The Maxwell Universe Research Program — A Logical Map

Section-by-Section Structure, Claims, Dependencies, and Status

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One-Sentence Summary. A complete logical map of the Maxwell Universe Research Program, organizing its output documents by sections, claims, dependencies, and production status.

Abstract. This document provides a systematic, section-by-section map of the Maxwell Universe Research Program. Each output document is identified by its title and production status (published with DOI or in preparation). For every major section, we list its key claims, logical dependencies, consequences for later documents, and current status. The purpose is to preserve conceptual continuity, make dependencies explicit, and provide a stable reference point for extension and critique.

Keywords. Maxwell Universe, research program map, continuity equation, divergence-free flow, electromagnetic foundations, topology, minimal dynamics

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This document serves as a **conceptual checkpoint** for the Maxwell Universe Research Program.

It does not introduce new results. It does not reinterpret existing ones.

Its sole purpose is to **preserve structure**: to record what has been established, how results depend on one another, and where the program remains open.

The map is organized **by document**, and within each document **by section**. For each section we record:

- the key claim,
- its logical dependencies,
- what it enables downstream,
- its production status.

1. Light Speed as an Emergent Property of Electromagnetic Superposition

DOI: https://writing.preferredframe.com/doi/10.5281/zenodo.18209801

1.1. Program role

Establishes that effective propagation speed is not a primitive constant, but an emergent property of electromagnetic superposition.

1.2. Maxwell theory and superposition

Key claim Maxwell's equations are linear, but physical observables are quadratic. Linearity does not imply non-interaction.

Depends on - Linearity of Maxwell equations - Quadratic form of energy and phase observables

Enables - Phase delay without matter - Emergent refractive behavior

Status Resolved.

1.3. Quadratic observables and phase delay

Key claim Overlapping electromagnetic fields with different phases produce a total field whose evolution is slower than any individual component.

Depends on - Definition of electromagnetic energy density - Superposition of phase-shifted fields

Enables - Effective susceptibility without matter - Self-induced delay mechanisms

Status Resolved.

1.4. Effective light-speed variation

Key claim Local effective propagation speed depends on electromagnetic energy density and superposition structure.

Depends on - Previous sections - Operational definition of phase velocity

Enables - Refraction without matter - Field-only waveguiding - Basis for later self-confinement

Status Resolved.

2. String Theory Derivation in a Maxwell Universe

DOI: https://writing.preferredframe.com/doi/10.5281/zenodo.18249258

2.1. Program role

Shows how closed electromagnetic energy flow produces string- and membrane-like structure without introducing new objects.

2.2. Energy transport in Maxwell theory

Key claim Energy transport is intrinsic to Maxwell theory through the Poynting vector.

Depends on - Maxwell equations - Poynting theorem

Enables - Definition of flow velocity - Flow-first ontology

Status Resolved.

2.3. Toroidal organization and winding numbers

Key claim Closed divergence-free flows on a torus enforce integer winding numbers (m, n).

Depends on - Topology of the torus - Divergence-free tangent flows

Enables - Discrete global classification - Topological stability

Status Resolved.

2.4. Tension and inertia from energy flow

Key claim Localized circulating energy defines effective tension and inertial mass density.

Depends on - Energy density - Momentum density

Enables - Mass without particles - Energy–inertia equivalence

Status Resolved.

2.5. Stability and discrete excitation spectrum

Key claim Self-induced refraction and periodicity produce stable, discrete modes.

Depends on - Emergent refraction - Periodic boundary conditions

Enables - Particle-like persistence - Quantized excitations

Status Resolved.

3. Geometric Inertia: Mass as Trapped Energy

DOI: https://writing.preferredframe.com/doi/10.5281/zenodo.18249230

3.1. Program role

Derives inertial mass from geometry and circulation alone.

3.2. Geometry of constrained motion

Key claim Local propagation at the maximal rate combined with curved paths produces reduced effective translation.

Depends on - Euclidean geometry - Path length versus displacement

Enables - Subluminal effective motion without slowing local propagation

Status Resolved.

3.3. Momentum decomposition

Key claim Momentum splits into translational and circulating components; only the former contributes to net motion.

Depends on - Momentum density - Directional decomposition

Enables - Definition of inertial resistance

Status Resolved.

