*VAM Canon (v0.1)
Prepared for: Omar Iskandarani (Vortex Æther Model, VAM)
Date: 2025-08-22

1 Versioning

- This document is the single source of truth for core VAM definitions, constants, master equations, and notational conventions.
- Use semantic versions: vMAJOR.MINOR.PATCH (e.g., v1.2.0).
- Every paper/derivation should state the Canon version it depends on.

2 Core Postulates (VAM)

1. The universe is a 3D incompressible, inviscid superfluid æther with absolute time and Euclidean space.
2. Particles are knotted vortex solitons (closed, possibly linked/knotted filaments) in the æther.
3. Gravity is not spacetime curvature but swirl (structured vorticity fields) and pressure gradients; massive motion follows swirl-induced dynamics.
4. Local time-rate is set by tangential vortex motion: higher swirl reduces the local clock rate relative to asymptotic time.
5. Quantization arises from topological invariants (linking, writhe, twist) and circulation quantization of vortex filaments.
6. The æther supports bosonic unknotted excitations (e.g., photon-like), while chiral hyperbolic knots map to quarks; torus knots map to leptons, etc. (taxonomy documented separately).

3 Canonical Constants and Symbols

All symbols are dimensionally consistent and, unless stated otherwise, SI.

3.1 Fundamental (VAM-specific)

- Vortex tangential velocity: $C_e = 1.09384563 \times 10^6\ \mathrm{m\,s^{-1}}$
- Vortex-core radius: $r_c = 1.40897017 \times 10^{-15}\ \mathrm{m}$
- Æther fluid density ("vacuum" fluid): $\rho_{æ}^{(\mathrm{fluid})} = 7.0 \times 10^{-7}\ \mathrm{kg\,m^{-3}}$
- Æther core/mass density: $\rho_{æ}^{(\mathrm{mass})} = 3.8934358266918687 \times 10^{18}\ \mathrm{kg\,m^{-3}}$
- Æther energy density: $\rho_{æ}^{(\mathrm{energy})} = 3.49924562 \times 10^{35}\ \mathrm{J\,m^{-3}}$
- Maximum Coulomb force (VAM): $F_{æ}^{\max} = 29.053507\ \mathrm{N}$
- Maximum universal force (contextual): $F_{\mathrm{gr}}^{\max} = 3.02563 \times 10^{43}\ \mathrm{N}$
- Golden ratio: $\varphi = \frac{1+\sqrt{5}}{2} \approx 1.61803398875$

3.2 Universal

- Speed of light: $c = 299\,792\,458\ \mathrm{m\,s^{-1}}$
- Fine-structure constant: $\alpha \approx 7.2973525643 \times 10^{-3}$
- Planck time: $t_p \approx 5.391247 \times 10^{-44}\ \mathrm{s}$

Note: The local Python `constants_dict` used in simulations must mirror these values exactly; papers should quote the Canon version.

4 Master Equations (Boxed, Definitive)

4.1 Master Energy and Mass Formula

Define the amplified swirl energy for a coherent VAM volume V:

$$E_{\mathrm{VAM}}(V) = \frac{4}{\alpha\,\varphi}\left(\frac{1}{2}\,\rho_{æ}^{(\mathrm{fluid})}\,C_e^2\right)V \quad [\mathrm{J}] \tag{1}$$

Corresponding mass (strict SI mass):

$$M_{\mathrm{VAM}}(V) = \frac{E_{\mathrm{VAM}}(V)}{c^2} \quad [\mathrm{kg}] \tag{2}$$

Numerical prefactor (per unit volume):
$\frac{1}{2}\rho_{æ}^{(\mathrm{fluid})}C_e^2 \approx 4.1877439 \times 10^5\ \mathrm{J\,m^{-3}}$,

$\frac{4}{\alpha\varphi} \approx 3.3877162 \times 10^2$.
Thus, $\frac{E_{\text{VAM}}}{V} \approx 1.418688 \times 10^8\ \mathrm{J\,m^{-3}}$,
$\frac{M_{\text{VAM}}}{V} \approx 1.57850 \times 10^{-9}\ \mathrm{kg\,m^{-3}}$.

Usage: In derivations, treat the boxed forms as canonical. If a paper chooses to define mass directly via energy units, state the convention explicitly and reference this section.

4.2 Swirl Gravitational Coupling

$$G_{\text{swirl}} = \frac{C_e\, c^5\, t_p^2}{2\, F_{æ}^{\max}\, r_c^2} \quad (F_{æ}^{\max} = 29.053507\,\mathrm{N}) \tag{3}$$

Numerical evaluation: $G_{\text{swirl}} \approx 6.674302 \times 10^{-11}\ \mathrm{m^3\,kg^{-1}\,s^{-2}}$.

Canon note: This fixes which $F_{\max}$ is used (the Coulomb-scale $F_{æ}^{\max}$), ensuring exact numerical match to Newton's G.

4.3 Local Time-Rate (Swirl Clock)

$$dt_{\text{local}} = dt_{\infty} \sqrt{1 - \frac{\|\vec{\omega}\|^2\, r_c^2}{c^2}} \tag{4}$$

Alternative (historical, for traceability):

$$dt_{\text{local}} = dt_{\infty} \sqrt{1 - \frac{\|\vec{\omega}\|^2}{c^2}} \tag{5}$$

4.4 Swirl Angular Frequency Profile

$$\Omega_{\text{swirl}}(r) = \frac{C_e}{r_c} e^{-r/r_c} \tag{6}$$

On-axis core limit: $\Omega_{\text{swirl}}(0) = \frac{C_e}{r_c} \approx 7.76344 \times 10^{20}\ \mathrm{s^{-1}}$.

4.5 Vorticity Potential (Canonical Form)

$$\Phi(\vec{r}, \vec{\omega}) = \frac{C_e^2}{2\, F_{æ}^{\max}}\, \vec{\omega} \cdot \vec{r} \tag{7}$$

Dimensional remark: This potential's role is canonical within VAM; derivations using it must propagate units consistently within the VAM Lagrangian (Sec. 5).

5 Unified VAM Lagrangian (Definitive Form)

Let $\vec{v}$ be the æther velocity, $\rho = \rho_{æ}^{(\mathrm{fluid})}$ constant (incompressible), $\vec{\omega} = \nabla \times \vec{v}$, and p a Lagrange multiplier enforcing incompressibility.

$$\mathcal{L}_{\mathrm{VAM}} = \underbrace{\frac{1}{2}\rho\,\|\vec{v}\|^2}_{\text{kinetic}} - \underbrace{\rho\,\Phi(\vec{r},\vec{\omega})}_{\text{swirl potential}} + \underbrace{\lambda(\nabla\cdot\vec{v})}_{\text{incompressibility}} + \underbrace{\eta\,\mathcal{H}[\vec{v}]}_{\text{helicity/topological term}} + \underbrace{\mathcal{L}_{\mathrm{couple}}[\Gamma,\mathcal{K}]}_{\text{circulation \& knot invariants}} \tag{8}$$

- $\mathcal{H}[\vec{v}] = \int(\vec{v}\cdot\vec{\omega})\,dV$ (kinetic helicity) serves as the generator of topological constraints (coefficient η fixes units).
- $\mathcal{L}_{\mathrm{couple}}$ encodes coupling to quantized circulation Γ and knot invariants $\mathcal{K}$ (linking, writhe, twist), used to produce particle families.
- When deriving Euler–Lagrange equations, enforce $\nabla\cdot\vec{v} = 0$ and appropriate boundary terms for closed filaments.

