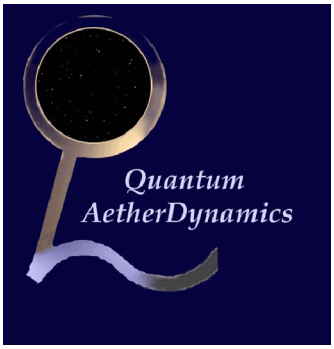

Quantum AetherDynamics Institute (QADI)

Quantifying Electric-Current Filaments in the Electric Universe with the Aether Physics Model (APM) and Quantum Measurement Units (QMU)

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Abstract

The Electric Universe (EU) community has long emphasized that many astrophysical structures are best described as electric-current systems: coaxial current tubes, filament bundles, and current-driven instabilities. The central barrier to broad scientific traction is not qualitative morphology but quantitative metrology: how to infer current, twist, shell structure, and power flow from remote observables without silently importing gage choices, hidden constants, or cancelation errors. This paper provides a ledger-closed route to that metrology by integrating Michael Clarage's observational current program with the Aether Physics Model (APM) and Quantum Measurement Units (QMU). The APM/QMU framework replaces permittivity/permeability bookkeeping with two geometric primitives—the Aether unit A_u and the Aether torsion curl—linked by the canonical closure $A_u \,\mathrm{curl} = {F_q}^2 \, {\lambda_C}^2$. With this closure, standard electromagnetic propagation constants become QMU identities, and the observational degeneracies highlighted by Clarage (return-current shells and polarization cancellation) become quantifiable invariants rather than qualitative caveats. We present a QMU-native inversion pipeline for force-free (Lundquist-type) filaments, define shell-count and cancelation diagnostics, and map EU filament phenomenology onto APM torsion-channel structure. SI correspondences are provided only in the appendix.

Keywords: Electric Universe; Birkeland currents; force-free fields; Lundquist filaments; torsion; QMU; APM; observational inversion

1 Audience and scope

This manuscript is written for (i) Michael Clarage and readers of Clarage (2005) who seek a rigorous path from observed morphology to quantitative current estimates, and (ii) the EU plasma community at large that wants a unit system and closure discipline capable of supporting falsifiable predictions across laboratory and astrophysical scales. The contribution is not a new qualitative narrative: it is a quantitative ledger that enables consistent inference and comparison.

Institutional attribution follows the QADI reference identity Thomson III (2025). QMU conversion benchmarks and distributed-charge rules are taken from Thomson (2025a,b).

2 Clarage's observational problem, restated as a metrology problem

Clarage's core point is operational: astrophysical currents can be physically large while appearing observationally small because (a) coaxial return-current structure cancels net magnetic signatures in many viewing geometries, and (b) remote diagnostics measure only partial projections of a 3D current system Clarage (2005). The EU community has treated this as a sociological/interpretive obstacle; here we treat it as a solvable metrology obstacle.

In other words, the question is not "do currents exist?" but:

1. What is the *least assumption* inversion from observables to a current-tube state?
2. What invariants diagnose shell cancellation and hidden current?
3. How do we compare in-situ and remote current in one algebra, from laboratory to galaxy, without re-tuning constants?

The APM/QMU ledger answers these by turning constants into identities and by forcing dimensional closure at every step.

3 QMU primitives and the canonical closure

QMU uses a small primitive set—electron mass m_e, Compton length λ_C, quantum frequency F_q, electrostatic charge-squared e^2, magnetic charge-squared ${e_{\text{emax}}}^2$, and the Aether unit A_u—from which derived units are constructed. The guiding discipline is ledger closure: every equation must close dimensionally in QMU.

A canonical sanity check is Ledger One, the Aether rotational self-identity,

$$A_u \,\text{curl} = {F_q}^2 \, {\lambda_C}^2,$$

which is the QMU-only form of electromagnetic propagation closure. Using the APM anchor $F_q \, \lambda_C = c$, Ledger One is recognized as

$$A_u \,\text{curl} = c^2.$$

This identity is the backbone for integrating EU electromagnetism with APM geometry: it decomposes the propagation constant into an Aether "stiffness" factor (A_u) and a torsional geometry factor (curl). This closure is the quantity that must be preserved when translating EU filament physics into an APM ledger.

4 Distributed charge, A_u, and why EU needs QMU

EU analyses often mix: (i) plasma-physics constitutive assumptions, (ii) electromagnetic constants (ε_0, μ_0), and (iii) geometric filament models. This mixture is not wrong, but it obscures what is assumed versus what is inferred, and it makes scaling across systems fragile.

The APM replaces this with a distributed-charge bookkeeping discipline. The key conversion rules and exceptions are codified in the charge conversion factor work Thomson (2025b). The practical message for EU metrology is:

You can write the filament inference problem entirely in terms of A_u *and* curl*, and then translate to SI only at the boundary.*

The resulting pipeline is robust against hidden constant choices and is naturally dimensionless once scaled by λ_C and F_q.

