The Vortex Æther Model: A Vorticity-Based Framework for Gravity and Electromagnetism

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Contents

Abstract

This paper introduces the Vortex Æther Model (VAM), a novel approach to fundamental physics where gravity and electromagnetism emerge from vorticity fields in an incompressible, inviscid Æther. Unlike General Relativity, which relies on spacetime curvature, VAM posits that gravitational attraction arises from pressure gradients induced by vortex filaments. We develop the governing equations of VAM, analyze its implications for photon dynamics, and propose experimental tests for validation.

Symbol	Description
V	Mass of liquid in circular motion (Vortex)
Γ	Circulation: $\oint \mathbf{v} \cdot d\mathbf{s}$
ω	Vorticity magnitude $\nabla \times \mathbf{v}$
Φ	Vorticity-induced potential function
R	Characteristic vortex radius
L	Rotational vortex core length
Ψ	Stream function of vortex motion
ρ	Fluid density
$\mathbf{v}$	Velocity vector field
$\boldsymbol{\Omega}$	Angular velocity vector
H	Helicity: $\int \mathbf{v} \cdot \omega \, dV$
K	Enstrophy: $\int \omega^2 \, dV$

Table 1: Glossary of Terms for Incompressible Non-Viscous Liquid Æther

Symbol	Description
Γ	Vortex circulation strength, defined as $\Gamma = \oint_C \mathbf{v} \cdot d\mathbf{s}$.
ω	Vorticity magnitude, given by $\omega = \nabla \times \mathbf{v}$.
R	Characteristic vortex radius, representing the scale of rotation.
Φ	Vorticity-induced potential function, satisfying $\nabla^2 \Phi = -\omega$.
Ψ	Stream function for incompressible flow, where $\mathbf{v} = \nabla \times \Psi$.
H	Helicity, a measure of the knottedness of vortex tubes: $H = \int \mathbf{v} \cdot \omega \, dV$.
K	Enstrophy, representing rotational energy density: $K = \frac{1}{2} \int \omega^2 dV$.
ρ	Local Æther density, assumed to be incompressible in the model.
p	Pressure in the Æther model, often governed by Bernoulli-like principles.
$\mathbf{A}$	Vector potential, where $\mathbf{B} = \nabla \times \mathbf{A}$ in magnetohydrodynamic analogies.
$\mathbf{J}$	Vortex current density, defined by $\mathbf{J} = \nabla \times \omega$.
λ	Vortex core parameter, related to the characteristic decay length of vorticity.
Ψ_k	Vortex knot function describing topological structures in the Æther.

Table 2: Notation for the incompressible non-viscous Æther model.

1 Introduction

The nature of gravity and electromagnetism has long been debated. Classical Æther theories, as explored by Maxwell and Kelvin, proposed a medium for wave propagation. VAM extends this concept by modeling the Æther as a structured superfluid, where stable vortex knots correspond to fundamental particles, and pressure gradients drive gravitational interactions [**?, ?, ?, ?, ?, ?**].

2 Mathematical Formulation of VAM

2.1 Vorticity Transport Equation

$$\frac{D\boldsymbol{\omega}}{Dt} = (\boldsymbol{\omega} \cdot \nabla)\mathbf{v} - \boldsymbol{\omega}(\nabla \cdot \mathbf{v}) \tag{1}$$

2.2 Biot-Savart Law for Vortex Filaments

$$\mathbf{v}(\mathbf{r}) = \frac{1}{4\pi} \int \frac{\boldsymbol{\omega} \times (\mathbf{r} - \mathbf{r}')}{|\mathbf{r} - \mathbf{r}'|^3} d^3\mathbf{r}' \tag{2}$$

2.3 Bernoulli Equation and Gravity

$$P + \frac{1}{2}\rho v^2 + \rho\Phi = \text{constant} \tag{3}$$

2.4 Photon Frequency as a Function of Vortex Circulation
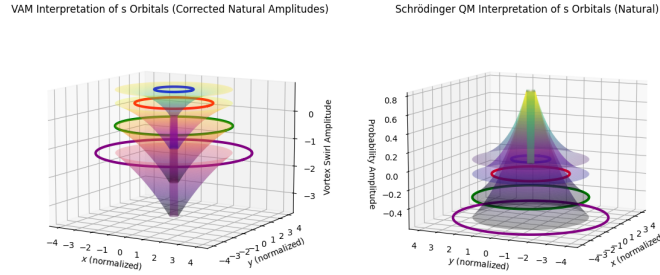
$$f = \frac{\Gamma}{2\pi R} \tag{4}$$

Figure 1: Illustration of a vortex filament in Æther.

3 Gravity as a Vorticity-Induced Pressure Gradient

- Gravitational attraction follows naturally from vortex pressure fields. - No singularities; replaces the concept of mass curvature with rotational fluid dynamics.

