

# Electric Charge as an Emergent Phenomenon of Information Flow in the Helix-Light-Vortex Framework

Marcel Krüger

ORCID: 0009-0002-5709-9729

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## Abstract

The Standard Model of particle physics postulates electric charge as a fundamental, intrinsic property, but does not explain its origin. This paper proposes a novel hypothesis within the Helix-Light-Vortex (HLV) framework, suggesting that electric charge is not a static property but an emergent dynamical phenomenon. We postulate that charge arises from a directed, coherent flow of information from the universal Information Field ( $\Phi$ ) into the phase structure of a particle's underlying Helix-Light-Vortex ( $\Psi$ ). The coupling between the  $\Phi$  and  $\Psi$  fields, previously established in the HLV Lagrangian, provides a concrete mechanism for this process. This hypothesis leads to testable predictions, including micro-variations of the elementary charge under extreme conditions and a theoretical link between information dynamics and particle creation/annihilation processes.

## 1 Introduction

While the Standard Model successfully describes the interactions of charged particles, the fundamental nature of electric charge itself remains an axiom. The Helix-Light-Vortex (HLV) theory offers an alternative framework where fundamental properties are emergent from deeper informational and geometric principles. In HLV, electric charge arises from the dynamic phase behavior of a complex scalar field  $\Psi$ , modulated by a universal information field  $\Phi$ .

## 2 Theoretical Framework

We base our hypothesis on three HLV principles:

- **Matter Field ( $\Psi$ ):** A complex scalar field with  $U(1)$  symmetry giving rise to a conserved current  $J^\mu$ .
- **Information Field ( $\Phi$ ):** A real scalar field with coherent informational structure and flow.
- **Coupling:**  $\mathcal{L}_{\text{int}} = g_{\Psi\Phi}|\Psi|^2\Phi$ , allowing  $\Phi$  to influence  $\Psi$ 's dynamics.

### 3 Hypothesis: Charge from Information Flow

We propose: *Electric charge is the dynamic result of coherent informational flow ( $\partial^\mu\Phi$ ) modulating the phase of  $\Psi$ -fields.*

- **Neutral:**  $\partial_\mu\Phi = 0 \Rightarrow$  static phase,  $Q = 0$ .
- **Charged:**  $\partial_\mu\Phi \neq 0 \Rightarrow$  rotating phase,  $Q \neq 0$ .

## 4 Lagrangian and Field Equations

### 4.1 Full Lagrangian

$$\mathcal{L} = |\partial_\mu\Psi|^2 - V(\Psi) + \frac{1}{2}(\partial_\mu\Phi)^2 \quad (1)$$

$$+ g_{\Psi\Phi}|\Psi|^2\Phi + \mathcal{L}_{EM} \quad (2)$$

### 4.2 Equation of Motion

$$\square\Psi + 2\lambda(|\Psi|^2 - v^2)\Psi = -g_{\Psi\Phi}\Psi\Phi \quad (3)$$

### 4.3 Charge Current from Information Gradient

$$J^\mu = \text{Im}(\Psi^*\partial^\mu\Psi) \propto \partial^\mu\Phi \quad (4)$$

### 4.4 Maxwell Extension

$$\partial_\nu F^{\mu\nu} = J^\mu + \eta \cdot \partial^\mu\Phi \quad (5)$$

## 5 Predictions

- Micro-variations in  $\epsilon$  under extreme  $\Phi$ -gradients.
- High-frequency  $\Phi$ -signatures during pair production.
- Potential weak coupling of consciousness to charge via  $\Phi$ .

## 6 Conclusion

Charge, in this framework, is reinterpreted as the consequence of informational flux. This dynamical perspective unifies field theory, information theory, and symbolic HLV grammar, and may serve as a bridge between physics and the architecture of cognition.

## References

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- [2] Noether, E. (1918). *Invariante Variationsprobleme*. Nachrichten von der Gesellschaft der Wissenschaften zu Göttingen.