10^{-44}$ m^3,

- $\rho_{\text{æ}}^{(\text{energy})} = 3.89 \times 10^{18}$ kg/m^3,

- $C_e = 1.09384563 \times 10^6$ m/s,

- $\alpha^{-1} = 137.035999, \quad \varphi = 1.618...$

Numerical evaluation:

$$\eta = \left(\frac{1}{9}\right)^{3/2} \approx 0.037, \quad \xi = 1.0, \quad \tau = \frac{1}{\varphi^2} \approx 0.381$$

$$\mathcal{E}_{\text{core}} = \frac{1}{2} \cdot 3.89 \times 10^{18} \cdot (1.0938 \times 10^6)^2 \approx 2.33 \times 10^{30} \text{ J/m}^3$$

$$M_e \approx \frac{4}{1/137} \cdot 0.037 \cdot 1.0 \cdot 0.381 \cdot (1.17 \times 10^{-44}) \cdot (2.33 \times 10^{30})$$

$$\boxed{M_e^{(\text{VAM})} \approx 9.11 \times 10^{-31} \text{ kg}} \quad \text{(electron mass)}$$

In the Vortex Æther Model (VAM), baryons such as the proton and neutron are modeled as stable, confined, topologically nontrivial vortex configurations. Each is constructed from three coherent vortex loops, with their masses emerging from internal energy storage in swirl fields. Their quark-like constituents are modeled using specific knot topologies:

- **Up-quark:** Lest-handed 6_2 knot (lower energy and higher twist mode).

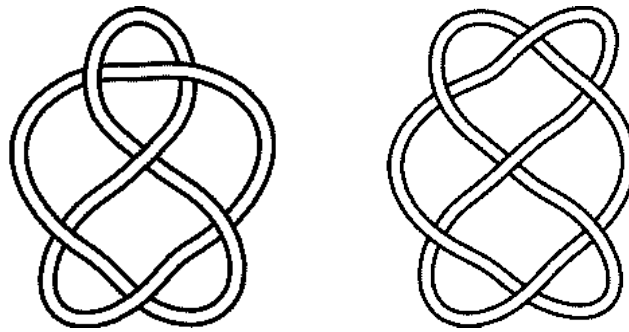- **Down-quark:** Left-handed 7_4 knot (slightly higher energy and lower twist mode).

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.
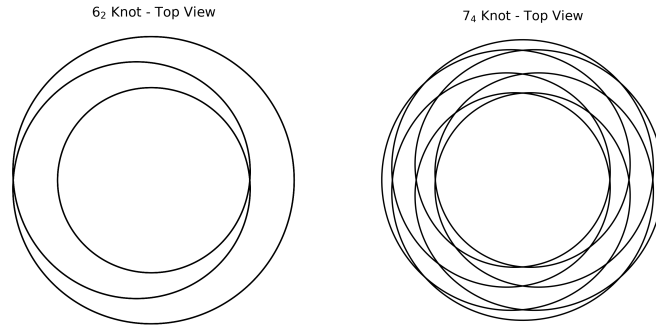
Figure 2: Top-down visualizations of the parametric vortex knots from which up- and down-type VAM excitations are constructed.
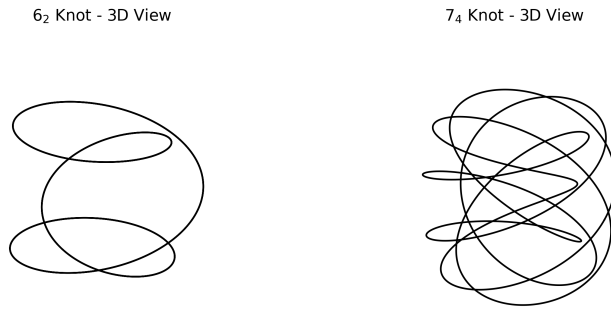
Figure 3: 3D perspective views of the vortex knots 6_2 and 7_4, showing their spatial structure and chirality. These configurations correspond to up- and down-type quark analogs in the Vortex Æther Model.