3.4. Mass from circulation

Key claim Inertial mass measures momentum trapped in circulation.

Depends on - Previous decomposition

Enables - Mass without matter

Status Resolved.

3.5. Topological stability

Key claim Knotted or wound circulation prevents continuous unwinding, stabilizing mass (self-sustaining electromagnetic knots.)

Depends on - Topology - Integer winding

Enables - Persistent objects

Status Resolved.

4. Defining Electromagnetic Fields from Continuity and Divergence-Free Structure

DOI: https://writing.preferredframe.com/doi/10.5281/zenodo.18269184

4.1. Program role

Clarifies how vector fields arise from scalar energy descriptions without adding new primitives.

4.2. Scalar configurations and spatial flow

Key claim A single scalar configuration by itself does not define flow; flow is defined by the spatial relation between scalar configurations under continuity.

Depends on - Continuity equation

Enables - Necessity of vectorial description

Status Resolved.

4.3. Divergence-free structure and circulation

Key claim Locally, divergence-free structure implies curl structure and circulation; globally, topology determines allowed circulation.

Depends on - Vector calculus identities - Topological conditions

Enables - Toroidal shells - Circulating energy structures

Status Resolved.

4.4. Representation versus dynamics

Key claim $(u, \mathbf{S})$ represent energy content and flow; $(\mathbf{E}, \mathbf{B})$ are one possible encoding. Dynamics must not be conflated with representation.

Depends on - Degree-of-freedom counting

Enables - Avoidance of false derivations

Status Resolved.

4.5. Reconstruction lemma

Key claim Given $(u, \mathbf{S})$ with $|\mathbf{S}| \leq cu$, at least one pair $(\mathbf{E}, \mathbf{B})$ exists reproducing them.

Depends on - Algebraic constraints - Energy and flux definitions

Enables - Field reconstruction - Interpretation of polarization

Status Resolved.

5. Maxwell Electromagnetism as the Minimal Dynamics of Divergence-Free Energy Flow

DOI: https://writing.preferredframe.com/doi/10.5281/zenodo.18264435

5.1. Program role

Explains why Maxwell's equations appear as the minimal evolution law compatible with divergence-free transport.

5.2. Continuity as kinematic

Key claim Continuity constrains accounting, not motion.

Depends on - Definition of continuity

Enables - Need for a dynamical closure

Status Resolved.

5.3. Failure of gradient-driven dynamics

Key claim Gradient-driven evolution generically creates divergence and cannot describe source-free transport.

Depends on - Vector calculus identities

Enables - Exclusion of algebraic-only evolution

Status Resolved.

5.4. Curl as minimal divergence-preserving operator

Key claim Curl-based evolution preserves divergence-free structure identically.

Depends on - Identity: divergence of a curl vanishes

Enables - Justification of curl dynamics

Status Resolved.

5.5. Dimensionality

Key claim Curl, circulation, and knots coexist only in three dimensions.

Depends on - Differential geometry - Knot theory

Enables - Dimensional selectivity

Status Resolved.

6. Canonical Glossary of Terms and Symbols

DOI: https://writing.preferredframe.com/doi/10.5281/zenodo.18272625

6.1. Program role

Fixes terminology and prevents conceptual regression.

Status Resolved, authoritative.

7. The Maxwell Universe Research Program

DOI: https://writing.preferredframe.com/doi/10.5281/zenodo.18274175

7.1. Program role

Defines stance, scope, and boundaries of the program.

7.2. Key clarifications

- Source-free does not deny localized structures.
- Charges and currents are configurations, not primitives.
- Stability arises from topology, not forces.
- Minimal does not mean unique or final.

Status Resolved.

8. Global program status

8.1. Fully established

- Refraction without matter
- Mass without particles
- Stability without forces (stability arising from circulation and topology rather than force balance)
- String- and membrane-like structure as effective descriptions
- Maxwell dynamics as minimal divergence-preserving evolution
- Vector fields arising from scalar relations under continuity

9. Closing note

This map is a **stability surface**.

It preserves what is logically forced, records what remains open, and prevents regression.

Nothing here is speculative. Nothing here is implicit.

Everything else in a Maxwell Universe builds from this.