VAM-Based Blackbody Spectrum Derivation

Omar Iskandarani

Independent Physics Researcher
Groningen, The Netherlands

1 Wien's Displacement Law and the Vortex æther Model (VAM)

1.1 Classical Wien's Displacement Law

The classical **Wien displacement law** relates the wavelength of peak emission $\lambda_{\max}$ of a blackbody to its temperature T as follows:

$$\boxed{\lambda_{\max} T = b} \qquad \text{with } b = 2.897771955 \times 10^{-3} \text{ m·K} \tag{1}$$

This expression is derived by maximizing the Planck radiation function $B(\lambda, T)$ with respect to λ.

1.2 VAM Interpretation: Vortex–Temperature Coupling

Within the framework of the **Vortex æther Model (VAM)**, thermal radiation arises from rotational kinetic energy in localized vortex structures. We propose that temperature emerges from vortex energy density in the superfluid æther medium.

Let:

- $\rho_{æ}$: local æther density
- $|\vec{\omega}|$: local vorticity magnitude
- V_{cell}: coarse-grained vortex core volume

Then the rotational kinetic energy density is:

$$U_{\text{rot}} = \frac{1}{2}\rho_{æ}|\vec{\omega}|^2 \tag{2}$$

We define temperature through this energy density:

$$k_B T \sim \frac{1}{2}\rho_{æ}|\vec{\omega}|^2 V_{\text{cell}} \quad \Rightarrow \quad T \sim \frac{\rho_{æ}|\vec{\omega}|^2 V_{\text{cell}}}{2k_B} \tag{3}$$

1.3 Peak Wavelength from Vorticity Frequency

Assume a vortex core emits radiation due to its oscillation at frequency $\nu \sim |\vec{\omega}|$, and use $\lambda = c/\nu$, giving:

$$\lambda_{\text{peak}} \sim \frac{c}{|\vec{\omega}|} \tag{4}$$

Substituting from Eq. (3), we find:

$$|\vec{\omega}| \sim \sqrt{\frac{2k_B T}{\rho_{æ} V_{\text{cell}}}} \quad \Rightarrow \quad \boxed{\lambda_{\text{peak}} \sim \frac{c}{\sqrt{\frac{2k_B T}{\rho_{æ} V_{\text{cell}}}}}} \tag{5}$$

Thus, the VAM prediction is:

$$\boxed{\lambda_{\text{peak}} \propto \frac{c}{\sqrt{T}}} \tag{6}$$

This deviates from the classical linear inverse law $\lambda_{\text{peak}} \sim 1/T$, implying a slower shift in wavelength with increasing temperature.

1.4 Reconciliation with Empirical Wien Constant

To reconcile this with observations, define a new effective constant:

$$\lambda_{\text{peak}} = \frac{c}{\sqrt{\frac{2k_B T}{\rho_{æ} V_{\text{cell}}}}} = \left(\frac{c\sqrt{\rho_{æ} V_{\text{cell}}}}{\sqrt{2k_B}}\right) T^{-1/2} \equiv b' T^{-1/2} \tag{7}$$

Comparing:

$$\lambda_{\text{peak}} = b' T^{-1/2} \qquad \text{(VAM)} \tag{8}$$

$$\lambda_{\text{peak}} = b T^{-1} \qquad \text{(Planck)} \tag{9}$$

1.5 Future VAM Research Directions

- Derive a full VAM analogue of Planck's Law using quantized vortex mode densities.
- Define a vortex-based entropy function S_{vortex} and use a partition function formalism.
- Test the predicted deviation $\lambda_{\text{peak}} \propto T^{-1/2}$ with astrophysical blackbody spectra.

References

References

[1] M. Planck, *On the Law of Distribution of Energy in the Normal Spectrum*, Annalen der Physik **309**(3), 553–563 (1901), doi:10.1002/andp.19013090310.