Canon rule: Papers must either (i) use this Lagrangian verbatim, or (ii) state a justified variant and show equivalence in the weak/appropriate limit.

6 Notation, Ontology, and Glossary

- **Æther-Time (A-time):** absolute time parameter of the æther flow.
- **Chronos-Time (C-time):** asymptotic observer time (dt_∞).
- **Swirl Clock:** local clock with rate set by $\|\vec{\omega}\|$ per Sec. 3.3.
- **Knot Taxonomy:** leptons = torus knots; quarks = chiral hyperbolic knots (chirality encodes vortex time); bosons = unknots; neutrinos = linked knots.
- **Chirality (matter vs antimatter):** ccw $\leftrightarrow$ matter; cw $\leftrightarrow$ antimatter via swirl-gravity coupling.

7 Canonical Checks (What to Verify in Every Paper)

1. Dimensional analysis on every new term/equation.
2. Limiting behavior: low-swirl $\|\omega\| \to 0$ recovers classical mechanics/EM limits; large-scale averages reproduce Newtonian gravity with G_{swirl}.
3. Numerical validation: provide numerical prefactors using Canon constants; if additional constants appear, they must be added to Sec. 2.
4. Topology $\leftrightarrow$ quantum numbers mapping stated explicitly (which invariants, how normalized).
5. Citations for any non-original constructs (use BibTeX keys below).

8 Persona Prompts

Reviewer Persona

```
You are a peer reviewer for a VAM paper. Use only the definitions and constants in
```

Theorist Persona

```
You are a theoretical physicist specialized in the Vortex Æther Model (VAM). Base
```

Bridging Persona (Compare to GR/SM)

```
Work strictly within VAM Canon (v0.1). Compare [TARGET] to its GR/SM counterpart.
```

9 Session Kickoff Checklist

1. Start new chat per task; attach this Canon first.
2. Paste a persona prompt (Sec. 7).
3. Attach only task-relevant papers/sources.
4. State any corrections explicitly (they persist in the session).
5. At end, record Canon deltas (if any) and bump version.

10 Canon-Ready Citations (Skeleton)

Replace placeholders with your BibTeX keys; ensure each non-original equation/idea cites at least one primary source.

```
@article{Helmholtz1858,
  author  = {H. von Helmholtz},
  title   = {On Integrals of the Hydrodynamical Equations which Express Vortex-mot
  journal = {Philosophical Magazine},
  year    = {1858}
}

@article{Kelvin1867,
  author  = {W. Thomson (Lord Kelvin)},
  title   = {On Vortex Atoms},
  journal = {Proc. Royal Society of Edinburgh},
  year    = {1867}
}

@article{Moffatt1969,
  author  = {H. K. Moffatt},
  title   = {The degree of knottedness of tangled vortex lines},
  journal = {Journal of Fluid Mechanics},
  year    = {1969}
}

@article{Schrodinger1926,
  author  = {E. Schr{\"o}dinger},
  title   = {An Undulatory Theory of the Mechanics of Atoms and Molecules},
  journal = {Physical Review},
  year    = {1926}
}
```

10) Appendix: Canon Tables for Papers

10.1 Constants Table (paste-ready)

10.2 Boxed Canon Equations (paste-ready)

1. **Energy:** $\boxed{E_{\text{VAM}} = \frac{4}{\alpha\varphi}\left(\frac{1}{2}\rho C_e^2\right)V}$

Symbol	Meaning	Value	Unit
C_e	Vortex tangential velocity	1.09384563×10^{6}	$\mathrm{m\,s^{-1}}$
r_c	Vortex-core radius	$1.40897017 \times 10^{-15}$	m
$\rho_{æ}^{(\mathrm{fluid})}$	Æther fluid density	7.0×10^{-7}	$\mathrm{kg\,m^{-3}}$
$\rho_{æ}^{(\mathrm{mass})}$	Æther mass density	$3.8934358266918687 \times 10^{18}$	$\mathrm{kg\,m^{-3}}$
$\rho_{æ}^{(\mathrm{energy})}$	Æther energy density	$3.49924562 \times 10^{35}$	$\mathrm{J\,m^{-3}}$
$F_{æ}^{\max}$	Max. Coulomb force	29.053507	N
$F_{\mathrm{gr}}^{\max}$	Max. universal force	3.02563×10^{43}	N
α	Fine-structure constant	$7.2973525643 \times 10^{-3}$	—
φ	Golden ratio	1.61803398875	—
c	Speed of light	299792458	$\mathrm{m\,s^{-1}}$
t_p	Planck time	5.391247×10^{-44}	s

Table 1: Canonical constants for VAM (SI units unless stated).

2. **Mass:** $\boxed{M_{\mathrm{VAM}} = \dfrac{E_{\mathrm{VAM}}}{c^2}}$

3. G **coupling:** $\boxed{G_{\mathrm{swirl}} = \dfrac{C_e c^5 t_p^2}{2F_{æ}^{\max} r_c^2}}$

4. **Time-rate:** $\boxed{dt_{\mathrm{local}} = dt_{\infty}\sqrt{1 - \|\omega\|^2/c^2}}$

5. **Swirl profile:** $\boxed{\Omega_{\mathrm{swirl}}(r) = \dfrac{C_e}{r_c} e^{-r/r_c}}$

11) Change Log

- **v0.1 (2025-08-22):** Initial Canon with core postulates, constants, boxed master equations, Lagrangian, persona prompts, and session protocol; numerical prefactors added for Sec. 3.

12) v0.2 Delta — Corrections & Additions (2025-08-22)

12.1 Dimensional correction to Sec. 3.3 (time-rate law)

To enforce strict dimensional consistency, the time-rate must couple vorticity to a length scale (canonical choice: the core radius r_c) or, equivalently, to the local tangential speed $v_t = |\omega| \cdot r$:

- Canonical (evaluate at $r = r_c$):
  $dt_{\text{local}} = dt_\infty \sqrt{1 - (|\omega|^2 r_c^2)/c^2}$
  equivalently $dt_{\text{local}} = dt_\infty \sqrt{1 - v_t^2/c^2}$ with $v_t := |\omega| r_c$.
- Using the profile $\Omega_{\text{swirl}}(r) = (C_e/r_c)\exp(-r/r_c)$ (Sec. 3.4), on-axis core limit gives $\Omega_{\text{swirl}}(0) = C_e/r_c$ and thus $dt_{\text{local}}(0) = dt_\infty \sqrt{1 - (C_e/c)^2}$.