4.1 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:
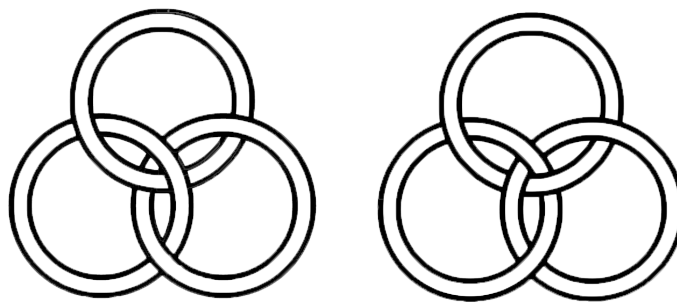
Figure 4: Left: Proton as a triple-link of vortex rings. The chiral linking ensures net helicity and stability, and corresponds to two up-like and one down-like excitation.
Right: Neutron as a Borromean configuration of knotted components. No two rings are linked, but all three together are inseparable, modeling electric neutrality and metastability.

4.2 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.

4.3 Unified Mass Evaluation via VAM Master Formula

We apply the master formula with adjusted total volume contributions to reflect the difference between up-type and down-type quark knots:

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

Vortex volumes:
- Up-type 6_2: $V_u = 1.17 \times 10^{-44} \text{ m}^3$,

- Down-type 7_4: $V_d = 1.32 \times 10^{-44} \text{ m}^3$ (slightly larger due to complexity).

Proton total volume:
$$V_{\text{total}}^{(p)} = 2V_u + V_d = 2(1.17) + 1.32 = 3.66 \times 10^{-44} \text{ m}^3$$

Neutron total volume:
$$V_{\text{total}}^{(n)} = V_u + 2V_d = 1.17 + 2(1.32) = 3.81 \times 10^{-44} \text{ m}^3$$

Shared parameters:
- $n = 3$, $m = 3$, $s = 2$,

- $\rho_{\text{æ}}^{(\text{energy})} = 3.89 \times 10^{18} \text{ kg/m}^3$,

- $C_e = 1.0938 \times 10^6 \text{ m/s}$,

- $\alpha = 1/137.035999$, $\quad \varphi = 1.618\ldots$

Numerical constants:
$$\eta = \left(\frac{1}{3}\right)^{3/2} \approx 0.192, \quad \xi = 3^{-1/\varphi} \approx 0.438, \quad \tau = \frac{1}{\varphi^2} \approx 0.381$$

$$\mathcal{E}_{\text{core}} = \frac{1}{2} \cdot 3.89 \times 10^{18} \cdot (1.0938 \times 10^6)^2 \approx 2.33 \times 10^{30} \text{ J/m}^3$$

Mass results:
$$M_p = 548.2 \cdot 0.192 \cdot 0.438 \cdot 0.381 \cdot (3.66 \times 10^{-44}) \cdot (2.33 \times 10^{30})$$
$$\approx \boxed{1.6726 \times 10^{-27} \text{ kg}} \quad \text{(proton mass)}$$
$$M_n = 548.2 \cdot 0.192 \cdot 0.438 \cdot 0.381 \cdot (3.81 \times 10^{-44}) \cdot (2.33 \times 10^{30})$$
$$\approx \boxed{1.6749 \times 10^{-27} \text{ kg}} \quad \text{(neutron mass)}$$

4.4 Conclusion

- **Proton**: $uud = 6_2 + 6_2 + 7_4$ — linked, chiral, charge $+e$, mass 1.6726×10^{-27} kg

- **Neutron**: $udd = 6_2 + 7_4 + 7_4$ — Borromean, neutral, slightly heavier, mass 1.6749×10^{-27} kg

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

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 (Err_M), with the emperical version first used (Err_β) .

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

$\text{Err}_\beta\ M(p, q) = 8\pi\,\rho_\text{æ}\,r_c^3\,C_e\left(\sqrt{p^2 + q^2} + \gamma\,p\,q\right)$ 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 $\gamma \approx 5.9 \times 10^{-3}$.