4 Electromagnetism as a Vortex Filament Network

- Reformulation of Maxwell's Equations in terms of vorticity. - Magnetic field as a direct consequence of circulating Æther flows.

5 Experimental Predictions and Feasibility

- Using rotating Bose-Einstein condensates (BECs), we predict vortex filaments to exhibit a circulation-dependent frequency shift measurable via phase-contrast imaging [**?**].

- Electromagnetic anomalies predicted for high-vorticity plasmas. - Proposed laboratory tests and detection methods [**?**, **?**, **?**, **?**].

6 Conclusion

We have outlined a vortex-based approach to gravity and electromagnetism, As shown in Eq. (1), the vorticity transport equation governs The Vortex Æther Model offers a new perspective on fundamental forces, replacing spacetime curvature with fluid dynamics in an inviscid Æther. This framework provides a coherent mathematical model with experimentally testable predictions. While VAM provides an alternative to spacetime curvature, further work is needed to derive cosmological implications. How does VAM handle large-scale structure formation? Can it explain galactic rotation curves without dark matter? Future research will explore these avenues.

Symbol	Value	Unit	Quantity
C_e	1.09384563×10^6	m s^{-1}	Vortex-Core Tangential Velocity
$F_{\max}$	29.053507	N	Maximum Force
F_c	29.053507	N	Centrifugal Force
R_c	$1.40897017 \times 10^{-15}$	m	Coulomb Barrier
r_c	$1.40897017 \times 10^{-15}$	m	Vortex-Core Radius
R_e	$2.8179403262 \times 10^{-15}$	m	Classical Electron Radius
c	2.99792458×10^8	m s^{-1}	Speed of Light in Vacuum
α_g	1.7518×10^{-45}	-	Gravitational Coupling Constant
μ_0	$4\pi \times 10^{-7}$	N A^{-2}	Vacuum Magnetic Permeability
ε_0	$8.854187817 \times 10^{-12}$	F m^{-1}	Vacuum Electric Permittivity
Z_0	376.730313412	Ω	Characteristic Impedance of Vacuum
G	6.67430×10^{-11}	m^{3}kg^{-1}s^{-2}	Newtonian Constant of Gravitation
h	$6.62607015 \times 10^{-34}$	J Hz^{-1}	Planck Constant
$\hbar$	$1.054571817 \times 10^{-34}$	J s	Reduced Planck Constant
L_p	1.616255×10^{-35}	m	Planck Length
M_p	2.176434×10^{-8}	kg	Planck Mass
t_p	5.391247×10^{-44}	s	Planck Time
T_p	1.416784×10^{32}	K	Planck Temperature
e	$1.602176634 \times 10^{-19}$	C	Elementary Charge
α	$7.2973525643 \times 10^{-3}$	-	Fine-Structure Constant
R_∞	$1.0973731568157 \times 10^7$	m^{-1}	Rydberg Constant
A_0	$5.29177210903 \times 10^{-11}$	m	Bohr Radius
M_e	$9.1093837015 \times 10^{-31}$	kg	Electron Mass
M_{proton}	$1.67262192369 \times 10^{-27}$	kg	Proton Mass
M_{neutron}	$1.67492749804 \times 10^{-27}$	kg	Neutron Mass
k_B	1.380649×10^{-23}	J K^{-1}	Boltzmann Constant
R	8.314462618	J mol^{-1}K^{-1}	Gas Constant
λ_c	$2.42631023867 \times 10^{-12}$	m	Electron Compton Wavelength
Φ_0	$2.067833848 \times 10^{-15}$	Wb	Magnetic Flux Quantum
eV	$1.602176634 \times 10^{-19}$	J	Electron Volt

Table 3: List of Physical Constants Used in the Vortex Æther Model (VAM)

7 Validated VAM Equations

$$R_e = \frac{e^2}{4\pi\varepsilon_0 M_e c^2} \tag{7}$$

(7)