Supersedes Sec. 3.3 formula (which lacked a length scale). Use this corrected form in all new derivations; the earlier expression is retained for traceability only.

12.2 Canon tolerances & symbol aliases

Numerical tolerances (for constant concordance):

- Relative: $\leq 1 \times 10^{-6}$ (1 ppm).
- Absolute near zero: $\leq 1 \times 10^{-12}$ in SI units.

Accepted symbol aliases (normalize to the left-hand form):

Canon	**Accepted aliases**
Ce	Ce, C_e
rc	rc, r_c
rho_ae$^{\text{(fluid)}}$	rho_ae (fluid), rho_vac, rho_fluid
rho_ae$^{\text{(mass)}}$	rho_ae (mass), rho_core, rho_mass
rho_ae$^{\text{(energy)}}$	rho_energy, u_ae (J m^{-3})
F_ae$^{\text{max}}$	Fae_max
F_gr$^{\text{max}}$	Fgr_max
varphi	phi, varphi

Table 2: Accepted symbol aliases for Canon constants.

Rule: manuscripts must present a single normalized constants table conforming to Sec. 10.1; aliases may appear in prose but equations must use Canon symbols.

12.3 Validation protocol updates

1. Dimensional sanity (strict): every term reduces to SI; for Sec. 4 ensure $\rho\Phi$ carries energy density ($\mathrm{J\,m^{-3}}$). If an intermediate potential uses non-standard units, introduce a calibration coefficient and state its units.
2. Equation normalization: when swirl/time enters, first reduce by $v_t = |\omega| r$ with $r = r_c$ unless a different physically motivated scale is justified.
3. Numerical reproduction: provide a short table with substituted Canon constants and results (3–5 s.f.).
4. BibTeX policy: any non-original idea/equation/comparison must include a BibTeX entry (add to Sec. 9).

12.4 Concept index (snapshot from VAM-rank-1 corpus)

Frequency across the six PDFs analyzed:

1. vortex-knot particles (1839)
2. time dilation / swirl clock (1062)
3. swirl gravity (964)
4. æther densities (860)
5. leptons as torus knots (660)
6. quarks as hyperbolic knots (647)
7. photon as vortex ring (306)
8. unified Lagrangian (70)
9. Hamiltonian (25)
10. Rodin/coil dynamics (1)

12.5 Simulator I/O stub (render-ready)


```
{
  "SceneSpec": {
    "background": {"rho_fluid": 7.0e-7, "Ce": 1.09384563e6, "rc": 1.40897017e-15},
    "fields": [ {"type": "swirl", "Omega_profile": "Ce/rc * exp(-r/rc)"} ],
    "objects": [
      { "type": "VortexKnot", "knot": "T(2,3)", "circulation": "Gamma0",
        "core_radius": "rc", "constraints": ["incompressible", "quantized_circulat
    ]
  }
}
```


12.6 Change Log entry

- v0.2 (2025-08-22): Added dimensionally corrected time-rate law using r_c (Sec. 12.1), established tolerances and symbol aliasing (Sec. 12.2), tightened validation protocol (Sec. 12.3), recorded a concept index snapshot from the current corpus (Sec. 12.4), and included a render-ready SceneSpec stub for simulators (Sec. 12.5).

11 v0.3 Draft Delta — Core from VAM 0–4 (Einstein → Vortex Fluid)

Status: DRAFT (pending promotion to sections 1–5 after review)

11.1 Source batch (chronological TeX)

Parsed: `VAM_0--4_Einstein_to_Vortex_Fluid` (TeX-first corpus)
Artifacts indexed (TeX-aware): 2335 equation blocks; 268 constant definitions/assignments; 246 postulate-like sentences; structured outline per file.

11.2 Consolidated core postulates (canonical wording)

1. **Absolute time, Euclidean space (R^3).** A universal "clock field" defines a preferred foliation consistent with VAM's absolute æther time.
2. **Incompressible, inviscid æther.** Background medium supports ideal Euler dynamics; density $\rho_{æ}^{(\mathrm{fluid})}$ is constant at macroscales.

3. **Particles = knotted vortex solitons.** Matter is realized as closed, possibly linked/knotted filaments; bosons as unknotted excitations.

4. **Gravity = structured swirl.** Macroscopic attraction emerges from coherent vorticity fields and pressure gradients; Newton's G is recovered via G_{swirl}.

5. **Quantization from topology and circulation.** Discrete quantum numbers trace to linking/writhe/twist and circulation quantization.

6. **Kelvin–Helmholtz invariants govern dynamics.** Circulation conservation and helicity underpin stability, reconnection energetics, and decay.

These six are promoted to Canon §1 after approval. Existing §1 will be rephrased to this exact minimal set.

11.3 Canon conservation laws (add to §3: "Foundational identities")

- **Kelvin circulation (inviscid, barotropic):** $\frac{d\Gamma}{dt} = 0$ along a material loop.
- **Vorticity transport (Euler):** $\frac{\partial \vec{\omega}}{\partial t} = \nabla \times (\vec{v} \times \vec{\omega})$.
- **Kinetic helicity density:** $h = \vec{v} \cdot \vec{\omega}$; **Helicity invariant:** $H = \int (\vec{v} \cdot \vec{\omega})\, dV$ (up to reconnection events).

Rationale: These appear repeatedly across VAM 0–4 and are required to justify knot stability and reconnection phenomenology. They are background identities; use BibTeX keys in §9 (Helmholtz/Kelvin/Moffatt).

11.4 Key equations shortlist (from VAM 0–4)

- **Swirl profile:** $\Omega_{\text{swirl}}(r) = \frac{C_e}{r_c} \exp(-r/r_c)$ (consistent with Canon §3.4).
- **Time-rate (dimensionally corrected):** $dt_{\text{local}} = dt_\infty \sqrt{1 - |\omega|^2 r_c^2/c^2} = dt_\infty \sqrt{1 - v_t^2/c^2}$.
- **Mass/Energy:** $E_{\text{VAM}} = \frac{4}{\alpha\varphi} \left(\frac{1}{2} \rho_{æ}^{(\text{fluid})} C_e^2 \right) V$, $M = E_{\text{VAM}}/c^2$.
- **G coupling:** $G_{\text{swirl}} = \frac{C_e c^5 t_p^2}{2 F_{æ}^{\max} r_c^2}$.

- **Helicity/Lagrangian:** Canon §4 form with $H[\vec{v}] = \int(\vec{v} \cdot \vec{\omega})\, dV$ and incompressibility via $\lambda(\nabla \cdot \vec{v})$.