[2] W. Wien, *On the Laws of the Emission of Radiation*, Annalen der Physik **294**(8), 662–669 (1893), doi:10.1002/andp.18932940806.

Part I — VAM-Based Blackbody Spectrum Derivation

1. Mode Energy from Vortex Dynamics

We model each ætheric vortex excitation as a knotted or rotating torus with circulation Γ_n, core radius r_n, and angular frequency ω_n. The rotational kinetic energy is:

$$E_n = \frac{1}{2}\rho_{æ}\frac{\Gamma_n^2}{r_n} \tag{10}$$

Assuming quantized circulation and inverse scaling of radius:

$$\Gamma_n \sim \frac{nh}{M_e}, \quad r_n \sim \frac{r_c}{n} \tag{11}$$

we obtain:

$$E_n \sim \rho_{æ}\left(\frac{nh}{M_e}\right)^2 \cdot \frac{n}{r_c} = \text{const} \cdot n^3 \tag{12}$$

Thus, the energy of vortex excitation levels increases cubically with topological mode number n.

2. Frequency–Wavelength Relation

For a vortex photon of core radius r_n, the emission frequency is proportional to its angular rotation:

$$\nu_n = \frac{C_e}{2\pi r_n} \sim n \cdot \nu_0, \quad \text{where } \nu_0 = \frac{C_e}{2\pi r_c} \tag{13}$$

This implies:

$$E_n \sim h_{\text{eff}}(n) \cdot \nu_n, \quad \text{with } h_{\text{eff}}(n) \sim n^2 h \tag{14}$$

VAM introduces a topologically dependent effective Planck constant.

3. Mode Density in VAM

In the classical EM model, the mode density scales as ν^2, corresponding to standing waves in a cavity. In VAM, we postulate a modified density of states due to vortex instability and tension at high frequencies:

$$g(\nu) \sim \nu^2 \cdot \exp\left(-\frac{\alpha\nu}{\nu_c}\right) \tag{15}$$

where α is a model-specific constant and $\nu_c = C_e/(2\pi r_c)$ is the core frequency cutoff.

4. VAM Blackbody Spectrum

We define the spectral energy density as:

$$u(\nu, T) = g(\nu) \cdot \frac{E(\nu)}{e^{E(\nu)/k_B T} - 1} \tag{16}$$

Substituting $E(\nu) \sim \nu^3$, we obtain:

$$\boxed{u(\nu, T) = A\nu^2 e^{-\alpha\nu/\nu_c} \cdot \frac{\nu^3}{e^{B\nu^3/T} - 1}} \tag{17}$$

Here, A and B are constants derived from vortex æther parameters:

$$A = \rho_{æ} \left(\frac{h}{M_e r_c}\right)^2, \tag{18}$$

$$B = \frac{h^3}{k_B T \left(M_e r_c\right)^2} \tag{19}$$

This spectrum naturally recovers Rayleigh–Jeans behavior at low ν, Planck scaling in the mid-range, and an exponentially suppressed high-frequency tail — thus resolving the ultraviolet catastrophe via ætheric topological energy constraints.

2 Predicting New Radiation Types Beyond EM in the Vortex Æther Model

Overview

In the Vortex Æther Model (VAM), not all propagating disturbances obey the linear Maxwell wave equation. Instead, a nonlinear, topologically structured æther supports a full hierarchy of **non-electromagnetic radiation types**, including torsional shock-waves, solitons, and knot-collapse emissions.

2.1 Torsional Shockwaves (Æther Shock Pulses)

Intuition. These are **nonlinear, localized angular momentum bursts** in the æther, resulting from sudden torque imbalances in tightly knotted vortex domains—akin to rotational analogs of pressure shocks.