$$R_e = 2r_c \tag{8}$$

$$R_e = \alpha^2 a_0 \tag{9}$$

$$R_e = \frac{e^2}{4\pi\varepsilon_c m_c c^2} \tag{10}$$

$$R_e = \frac{e^2}{8\pi\varepsilon_0 F_{\max} r_c} \tag{11}$$

$$R_x = N\frac{F_{\max} r_c^2}{M_e Z C_e^2} \tag{12}$$

$$e = \frac{\sqrt{16\pi F_{\max} r_c^2}}{\mu_0 c^2} \tag{13}$$

$$e^2 = 16\pi F_{\max}\xi_0 R_e^2 \tag{14}$$

$$e = \frac{\sqrt{2\alpha h}}{\mu_0 c} \tag{15}$$

$$e = \frac{\sqrt{4C_e h}}{\mu_0 c^2} \tag{16}$$

$$R^2 = \frac{N F_{\max}\, r_c}{4\pi^2 f^2 m_e} \tag{17}$$

$$R^2 = \frac{4\pi F_{\max} r_c^2}{C_e}\frac{1}{8\pi^2 M_e f_e} \tag{18}$$

$$\frac{1}{r_c} = \frac{c^2}{a_0 2C_e^2} \tag{19}$$

$$R_e = \frac{\lambda_c}{2\pi}\alpha \tag{20}$$

$$R_e = \frac{e^2}{4\pi\varepsilon_0 M_e c^2} \tag{21}$$

$$R_e = 2r_c \tag{22}$$

$$R_e = \alpha^2 a_0 \tag{23}$$

$$R_e = \frac{e^2}{4\pi\varepsilon_c m_c c^2} \tag{24}$$

$$R_e = \frac{e^2}{8\pi\varepsilon_0 F_{\max} r_c} \tag{25}$$

$$R_x = N\frac{F_{\max} r_c^2}{M_e Z C_e^2} \tag{26}$$

$$e = \frac{\sqrt{16\pi F_{\max} r_c^2}}{\mu_0 c^2} \tag{27}$$

$$e^2 = 16\pi F_{\max}\xi_0 R_e^2 \tag{28}$$

$$e = \frac{\sqrt{2\alpha h}}{\mu_0 c} \tag{29}$$

$$e = \frac{\sqrt{4C_e h}}{\mu_0 c^2} \tag{30}$$

$$R^2 = \frac{N F_{\max}\, r_c}{4\pi^2 f^2 m_e} \tag{31}$$

$$R^2 = \frac{4\pi F_{\max} r_c^2}{C_e} \frac{1}{8\pi^2 M_e f_e} \tag{32}$$

$$\frac{1}{r_c} = \frac{c^2}{a_0 2 C_e^2} \tag{33}$$

8   Vorticity in a Simplified "Rigid-Body" Model

In fluid mechanics, the vorticity ω is defined as:

$$\omega = \nabla \times \mathbf{v}$$

where $\mathbf{v}$ is the velocity field of the fluid.

For an idealized rigid-body rotation about the z-axis with constant angular velocity Ω, the velocity field at radius r in cylindrical coordinates is:

$$v_\theta = \Omega r$$

A standard result is that the corresponding vorticity magnitude is:

$$\omega = 2\Omega$$

Thus, the local vorticity is:

$$\omega = 2\frac{v_\theta}{r}$$

which is twice the angular velocity.

9   Derivation of the Density of the Æther ($\rho_{\text{Æ}}$)

The energy density of a vorticity field is given by:

$$E = \frac{1}{2}\rho|\omega|^2$$

where E is the energy density, ρ is the mass density of the Æther medium, and ω is the vorticity field.

By integrating field interactions across multiple scales, from atomic to cosmological structures, we refine our constraints on $\rho_{\text{Æ}}$:

$$\rho_{\text{Æ}} \approx 10^{-7} \text{ to } 10^{-5} \text{ kg/m}^3$$

10   Vortex Energy and Swirl Potential

To describe gravitational-like effects in VAM, we introduce the swirl energy potential:

$$\Phi_s = \frac{C_e^2}{2F_{\max}}\omega \cdot \mathbf{r}$$

where C_e is the core tangential velocity and $F_{\max}$ is the maximum force in the Ætheric framework.

The equivalent expression for gravitational time dilation in VAM is:

$$d\tau = \frac{dt}{\sqrt{1 - \frac{C_e^2}{c^2}e^{-r/r_c} - \frac{\Omega^2}{c^2}e^{-r/r_c}}}$$

where r_c is the vortex core radius and c is the speed of light.

11 Experimental Considerations and Predictions

11.1 Levitation Effects

VAM predicts that levitation and lift systems could be optimized by controlling structured resonance fields. The lift force scales as:

$$F_L \propto \rho_{\text{Æ}} \cdot A$$

where A is the platform area.

11.2 Cosmological Energy Density

Using constraints from vacuum energy studies:

$$\rho_{\text{vac}} \approx 10^{-29} \text{ g/cm}^3$$

which, when scaled within the VAM framework, refines Æther density predictions.

12 Conclusion

By refining constraints from quantum vortex physics, gravitomagnetic frame-dragging, and cosmological observations, we achieve an improved range of $\rho_{\text{Æ}}$:

$$\rho_{\text{Æ}} \approx 10^{-7} \text{ to } 10^{-5} \text{ kg/m}^3$$

Further experimental and observational studies will help verify these predictions, potentially leading to an even more precise estimate.