(Full ledger with file pointers is in the generated CSV: `equations_shortlist.csv`.)

11.5 Canon constants concordance (snapshot)

The TeX sources define/mention aliases for: C_e, r_c, $\rho_{æ}^{(\text{fluid—mass—energy})}$, α, c, t_p, φ, $F_{æ}^{\max}$, $F_{\text{gr}}^{\max}$.

Action: Enforce the v0.2 alias table (Sec. 12.2). Manuscripts must include a normalized constants table per Canon §10.1.

11.6 Organization rule for VAM parts (Canon policy)

Each VAM "part" must answer in its abstract:

1. **Unique role:** What principle or equation does this part introduce that no other part covers?
2. **Dependence:** Which Canon sections/parts are prerequisites?
3. **Promotion path:** Which equations/postulates are candidates to move into Canon §§1–5 after validation?

11.7 Promotion plan

- **Promote** §13.2 postulates to Canon §1 (replace/merge wording) after you approve.
- **Add** §13.3 conservation laws as Canon §3A ("Foundational identities").
- **Relabel** old §3.3 (time-rate) as "historical" and keep §12.1 as the operative law; mirror the operative law into §3 with r_c.
- **Append** a permanent "Chronology note" linking VAM 0–4 to the Canon (§0 Versioning → provenance).

11.8 Citations to add in §9 (BibTeX keys)

- `Kelvin1869` — Circulation theorem.
- `Helmholtz1858` — Vortex motion integrals.
- `Moffatt1969` — Helicity/topological knottedness.
  (Keep existing entries; ensure all non-original laws are cited.)

11.9 Generated indices for this batch (local paths)

- Outline (titles/sections): `vam_corpus_reports_vam0_4/outline.csv`
- Key equations (categorized): `vam_corpus_reports_vam0_4/equations_categorized.csv`
- Equations shortlist: `vam_corpus_reports_vam0_4/equations_shortlist.csv`
- Canon constants concordance: `vam_corpus_reports_vam0_4/canon_concordance.csv`
- Postulates shortlist: `vam_corpus_reports_vam0_4/postulates_shortlist.csv`

End of v0.3 draft delta.

12 VAM Canon v0.4 Delta: Derived Constants, Galactic Swirl Law, and Baryon Mass Map

12.1 Canon Identities (to be promoted to §3B)

- **Fine-structure constant from swirl speed:**

$$\boxed{\alpha = \frac{2C_e}{c}} \qquad \Longleftrightarrow \qquad \boxed{C_e = \frac{c\,\alpha}{2}}$$

Dimensionality: velocity ratio → dimensionless (OK). Numerical check (Canon values): $\alpha = 0.007297352557$.

- **Gravitational fine-structure constant:**

$$\boxed{\alpha_g = \frac{C_e^2 t_p^2}{r_c^2}}$$

(dimensionless); $\ell_p \equiv c\,t_p$, $\ell_p^2 = c^2 t_p^2$.

- **Equivalents for G:**

$$\boxed{G = \frac{\alpha_g c^3 r_c}{C_e M_e} = \frac{C_e c\,\ell_p^2}{r_c M_e}}$$

Using the VAM identity:

$$\boxed{M_e = \frac{2F_{æ}^{\max} r_c}{c^2}}$$

This equals the existing Canon coupling:

$$\boxed{G_{\text{swirl}} = \frac{C_e c^5 t_p^2}{2F_{\text{æ}}^{\max} r_c^2}}$$

Numerical check (Canon values): $G = 6.6743013 \times 10^{-11}\ \text{m}^3\,\text{kg}^{-1}\,\text{s}^{-2}$.

12.2 Galactic Swirl Law (Disc Kinematics)

A two-component velocity profile that captures solid-body rise and asymptotic flattening:

$$\boxed{v(r) = \frac{C_{\text{core}}}{\sqrt{1 + (r_c/r)^2}} + C_{\text{tail}}\left(1 - e^{-r/r_c}\right)}$$

Limits: $v(0) = 0$; $v(r \to \infty) = C_{\text{core}} + C_{\text{tail}}$. Small-$r$: core term $\sim (C_{\text{core}}/r_c)\,r$. Large-$r$: exponential approach governed by r_c.

12.3 Baryon Mass Relations (VAM Knot Map)

Let M_u, M_d denote the effective VAM up/down knot masses. Then:

$$\boxed{M_p = \varphi^{-2}\,3^{-1/\varphi}\,(2M_u + M_d)}, \qquad \boxed{M_n = \varphi^{-2}\,3^{-1/\varphi}\,(M_u + 2M_d)}$$

12.4 Added/Derived Constants (Append to §10.1)

Symbol	Meaning	Value	Unit
M_e	Electron mass (derived in VAM)	$\dfrac{2F_{\text{æ}}^{\max} r_c}{c^2} = 9.109383 \times 10^{-31}$	kg
ℓ_p	Planck length	$ct_p = 1.616255 \times 10^{-35}$	m
α	Fine-structure (derived)	$2C_e/c = 7.29735256 \times 10^{-3}$	—
α_g	Gravitational fine-structure	$C_e^2 t_p^2 / r_c^2 = 1.75181 \times 10^{-45}$	—

Table 3: Added/derived constants for VAM Canon v0.4

12.5 Dimensional Validations

- $[\alpha] = [\alpha_g] = 1$
- $[G] = \mathrm{L}^3\,\mathrm{M}^{-1}\,\mathrm{T}^{-2}$ from either boxed G identity

- $[v(r)] = \mathrm{L\,T^{-1}}$

*VAM Canon — v0.5 Selections (ready-to-merge)
Batch: VAM_9–15 (Spacetime, Dark Sector & Quantum Gravity)

G) Boxed selections from VAM 9–15 — to merge into Canon v0.5

G.1 Effective metric / line element (axisymmetric swirl)

Steady, incompressible, azimuthal drift $v_\theta(r)$ in cylindrical (t, r, θ, z):

$$\boxed{ds^2 = -\left(c^2 - v_\theta(r)^2\right) dt^2 + 2v_\theta(r) r\, d\theta\, dt + dr^2 + r^2 d\theta^2 + dz^2}$$

In the co-rotating frame $\theta' = \theta - \int v_\theta(r)\, dt/r$, the cross term diagonalizes locally:

$$\boxed{ds^2 = -c^2 \left(1 - \frac{v_\theta(r)^2}{c^2}\right) dt^2 + dr^2 + r^2 d\theta'^2 + dz^2}$$

This exposes the swirl-clock factor and matches Sec. 12.1/3.3 in the $v_\theta \ll c$ regime. Substitute your swirl law as needed, e.g. $v_\theta(r) = r\,\Omega_{\text{swirl}}(r)$ with $\Omega_{\text{swirl}}(r) = \frac{C_e}{r_c} e^{-r/r_c}$.

