Standard Model Lagrangian in Vortex Æther Model Units

Omar Iskandarani

May 2025

Introduction

The Standard Model of particle physics can be reformulated using the fundamental constants of the Vortex Æther Model (VAM):

- C_e: vortex-core tangential velocity (swirl speed)
- r_c: vortex core radius (minimum scale of circulation)
- $\rho_æ$: density of the æther (mass per unit volume)
- F_{max}: maximum interaction force in the æther

These constants define a new natural unit system where energy, mass, and time arise from fluid-like motion and topological structure.

Supporting Experimental and Theoretical Evidence

The VAM framework draws on a wide body of experimental and theoretical evidence supporting vortex stretching, helicity conservation, and mass-energy equivalence through fluid structures:

- **Batchelor (1953)** – Demonstrated how vortex line stretching in turbulent flows leads to reduced core radius and increased swirl.
- **Vinen (2002)** – Reviewed quantized vortex dynamics in superfluid helium, showing how vortex lines stretch and shrink under tension.
- **Bewley et al. (2008)** – Used tracer particles to visualize quantized vortices thinning and reconnecting in He II.
- **Moffatt (1969)** – Introduced helicity as a conserved quantity, related to topological knottedness of vortex tubes.
- **Irvine et al. (2013–2018)** – Created and observed real vortex knots in fluids, verifying energy transfer via reconnection and helicity preservation.
- **Bartlett van Buren (1986)** – Proposed that inertial mass may be structurally emergent from internal tension, analogous to vortex inertia in VAM.

These works confirm that stretching, shrinking vortex structures in classical and quantum fluids reproduce the core features of relativistic mechanics when reinterpreted in VAM.

c4825aa0-8e0b-446f-87ef-6320137a44ff.png

Figure 1: Knotted vortex-gear structure inspired by Dr. Saul Schleimer and Henry Segerman. The rotating knotted core transmits helicity and swirl to a threaded axial vortex. This mechanical structure embodies VAM's principle that vortex knots induce a directed flow — corresponding to time and field propagation.

Vortex-Gear Analogy

This mechanism can be understood as:

- The knot: a topological fermion-like excitation
- The swirl: tangential velocity CeC$_e$$Ceinducinghelicity$
- The bolt: polar vortex thread representing field line or temporal evolution
- The coupling: local swirl induces global motion — a direct mechanical analogue of inertia and time

Base Units

$$L_0 = r_c \quad \text{(length unit)}$$
$$T_0 = \frac{r_c}{C_e} \quad \text{(time unit)}$$
$$M_0 = \frac{F_{\max} r_c}{C_e^2} \quad \text{(mass unit)}$$
$$E_0 = F_{\max} r_c \quad \text{(energy unit)}$$

Emergent Constants

$$\hbar_{\text{VAM}} = m_e C_e r_c$$
$$c = \sqrt{\frac{2F_{\max} r_c}{m_e}} \quad \text{(light speed as emergent wave velocity)}$$

Full VAM Lagrangian Structure

$$\begin{aligned}
\mathcal{L}_{\text{VAM}} = \; & \underbrace{\sum_a \left(-\frac{1}{4} F^a_{\mu\nu} F^{a\mu\nu}\right)}_{\textbf{Vorticity field energy}\text{: vortex tension and linking}} \\
& + \underbrace{\sum_f i(m_f C_e r_c)\bar{\psi}_f \gamma^\mu D_\mu \psi_f}_{\textbf{Fermion inertia}\text{: mass from swirl momentum}} \\
& - \underbrace{|D_\mu \phi|^2}_{\textbf{Ætheric stiffness}\text{: resistance to vortex perturbation}} \\
& - \underbrace{\left(-\frac{F_{\max}}{r_c}|\phi|^2 + \lambda|\phi|^4\right)}_{\textbf{Fluid pressure potential}\text{: phase equilibrium}} \\
& - \underbrace{\sum_f \left(y_f \bar{\psi}_f \phi \psi_f + \text{h.c.}\right)}_{\textbf{Added-mass interaction}\text{: vortex mass from pressure drag}} \\
& + \underbrace{\text{topological helicity and reconnection terms}}_{\textbf{Gauge dynamics}\text{: linking, knotting, braiding}}
\end{aligned}$$

Derived Couplings and Relations

$$\alpha = \frac{2C_e}{c}$$
$$e^2 = 8\pi m_e C_e^2 r_c$$
$$\Gamma = 2\pi r_c C_e = \frac{h}{m_e}$$
$$v = \sqrt{\frac{F_{\max} r_c^3}{C_e^2}} \quad \text{(Higgs vev from æther pressure)}$$

Field Units and Dimensional Consistency

Each term in the Lagrangian has energy density units [E0rc3=Fmaxrc2] $\left[\frac{E_0}{r_c^3} = \frac{F_{\max}}{r_c^2}\right]$ $[rc3E0 = rc2Fmax].Thisensuresallcomp$