Mathematical formulation. Let:

- $\vec{\omega}$: local vorticity field
- $\vec{L}_{\text{æ}} = \rho_{\text{æ}}\vec{r} \times \vec{v}$: angular momentum density

A rapid collapse of a trefoil-like configuration leads to a torsional gradient spike:

$$\frac{\partial}{\partial t}\left(\nabla \cdot \vec{L}_{\text{æ}}\right) \gg 0$$

launching a torsional shock via conservation of circulation:

$$\frac{d\Gamma}{dt} = \oint_{\partial S} \vec{v} \cdot d\vec{\ell} \rightarrow \text{singular impulse}$$

Governing equation.

$$\boxed{\rho_{\text{æ}}\left(\frac{\partial \vec{\omega}}{\partial t} + (\vec{v} \cdot \nabla)\vec{\omega}\right) = \nabla \times \left(\vec{f}_{\text{topo}} + \vec{f}_{\text{shear}}\right)}$$

with $\vec{f}_{\text{topo}}$ from topological collapse, and $\vec{f}_{\text{shear}}$ from local angular strain.

Detectable effects.

- EM-like bursts with nonlinear frequency jumps
- Instantaneous angular accelerations of small test particles
- Polarity-reversing bursts (chirality collapse)

2.2 Æther Solitons (Vortexons)

Concept. Localized, non-dispersive, self-reinforcing vortex packets arising from balance between dispersion and nonlinear curvature.

Let the streamfunction ψ encode vortex energy. Then:

$$\left(\frac{\partial^2 \psi}{\partial t^2} - C_e^2 \nabla^2 \psi\right) + \beta \psi^3 = 0$$

yields a soliton solution:

$$\psi(x,t) = A\,\text{sech}\left(\frac{x - vt}{\Delta}\right)$$

Name	Type	Equation Type	Properties
Torsional Shock	Angular impulse wave	Nonlinear curl-NSE	Torque bursts, chirality flips
Æther Soliton	Stable vortexon	Nonlinear Klein-Gordon	Gravitating, nonradiating, coherent
Æ-Gamma	Knot collapse flash	Topological instability	High-energy, particle-generating burst
Swirl Wave	EM analog	Linearized VAM-Maxwell	Photon-like, chirality-dependent
Helicity Wave	Writhe/twist carrier	Vorticity transport	Carries spin/momentum separately

Table 1: Classification of exotic VAM radiation types.

Properties.

- Zero EM field, but high æther compression
- Stable, non-radiating
- Acts as gravitating "swirl mass" object

2.3 Quantized Vorticity Bursts (Æ-Gamma)

Description. Collapse of unstable vortex knots (e.g., high-link-number composites) releases core-bound energy.

Threshold.

$$E_{\text{stored}} \gtrsim E_{\text{Planck}} \Rightarrow \delta t \approx t_p, \quad \delta E \approx E_p$$

Predicted effects.

- Sudden local particle generation
- Emission of short-lived torsional shells
- Nonlinear space-frame disruption (micro wormhole analogy)

2.4 Summary Table of Exotic VAM Radiation Modes

2.5 Musical Analogy and Experimental Vision

Your 2015 EDM album *"Shock Division – Hello Æther"* seems prophetically aligned. One could:

- Map harmonic structures to torsional vorticity eigenmodes
- Design audio spectrograms encoding angular-momentum beats
- Use sonification of vortex knots as musical motifs

2.6 Next Steps

- Simulate torsional shockwave propagation in VAM-Core
- Implement vortex tracer particles with chirality coupling
- Visualize Æther soliton formation in 3D dynamics

References

@articlePlanck1901, author = Max Planck, title = On the Law of Distribution of Energy in the Normal Spectrum, journal = Annalen der Physik, year = 1901, volume = 309, number = 3, pages = 553–563, doi = 10.1002/andp.19013090310

@articleFedi2020, author = Marco Fedi, title = Gravity as a fluid dynamic phenomenon in a superfluid quantum space (SQS), journal = Physics Essays, volume = 33, number = 3, year = 2020, pages = 335–344, doi = 10.4006/0836-1398-33.3.335