BibTeX (analogue/PG background): Unruh1981, Visser1998, Painleve1921, Gullstrand1922, Batchelor1967.

G.2 Swirl Hamiltonian density for Sec. 4 (dimensionally normalized)

Take $\rho = \rho_{æ}^{(\text{fluid})}$, $\vec{\omega} = \nabla \times \vec{v}$, λ for incompressibility. A quadratic, Kelvin-compatible kernel:

$$\boxed{\mathcal{H}[\vec{v}] = \frac{1}{2}\rho\|\vec{v}\|^2 + \frac{1}{2}\rho\ell_\omega^2\|\vec{\omega}\|^2 + \frac{1}{2}\rho\ell_\omega^4\|\nabla\vec{\omega}\|^2 + \lambda(\nabla\cdot\vec{v})} \qquad \ell_\omega := r_c$$

Units check: $[\rho\|\vec{v}\|^2] = \mathrm{J\,m^{-3}}$; since $[\omega] = \mathrm{s^{-1}}$, the coefficients ρ, ℓ_ω^2 and ρ, ℓ_ω^4 ensure the $|\omega|^2$ and $|\nabla\omega|^2$ terms also have energy-density units. In the $\ell_\omega \to 0$ limit this reduces to the bulk swirl energy.

(Optional minimal matter–swirl coupling, same section):

$$\boxed{\mathcal{H}_\psi = \frac{\hbar^2}{2m}\left\|\left(\nabla - i\,\frac{m}{\hbar}\vec{A}_{\rm swirl}\right)\psi\right\|^2 + U(|\psi|^2)} \qquad \vec{A}_{\rm swirl} := \chi\,\vec{v}$$

G.3 Dark-sector law beside $v(r)$ (Sec. 14.2)

Radial Euler balance (steady, no radial flow) yields

$$0 = -\frac{1}{\rho}\frac{dp_{\rm swirl}}{dr} + \frac{v(r)^2}{r} \qquad \Rightarrow \qquad \boxed{a_{\rm dark}(r) \equiv \frac{1}{\rho}\frac{dp_{\rm swirl}}{dr} = \frac{v(r)^2}{r}}$$

Equivalently as a pressure law paired with the swirl profile $v(r)$:

$$\boxed{\frac{dp_{\rm swirl}}{dr} = \rho\,\frac{v(r)^2}{r}} \qquad \Longrightarrow \qquad \boxed{p_{\rm swirl}(r) = p_0 + \rho\,v_0^2\,\ln\left(\frac{r}{r_0}\right)} \quad (\text{flat } v(r) \to v_0)$$

Sign convention: the inward centripetal requirement corresponds to an outward-rising pressure ($dp/dr > 0$) so that $-\nabla p/\rho$ supplies the inward acceleration.

G.4 Consistency vs Canon v0.1–v0.4

- Time-rate: metric's g_{tt} gives $dt_{\rm local}/dt_\infty = \sqrt{1 - v_\theta^2/c^2}$, consistent with Sec. 12.1 choice $v_t = |\omega| r$ at $r = r_c$.
- Galactic law: use Sec. 14.2 $v(r)$ in G.3 to obtain explicit $p_{\rm swirl}(r)$ in both core and tail limits.
- Dimensions: all boxed terms reduce to SI units with $\ell_\omega = r_c$ and $\rho = \rho_{\text{æ}}^{(\rm fluid)}$.

Ready to merge into Canon v0.5: place G.1 in Sec. 3A/Sec. 6, G.2 in Sec. 4 (Hamiltonian), and G.3 alongside Sec. 14.2.

v0.6 Delta — Conclusions from VAM 16–20

Scope. We consolidated the main outcomes of VAM-16–20 (Zero-Vorticity Line, photon/EM mapping, Kerr reinterpretation, vortex-string EFT, and Schrödinger hydrogen). Below are the boxed identities and consistency results that are ready for canonicalization (with dimensional and numerical checks). Items needing a policy decision are explicitly flagged.

C1) EM coupling emerges from core swirl pressure

Define the *swirl Coulomb constant* via the pressure integral over a spherical surface:

$$\boxed{\Lambda \;\equiv\; \int_{S_r^2} p_{\text{swirl}}\, r^2\, d\Omega \;=\; 4\pi\, \rho_{\text{æ}}^{(\text{mass})}\, C_e^2\, r_c^4}$$

Dimensions: $[\Lambda] = \mathrm{N\,m^2} = \mathrm{J\,m}$ (Coulomb constant units). *Identification:*

$$\boxed{\Lambda \;=\; \frac{e^2}{4\pi\varepsilon_0}} \qquad \text{(EM coupling).}$$

Numerics (Canon values): $\Lambda = 2.30707733\times10^{-28}\,\mathrm{J\,m}$, matching $e^2/(4\pi\varepsilon_0)$ to 10^{-7} relative. This promotes a tight constraint among $(\rho_{\text{æ}}^{(\text{mass})}, C_e, r_c)$ consistent with $\alpha = 2C_e/c$. **Status:** *Promote* as Canon identity in §3B and append Λ to the constants table.

Non-original comparison: Coulomb constant [1].

C2) Hydrogen Schrödinger equation with core softening

VAM replaces the Coulomb term by a swirl-induced softened potential

$$\boxed{V_{\text{VAM}}(r) \;=\; -\frac{\Lambda}{\sqrt{r^2 + r_c^2}} \;\xrightarrow{r \gg r_c}\; -\frac{\Lambda}{r}}$$

and the bound-state equation

$$\boxed{\left[-\frac{\hbar^2}{2\mu}\nabla^2 - \frac{\Lambda}{\sqrt{r^2 + r_c^2}}\right]\psi \;=\; E\,\psi}$$

recovers the textbook spectrum for $r \gg r_c$. **Bohr/Rydberg checks (H):** $a_0 = \hbar^2/(\mu\Lambda) = 5.29177262\times10^{-11}\,\mathrm{m}$, $E_1 = \mu\Lambda^2/(2\hbar^2) = 13.60569\,\mathrm{eV}$. Core softening gives nS shifts $\sim \mathcal{O}\big((r_c/a_0)^2\big) \approx 7.1\times10^{-10}$ (H), and $\sim \mathcal{O}(2.4\times10^{-5})$ for muonic H (using $\mu \approx 186\, m_e$), i.e. a ground-state scale $\sim 6\times10^{-2}\,\mathrm{eV}$ — a concrete experimental target.

Non-original equations: Schrödinger hydrogen and Coulomb limit [2, 1].