5 Electromagnetic correspondences expressed in APM geometry

The EU community frequently uses μ_0 and ε_0 explicitly in current inference (e.g., Ampère's law inversions). In QMU these appear as derived correspondences. Using the APM definition $A_u = 16\pi^2 k_C$ and the Maxwell propagation relation $c^2 = 1/(\mu_0 \varepsilon_0)$, Ledger One implies

$$\mu_0 = \frac{1}{4\pi \,\text{curl}}, \qquad \varepsilon_0 = \frac{4\pi}{A_u}. \tag{1}$$

Equation (1) is not an additional assumption; it is a consequence of the APM/QMU closure. It is the simplest explicit statement of "how APM quantifies the Electric Universe": the vacuum electromagnetic constants are geometric invariants of the Aether ledger.

Two immediately useful consequences follow.

First, Ampère-like inversions become *curl-weighted* rather than μ_0-weighted:

$$\nabla \times \mathbf{B} = \mu_0 \mathbf{J} \quad \Rightarrow \quad \mathbf{J} = 4\pi \,\mathrm{curl}\,(\nabla \times \mathbf{B}). \tag{2}$$

Second, the impedance and Poynting-flux bookkeepings can be written in $A_u, \mathrm{curl}, F_q, \lambda_C$ without introducing SI units. This matters because EU analyses often rely on power-per-length scalings of filaments; those can be expressed in APM as ledger identities rather than "plugging constants."

6 The force-free (Lundquist) filament as the EU reference state

Clarage emphasizes that many inferred current systems are coaxial and can support return-current shells Clarage (2005). The natural EU reference state for such a system is the cylindrical force-free condition

$$\nabla \times \mathbf{B} = \alpha \mathbf{B},$$

with α constant inside a domain. This is the Lundquist state and provides the canonical starting point for inversion because it has (i) a closed functional form, (ii) controllable shell structure (via Bessel zeros), and (iii) a physically meaningful twist parameter.

In QMU, α is naturally scaled as a dimensionless twist-per-Compton length:

$$\hat{\alpha} \equiv \alpha \, \lambda_C.$$

When expressed in QMU primitives, the "force-free closure" becomes an observationally testable constraint linking the measured pitch angle of polarization, the inferred axial field scale, and the shell count. This program is developed in detail in the QADI Lundquist filament work Thomson III (2026a).

6.1 Why shell counting matters (Clarage's cancellation) as a quantitative invariant

A coaxial current tube with alternating return-current shells can have large internal currents but a small net external magnetic signature. The observational question is then: how many shells ν are present, and what fraction of the internal current cancels?

In the QADI Lundquist treatment, shell count is not a vague morphology label; it is a measurable integer from Bessel-zero structure and multi-frequency polarization diagnostics. A key practical invariant is a cancellation diagnostic $\Pi(\nu)$ that scales monotonically with ν and can be extracted from stacked observations Thomson III (2026a). Clarage's qualitative warning becomes a number.

7 A QMU-native current inference: use circulation first, current second

Remote observations often provide constraints on **B** (via polarization, RM gradients, synchrotron emissivity, Zeeman in special cases) more directly than on **J**. The robust way to proceed is therefore to infer *magnetic circulation* first:

$$\mathcal{C}_B(r) \equiv \oint \mathbf{B} \cdot d\boldsymbol{\ell} \;=\; 2\pi r\, B_\phi(r).$$

In standard electromagnetism, $\mathcal{C}_B = \mu_0 I_{\rm enc}$. In QMU, with μ_0 replaced by (1), this becomes

$$I_{\rm enc}(r) \;=\; 4\pi\, \mathrm{curl}\, \mathcal{C}_B(r). \tag{3}$$

Equation (3) is the fundamental integration point for the EU community: it converts a directly inferable field-geometry quantity into a current estimate using only the Aether torsion curl. Return-current cancellation modifies the radial structure of $B_\phi(r)$ and therefore modifies $\mathcal{C}_B(r)$; it does not invalidate the inference method.

This approach also cleanly separates *what is measured* (circulation) from *what is inferred* (current), and it makes shell cancellation explicitly visible in $\mathcal{C}_B(r)$ rather than hidden in a guessed μ_0.

8 APM torsion channels: the physical meaning of EU filaments

EU phenomenology points to current-carrying filaments as organizing structures. The APM interpretation is stronger: a filament is an electromagnetic dressing of an Aether torsion channel. In that picture:

1. Aether torsion sets admissible filament topology (helical/force-free families).
2. Distributed charge determines which species populate which shells.
3. The observed filament bundle statistics trace the torsion state of the environment.

This mapping is the central conceptual integration, and it yields falsifiable predictions because torsion channels enforce integer-like constraints (shell counts, permitted twists, bundle partitioning).

The torsion-filament law work provides a quantitative link between enclosed mass and filament count $N(r)$, enabling EU current-filament language to be compared against gravitationally-inferred mass without invoking dark matter Thomson III (2026b). The helical-structure work then connects torsion to twist observables (RM gradients, polarization pitch, Doppler antisymmetry) Thomson III (2026d).