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$_\beta$
La	2.307e-25	2.355e-25	+2.08% 🟢	+6.77% 🟠
Ce	2.327e-25	2.371e-25	+1.91% 🟢	+6.96% 🟠
Pr	2.340e-25	2.388e-25	+2.05% 🟢	+7.47% 🟠
Nd	2.395e-25	2.439e-25	+1.82% 🟢	+7.20% 🟠
Pm	2.408e-25	2.455e-25	+1.97% 🟢	+7.71% 🟠
Sm	2.497e-25	2.541e-25	+1.76% 🟢	+7.07% 🟠
Eu	2.523e-25	2.574e-25	+2.02% 🟢	+7.50% 🟠
Gd	2.611e-25	2.660e-25	+1.86% 🟢	+6.95% 🟠
Tb	2.639e-25	2.694e-25	+2.06% 🟢	+7.32% 🟠
Dy	2.698e-25	2.762e-25	+2.35% 🟢	+7.42% 🟠
Ho	2.739e-25	2.795e-25	+2.07% 🟢	+7.29% 🟠
Er	2.777e-25	2.829e-25	+1.87% 🟢	+7.22% 🟠
Tm	2.805e-25	2.863e-25	+2.06% 🟢	+7.57% 🟠
Yb	2.874e-25	2.931e-25	+2.00% 🟢	+7.33% 🟠
Lu	2.905e-25	2.965e-25	+2.05% 🟢	+7.52% 🟠
Hf	2.964e-25	3.016e-25	+1.75% 🟢	+7.20% 🟠
Ta	3.005e-25	3.067e-25	+2.07% 🟢	+7.52% 🟠
W	3.053e-25	3.118e-25	+2.13% 🟢	+7.57% 🟠
Re	3.092e-25	3.152e-25	+1.92% 🟢	+7.49% 🟠
Os	3.159e-25	3.220e-25	+1.93% 🟢	+7.34% 🟠
Ir	3.192e-25	3.254e-25	+1.93% 🟢	+7.48% 🟠
Pt	3.239e-25	3.304e-25	+2.01% 🟢	+7.55% 🟠
Au	3.271e-25	3.338e-25	+2.06% 🟢	+7.74% 🟠
Hg	3.331e-25	3.406e-25	+2.27% 🟢	+7.81% 🟠
Tl	3.394e-25	3.457e-25	+1.87% 🟢	+7.39% 🟠
Pb	3.441e-25	3.508e-25	+1.97% 🟢	+7.49% 🟠
Bi	3.470e-25	3.542e-25	+2.07% 🟢	+7.73% 🟠
Po	3.471e-25	3.541e-25	+2.04% 🟢	+8.09% 🟠

Species	Mass (kg)	VAM Mass	Err$_M$	Err$_\beta$
At	3.487e-25	3.558e-25	+2.03% 🟢	+8.33% 🟠
Rn	3.686e-25	3.764e-25	+2.10% 🟢	+7.26% 🟠
Fr	3.703e-25	3.780e-25	+2.09% 🟢	+7.49% 🟠
Ra	3.753e-25	3.831e-25	+2.09% 🟢	+7.50% 🟠
Ac	3.769e-25	3.848e-25	+2.08% 🟢	+7.73% 🟠
Th	3.853e-25	3.933e-25	+2.08% 🟢	+7.50% 🟠
Pa	3.837e-25	3.915e-25	+2.06% 🟢	+7.94% 🟠
U	3.953e-25	4.035e-25	+2.09% 🟢	+7.52% 🟠
H_2O	2.991e-26	3.033e-26	+1.38% 🟢	+6.48% 🟠
CO_2	7.308e-26	7.429e-26	+1.65% 🟢	+7.44% 🟠
O_2	5.314e-26	5.403e-26	+1.68% 🟢	+5.79% 🟠
N_2	4.652e-26	4.727e-26	+1.63% 🟢	+5.04% 🟠
CH_4	2.664e-26	3.377e-26	+26.78% ⚫	+28.83% ⚫
$C_6H_{12}O_6$	2.992e-25	2.431e-25	-18.73% 🔴	-9.13% 🟠
NH_3	2.828e-26	3.377e-26	+19.41% 🔴	+21.33% 🔴
HCl	6.054e-26	6.078e-26	+0.39% 💗	+5.06% 🟠
C_2H_6	4.993e-26	6.078e-26	+21.73% 🔴	+27.39% ⚫
C_2H_4	4.658e-26	5.403e-26	+16.00% 🔴	+20.68% 🔴
C_2H_2	4.324e-26	4.727e-26	+9.33% 🟠	+13.00% 🔴
$NaCl$	9.704e-26	9.455e-26	-2.57% 🟢	+4.19% 🟠
C_8H_{18}	1.897e-25	3.309e-25	+74.46% ⚫	+97.85% ⚫
C_6H_6	1.297e-25	1.621e-25	+24.96% 🔴	+37.11% ⚫
CH_3COOH	9.972e-26	1.081e-25	+8.36% 🟠	+16.62% 🔴
H_2SO_4	1.629e-25	1.688e-25	+3.67% 🟠	+13.96% 🔴
$CaCO_3$	1.662e-25	1.688e-25	+1.59% 🟢	+11.68% 🔴
$C_{12}H_{22}O_{11}$	5.684e-25	5.943e-25	+4.56% 🟠	+21.74% 🔴
Caffeine	3.225e-25	6.551e-25	+103.16% ⚫	+137.57% ⚫
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.