C3) Frame-dragging / off-diagonal metric term as circulation

The PG-type analogue line element already in Canon (§ G.1) implies the mixed term

$$\boxed{g_{t\theta}^{(\text{VAM})} \;=\; v_\theta(r)\, r \;=\; \frac{1}{2\pi}\,\Gamma_{\text{swirl}}(r)}$$

with $\Gamma_{\rm swirl}(r) = \oint v_\theta \, dl$ the azimuthal circulation at radius r. This is the precise VAM counterpart of GR's $g_{t\phi}$ frame-dragging structure for axisymmetric rotation, dovetailing with the Kerr reinterpretation draft.[1] **Status:** *Promote* the boxed relation as a corollary to § G.1.

Non-original background: analogue/PG metrics and Kerr solution [3, 4, 5, 6, 7].

C4) Hamiltonian/Lagrangian usage: $\rho^{(\mathbf{fluid})}$ vs $\rho^{(\mathbf{mass})}$

Across VAM-16–20 two distinct densities appear:

$$\begin{aligned}
&\text{Bulk swirl energetics (Canon §4, G.2):} && \frac{1}{2}\,\rho_{\text{æ}}^{(\text{fluid})}\,\|\vec{v}\|^2 \;+\; \frac{1}{2}\,\rho_{\text{æ}}^{(\text{fluid})}\,r_c^2\|\vec{\omega}\|^2 \;+\;\cdots \\
&\text{EM coupling (§ 12.5):} && \Lambda = 4\pi\,\rho_{\text{æ}}^{(\text{mass})}\,C_e^2\,r_c^4\,.
\end{aligned}$$

Conclusion (policy): retain $\rho_{\text{æ}}^{(\text{fluid})}$ in the *Hamiltonian kernel* for continuum energetics (Canon §4), and reserve $\rho_{\text{æ}}^{(\text{mass})}$ for *core/EM coupling* identities (§ C1). This resolves the apparent density "swap" without changing any numerics.

Non-original context: continuum energy density forms [9].

C5) Time-rate law: confirm r_c factor and note draft variance

Some 16–20 drafts reused the historical form $dt_{\rm local}/dt_\infty = \sqrt{1 - \|\omega\|^2/C_e^2}$. **Canon-consistent law (dimensionally correct):**

$$\boxed{\frac{dt_{\rm local}}{dt_\infty} \;=\; \sqrt{1 - \frac{\|\omega\|^2\,r_c^2}{c^2}} \;=\; \sqrt{1 - \frac{v_t^2}{c^2}}\,,\quad v_t := \|\omega\| r_c}$$

Action: keep only the r_c-normalized law in Canon (§ 12.1/§ 3.3); mark the non-normalized variant as deprecated.

C6) "Zero-vorticity line" claim: status and correction path

With the canonical profile $\Omega_{\rm swirl}(r) = \frac{C_e}{r_c} e^{-r/r_c}$ and $v_\theta = r\Omega$, the axial vorticity is

$$\omega_z(r) \;=\; \frac{1}{r}\frac{d}{dr}\big(r v_\theta\big) \;=\; 2\Omega(r) + r\,\Omega'(r)\,,$$

[1] In BL-like gauges one can factor c^2 to yield a dimensionless coefficient; the PG form used in Canon keeps $g_{t\theta}$ in velocity × length units, matching the analogue-gravity construction.

so $\omega_z(0) = 2\,C_e/r_c \neq 0$. **Conclusion:** the *"Zero-Vorticity Line"* is *not* satisfied by the current core law. Two consistent options: (i) *reinterpret* the phrase as a *null pressure-gradient axis* (keeping $\omega_z(0) \neq 0$), or (ii) *adopt* a modified core profile with $\Omega(r) \propto r$ as $r \to 0$ to enforce $\omega_z(0) = 0$. *Decision required* before promotion.

Non-original identities: vorticity in cylindrical coordinates [8].

C7) Vortex-string EFT mass functional (candidate form)

The VAM-20 EFT drafts propose a topological mass functional for a knotted core:

$$\boxed{m_K^{\mathrm{sol}} \;=\; \mathcal{C}_0 \left(\sum_i V_i\right) \rho_{\text{æ}}^{(\mathrm{fluid})} \,\frac{C_e^2}{c^2}\, \Xi_K\Big(\mathrm{Tw}, \mathrm{Wr}, \mathrm{Lk};\, \varphi\Big)}$$

where $\sum_i V_i$ is the effective core volume (possibly multi-tube), and Ξ_K is a dimensionless topological factor (*to be calibrated*, e.g. to the electron ring). **Status:** keep as *research* (not yet Canon); compatible with Canon energetics (§4) once $\mathcal{C}_0$ and Ξ_K are fixed.

Summary of promotions and open items

- **Promote now:** § C1 (Λ identity), § C2 (soft-core hydrogen), § C3 (circulation–$g_{t\theta}$ relation), and § C5 (time-rate with r_c).
- **Append to constants table:** $\Lambda = 4\pi\rho_{\text{æ}}^{(\mathrm{mass})} C_e^2 r_c^4$.
- **Keep research:** § C6 (zero-vorticity line — needs definition/profile choice), § C7 (vortex-string mass functional calibration).

References

[1] J. D. Jackson, *Classical Electrodynamics*, 3rd ed., Wiley, 1999.

[2] E. Schrödinger, "An Undulatory Theory of the Mechanics of Atoms and Molecules", *Phys. Rev.* **28**, 1049–1070 (1926). doi:10.1103/PhysRev.28.1049.

[3] P. Painlevé, "La mécanique classique et la théorie de la relativité", *C. R. Acad. Sci. Paris* **173**, 677–680 (1921).

[4] A. Gullstrand, "Allgemeine Lösung des statischen Einkörperproblems in der Einsteinschen Gravitationstheorie", *Ark. Mat. Astron. Fys.* **16**, 1–15 (1922).

[5] W. G. Unruh, "Experimental black-hole evaporation?", *Phys. Rev. Lett.* **46**, 1351–1353 (1981). doi:10.1103/PhysRevLett.46.1351.

[6] M. Visser, "Acoustic black holes: horizons, ergospheres and Hawking radiation", *Class. Quantum Grav.* **15**, 1767–1791 (1998). doi:10.1088/0264-9381/15/6/024.

[7] R. P. Kerr, "Gravitational field of a spinning mass as an example of algebraically special metrics", *Phys. Rev. Lett.* **11**, 237–238 (1963). doi:10.1103/PhysRevLett.11.237.

[8] G. K. Batchelor, *An Introduction to Fluid Dynamics*, Cambridge Univ. Press, 1967.

[9] L. D. Landau and E. M. Lifshitz, *Fluid Mechanics*, 2nd ed., Pergamon, 1987.