9 Transport and circuit correspondences in QMU

EU discourse often moves between circuit language (voltages, currents, power) and plasma language (fields, drifts, instabilities). The APM/QMU bridge is given by the QMU-closed transport formulation of Ohm's law Thomson III (2026c). The key integration point is that "effective resistivity" and "double-layer potentials" can be expressed as QMU composite identities, avoiding ambiguous mixtures of SI constants and plasma parameters.

Practically, this means EU circuit analogs can be promoted from heuristics to quantitative ledger statements, provided each step is written in QMU and closed with $A_u\,\mathrm{curl} = {F_q}^2\,{\lambda_C}^2$. When this discipline is followed, laboratory plasma experiments become scaling tests for astrophysical filaments rather than isolated demonstrations.

10 A minimal observational inversion pipeline (EU-ready)

This section summarizes a pragmatic, falsifiable workflow, designed to be used by EU observers and analysts.

Step 1: geometry and shell count

From filament width/brightness profiles and polarization structure, propose a cylindrical domain radius R and a shell count ν. Validate ν by checking whether multi-frequency polarization cancellation diagnostics $\Pi(\nu)$ behave monotonically as predicted Thomson III (2026a).

Step 2: twist parameter

Infer α (or $\hat{\alpha} \equiv \alpha\lambda_C$) from the observed pitch of polarization vectors, RM gradient sign structure, or Doppler antisymmetry if flow is present. Consistency checks are given in Thomson III (2026d).

Step 3: circulation and enclosed current

Infer $B_\phi(r)$ (or bounds on it) and compute $\mathcal{C}_B(r) = 2\pi r B_\phi$. Then infer I_{enc} using (3). Report both $\mathcal{C}_B$ and I_{enc}; the former is closer to observation and is robust to shell modeling choices.

Step 4: power flow and stability

Use the inferred $\mathbf{E} \times \mathbf{B}$ structure and force-free constraints to bound Poynting flux. Compare to circuit-language power using QMU-closed Ohmic relations Thomson III (2026c). Stability diagnostics (kink thresholds, helicity constraints) are evaluated in torsion/helicity variables Thomson III (2026d).

11 Predictions and tests: where EU can make new measurements

The integration above yields concrete predictions that can be tested with existing data and with modest laboratory analog work.

11.1 Cancellation scaling with shell count

If coaxial return-current shells are present, polarization/RM observables should show a shell-count-dependent cancellation scaling consistent with $\Pi(\nu)$ as defined in Thomson III (2026a). Stacked-sample tests across frequencies can falsify (or validate) the shell-cancellation hypothesis.

11.2 Integer-like constraints on twist families

Torsion-channel dressing predicts that permitted twist families cluster in discrete bands once scaled by $\hat{\alpha} = \alpha\lambda_C$, because λ_C is the natural length scale of the Aether ledger. Observationally, this predicts that the distribution of inferred twists should be multi-modal rather than continuous when analyzed in QMU scaling.

11.3 Laboratory coaxial-filament analog

A direct EU/APM laboratory test is to build a controlled coaxial return-current configuration (e.g., a plasma column with imposed axial current and engineered return shells), measure polarization rotation and magnetic profiles, and test whether the inferred $\mathcal{C}_B(r)$ and $\Pi(\nu)$ match the QMU scaling. Because QMU scaling uses λ_C, F_q as primitives, the comparison should be possible via dimensionless groups without retuning constants.

12 Discussion: what this integration changes

Clarage's observational case becomes stronger when embedded in a closure ledger. The APM/QMU contribution is not primarily "new physics" but *better bookkeeping*: constants become identities, and degeneracies become diagnosable. For EU discourse, this has three practical outcomes:

1. Current inference is reframed around circulation and torsion, making cancellation explicit.
2. Filament morphology is linked to torsion-channel families, yielding discrete constraints.
3. Laboratory and astrophysical systems can be compared by dimensionless QMU groups.

The resulting program is falsifiable: shell-count invariants and twist-band clustering can be measured or refuted.

A SI bridging (for comparison only; not used in the main derivations)

This appendix records the minimal SI correspondences implied by the QMU ledger. The main text avoids SI by design.

Using $A_u = 16\pi^2 k_C$ and Ledger One $A_u \mathrm{curl} = c^2$, the Maxwell constants may be written as

$$\varepsilon_0 = \frac{4\pi}{A_u}, \qquad \mu_0 = \frac{1}{4\pi \mathrm{curl}},$$

and therefore $c^2 = 1/(\mu_0\varepsilon_0)$ holds identically.

If a current I_{enc} is desired in SI amperes, the required charge-basis conversions are governed by the distributed-charge conversion rules and benchmarks summarized in Thomson (2025b,a). In practice, the most robust observational report is $\mathcal{C}_B(r) = 2\pi r B_\phi$, from which I_{enc} follows once the charge basis is specified.

Acknowledgments

The Quantum AetherDynamics Institute (QADI) is a private 501(c)(3) research institute developing the Aether Physics Model (APM) and Quantum Measurement Units (QMU) Thomson III (2025). Publications and data are archived with DOIs in the AetherPhysics Zenodo community: zenodo.org/communities/aetherphysics.

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