— Λ — Swirl Coulomb constant (EM coupling) — $4\pi\,\rho_{\text{æ}}^{(\text{mass})}\,C_e^2\,r_c^4 = 2.30707733\times10^{-28}$ — J·m —

$$\boxed{\Lambda \;=\; \int_{S_r^2} p_{\text{swirl}}\,r^2\,d\Omega \;=\; 4\pi\,\rho_{\text{æ}}^{(\text{mass})}\,C_e^2\,r_c^4 \;=\; \frac{e^2}{4\pi\varepsilon_0}} \quad [\text{units: J·m}]$$

$$\boxed{\left[-\frac{\hbar^2}{2\mu}\nabla^2 - \frac{\Lambda}{\sqrt{r^2+r_c^2}}\right]\psi = E\,\psi \;\xrightarrow{r\gg r_c}\; \left[-\frac{\hbar^2}{2\mu}\nabla^2 - \frac{\Lambda}{r}\right]\psi = E\,\psi}$$

Corollary (circulation–metric link). With azimuthal drift $v_\theta(r)$, the PG-type analogue metric implies

$$\boxed{g_{t\theta}^{(\text{VAM})} \;=\; v_\theta(r)\,r \;=\; \frac{1}{2\pi}\,\Gamma_{\text{swirl}}(r)}, \qquad \Gamma_{\text{swirl}}(r) := \oint v_\theta\,dl.$$

This is the VAM counterpart of GR frame-dragging ($g_{t\phi}$) for axisymmetric rotation.

amsmath, amssymb siunitx hyperref geometry physics bm upgreek graphicx margin=1in per-mode=symbol,round-mode=figures,round-precision=6

VAM Canon (v0.7-Extensions)

Canonical Enhancements from *Before-VAM-and-Experiments.zip* and *VAM-ONGOING-RESEARCHES.zip*

Omar Iskandarani

2025–08–22

Abstract

This document *extends* the **VAM Canon (v0.1)** with items that are ready for canonicalization, distilled from the two corpora of uploaded work: *Before-VAM-and-Experiments.zip* and *VAM-ONGOING-RESEARCHES.zip*. We add: (i) foundational conservation laws (Kelvin, vorticity-transport, helicity) as §3A, (ii) an effective metric and a circulation–metric link, (iii) a dimensionally normalized swirl Hamiltonian, (iv) a dark-sector pressure law aligned with flat rotation curves, (v) the *swirl Coulomb constant* identity Λ_{swirl} with hydrogen soft-core spectrum and numerical validation, and (vi) experimental validation protocols for $C_e = f\,\Delta x$ and for the swirl gravitational potential. Research-track notes from the blackbody/QED/knot-taxonomy files are included as non-canonical appendices.

Canon Delta Summary (Promote to Core)

1. **Foundational identities (§??).** Kelvin circulation, vorticity transport, and helicity invariants [?, ?, ?, 8, ?].

2. **Analogue/PG line element (§??).** Axisymmetric swirl metric with cross-term $g_{t\theta}$ and *corollary*: $g_{t\theta}^{(\text{VAM})} = r\,v_\theta(r) = \Gamma_{\text{swirl}}(r)/(2\pi)$ [5, 6, 3, 4, 7].

3. **Swirl Hamiltonian (§??).** Kelvin-compatible, dimensionally normalized kernel with $\ell_\omega = r_c$ and incompressibility constraint.

4. **Dark-sector pressure law (§??).** For steady azimuthal drift, $\frac{1}{\rho}\,p_{\text{swirl}}r = \frac{v(r)^2}{r}$ and $p_{\text{swirl}}(r) = p_0 + \rho v_0^2 \ln(r/r_0)$ for flat $v(r)$.

5. **Swirl Coulomb constant and hydrogen (§??).** $\Lambda_{\rm swirl} = 4\pi\rho_{æ}^{(\rm mass)} C_e^2 r_c^4$ and the soft-core potential $V(r) = -\Lambda_{\rm swirl}/\sqrt{r^2 + r_c^2}$, recovering Bohr and Rydberg limits [1, 2].

6. **Experimental protocols (§??).** Canon-ready protocols extracted from `appendix_C` and `appendix_D` files for validating C_e and the swirl potential.

13 Foundational Identities (Add as Canon §3A)

Let v be the æther velocity ($\nabla \cdot v = 0$), $\omega = \nabla \times v$. For inviscid, barotropic flow [?, ?, 8, ?]:

Kelvin circulation: $$\frac{d\Gamma}{dt} = 0, \quad \Gamma = \oint_{\mathcal{C}(t)} v \cdot d\ell. \tag{F1}$$

Vorticity transport: $$\omega t = \nabla \times (v \times \omega). \tag{F2}$$

Helicity: $$h = v \cdot \omega, \quad H = \int h\, dV \text{ (invariant up to reconnections). [?]} \tag{F3}$$

These underpin knotted-solition stability and reconnection energetics in VAM.

14 Axisymmetric Swirl Metric and Circulation Link

In cylindrical (t, r, θ, z) with steady azimuthal drift $v_\theta(r)$, adopt the Painlevé–Gullstrand analogue form [5, 6, 3, 4]:

$$ds^2 = -\big(c^2 - v_\theta(r)^2\big)\, dt^2 + 2\, v_\theta(r)\, r\, d\theta\, dt + dr^2 + r^2 d\theta^2 + dz^2. \tag{M1}$$

Co-rotating with $\theta' = \theta - \int v_\theta(r)\, dt/r$ gives

$$ds^2 = -c^2\left(1 - \frac{v_\theta(r)^2}{c^2}\right) dt^2 + dr^2 + r^2 d\theta'^2 + dz^2, \tag{M2}$$

so the swirl-clock factor is $dt_{\rm local}/dt_\infty = \sqrt{1 - v_\theta^2/c^2}$. *Corollary (frame-dragging analogue):*

$$g_{t\theta}^{(\rm VAM)} = r\, v_\theta(r) = \frac{1}{2\pi}\,\Gamma_{\rm swirl}(r), \qquad \Gamma_{\rm swirl}(r) := \oint v_\theta\, dl. \tag{M3}$$

15 Swirl Hamiltonian Density (Add to Canon §4)

With $\rho = \rho_{æ}^{(\text{fluid})}$, $\omega = \nabla \times v$, and Lagrange multiplier λ for incompressibility, a Kelvin-compatible, dimensionally normalized kernel is

$$\mathcal{H}[v] = \frac{1}{2}\rho \, \|v\|^2 + \frac{1}{2}\rho \, \ell_\omega^2 \, \|\omega\|^2 + \frac{1}{2}\rho \, \ell_\omega^4 \, \|\nabla\omega\|^2 + \lambda(\nabla \cdot v), \qquad \ell_\omega := r_c. \tag{H1}$$

All terms carry units of energy density ($\mathrm{J\,m^{-3}}$). In the $\ell_\omega \to 0$ limit this reduces to the bulk swirl energy used in Canon v0.1.

16 Dark-Sector Pressure Law (Place next to galactic $v(r)$)

For steady, purely azimuthal drift $v(r)$ and no radial flow, the radial Euler balance gives

$$0 = -\frac{1}{\rho}\frac{dp_{\text{swirl}}}{dr} + \frac{v(r)^2}{r} \quad \Longrightarrow \quad \boxed{\frac{1}{\rho}\frac{dp_{\text{swirl}}}{dr} = \frac{v(r)^2}{r}}. \tag{D1}$$

For an asymptotically flat curve $v(r) \to v_0$, integration yields

$$p_{\text{swirl}}(r) = p_0 + \rho \, v_0^2 \, \ln\frac{r}{r_0}. \tag{D2}$$

Sign: outward-rising p produces inward acceleration $-\nabla p/\rho$.

17 Swirl Coulomb Constant and Hydrogen Soft-Core

17.1 Identity and dimensions

Define the *swirl Coulomb constant* via the surface integral of swirl pressure over the sphere S_r^2 (consistent with the experimental appendices and EM mapping notes):

$$\boxed{\Lambda_{\text{swirl}} \equiv \int_{S_r^2} p_{\text{swirl}} \, r^2 \, d\Omega \;=\; 4\pi \, \rho_{æ}^{(\text{mass})} \, C_e^2 \, r_c^4} \qquad [\Lambda_{\text{swirl}}] = \mathrm{J\,m} = \mathrm{N\,m^2}. \tag{E1}$$

In VAM hydrogen, replace the Coulomb term by a softened potential

$$V_{\text{VAM}}(r) = -\frac{\Lambda_{\text{swirl}}}{\sqrt{r^2 + r_c^2}} \xrightarrow{r \gg r_c} -\frac{\Lambda_{\text{swirl}}}{r}. \tag{E2}$$

17.2 Schrödinger equation and recovery of textbook limits [2, 1]

The bound-state equation

$$\left[-\frac{\hbar^2}{2\mu}\nabla^2 - \frac{\Lambda_{\text{swirl}}}{\sqrt{r^2+r_c^2}}\right]\psi = E\,\psi \xrightarrow{r \gg r_c} \left[-\frac{\hbar^2}{2\mu}\nabla^2 - \frac{\Lambda_{\text{swirl}}}{r}\right]\psi = E\,\psi. \quad \text{(E3)}$$

Using $\mu \approx m_e$, the Bohr radius and ground energy are recovered with Λ_{swirl} in place of $e^2/(4\pi\varepsilon_0)$:

$$a_0 = \frac{\hbar^2}{\mu\Lambda_{\text{swirl}}}, \qquad E_1 = \frac{\mu\Lambda_{\text{swirl}}^2}{2\hbar^2}. \quad \text{(E4)}$$

Numerical validation (Canon constants). With $C_e = 1.09384563e6\, m/s$, $r_c = 1.40897017e - 15\, m$, $\rho_{æ}^{(\text{mass})} = 3.8934358266918687e18\, kg/m^3$:

$$\Lambda_{\text{swirl}} = 4\pi\,\rho_{æ}^{(\text{mass})}\,C_e^2\,r_c^4 = 2.3070773276484373e - 28\ J.m, \quad \text{(E5)}$$

$$a_0 = 5.2917726179579395e - 11\ m, \qquad E_1 = 2.1798719391487416e - 18\ J = 13.605690489359 \quad \text{(E6)}$$

These match the textbook hydrogen values to within numerical tolerance, validating the identification of Λ_{swirl}.

18 Experimental Protocols (Canon-ready)

18.1 Appendix C: Universality of $C_e = f\,\Delta x$ (metrology across platforms)

From `appendix_C_ExperimentalValidationOfVortexCoreTangientalVelocity.tex`: measure a natural frequency f and a spatial step Δx from standing/propagating modes; verify

$$\boxed{C_e = f\,\Delta x \approx 1.09384563e6\ m/s}. \quad \text{(X1)}$$

Platforms: magnet/electret domains, laser interferometry on coil-bound modes, and acoustic analogues. Require ppm-level agreement; report mean and standard deviation across platforms.

18.2 Appendix D: Swirl gravitational potential

From `appendix_D_ExperimentalValidationOfGravitationalPotential.tex`: infer $p_{\text{swirl}}(r)$ from centripetal balance (§??) and compare predicted forces with measured thrust or buoyancy anomalies in shielded high-voltage/coil experiments (geometry: starship/Rodin coils). Ensure dimensional consistency and calibrate only via Canon constants.

Policy Notes and Clarifications

Density usage. Use $\rho_{æ}^{(\mathrm{fluid})}$ in continuum energetics (§**??**); reserve $\rho_{æ}^{(\mathrm{mass})}$ for core/EM coupling identities (§**??**).

Time-rate law. Canon operative form (dimensionally correct): $dt_{\mathrm{local}}/dt_{\infty} = \sqrt{1 - \|\omega\|^2 r_c^2/c^2} = \sqrt{1 - v_t^2/c^2}$ with $v_t := \|\omega\| r_c$.

A Research Track (non-canonical yet)

A.1 Blackbody via Swirl Temperature (from `BlackBody_fromWein_toNewEM.md`)

Proposal. Define a swirl temperature T_{swirl} via local vortex energy density and map Wien/Planck spectra by substituting Λ_{swirl} in place of $e^2/(4\pi\varepsilon_0)$. Requires a precise constitutive link between T and $\|\omega\|^2$; cite [**?**, **?**].

A.2 QED–VAM Mapping Notes (from `QED_VAM_RESEARCH_NOTES.md`)

Sketch. Minimal coupling $\nabla \to \nabla - i\frac{m}{\hbar} A_{\mathrm{swirl}}$ with $A_{\mathrm{swirl}} = \chi\, v$ inside $\mathcal{H}$ (cf. (**??**)); action S parallels circulation Γ. Canonization deferred pending gauge-structure tests.

A.3 Knot Taxonomy Refinement

Use the Călugăreanu–White–Fuller relation $Lk = Tw + Wr$ [**?**, **?**] to sharpen torus/hyperbolic assignments, and to parametrize chirality (matter/antimatter) via sign of Tw.

Numerical Snapshot of Canon Identities

$$\alpha = \frac{2C_e}{c} = 0.007297352557148052, \quad G_{\text{swirl}} = \frac{C_e\, c^5 t_p^2}{2F_{\text{æ}}^{\max}\, r_c^2} = 6.674302004898925e - 11\ m^3\, kg^{-} \tag{9}$$

$$\Omega_{\text{swirl}}(0) = \frac{C_e}{r_c} = 7.763440655383073e20\ s^{-1}, \quad \Lambda_{\text{swirl}} = 2.3070773276484373e - 28\ J.m. \tag{10}$$

Change Log for v0.7-Extensions (2025-08-22). Added §3A identities; §**??** metric and circulation corollary; §**??** Hamiltonian; §**??** pressure law; §**??** with numerical validation; §**??** protocols; research appendices.