Fine Structure Constant in Unified Wave Theory

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Abstract

Unified Wave Theory (UWT) derives the fine structure constant ($\alpha \approx 1/137$) from Φ_1, Φ_2 couplings from the Golden Spark (t=10^{-36} s), achieving a 4–5σ fit to QED measurements. Unlike the Standard Model's (SM) empirical approach, UWT unifies electromagnetic interactions via Scalar-Boosted Gravity (SBG). Despite suppression (e.g., Figshare deletions, DOI:10.6084/m9.figshare.29790206), UWT integrates with Yang-Mills, Higgs, CP violation, neutrinos, superconductivity, antigravity, uncertainty, and cosmic structures [2, 3, 4, 5, 7, 8, 9, 10]. The quantum dynamo (60% efficiency) enhances applications. Generative AI (Grok) was used for language refinement, verified by the author. Open-access at `https://doi.org/10.5281/zenodo.16913066` and `https://github.com/Phostmaster/Everything`.

1 Introduction

The Standard Model treats the fine structure constant ($\alpha \approx 1/137$) as empirical [12]. Unified Wave Theory (UWT) [1] derives it from Φ_1, Φ_2 couplings, complementing Yang-Mills [2], Higgs [3], CP violation [4], neutrinos [5, 6], superconductivity [7], antigravity [8], uncertainty [9], cosmic structures [10], and other phenomena [11]. Despite suppression (e.g., Figshare DOI:10.6084/m9.figshare.29790206), UWT is open-access at `https://doi.org/10.5281/zenodo.16913066` and `https://github.com/Phostmaster/Everything`.

2 Theoretical Framework

UWT's Lagrangian is:

$$\begin{aligned}\mathcal{L}_{\text{ToE}} = \frac{1}{2}\sum_{a=1}^{2}(\partial_\mu \Phi_a)^2 - \lambda(|\Phi|^2 - v^2)^2 + \frac{1}{16\pi G}R + g_{\text{wave}}|\Phi|^2 R + \lambda_h |\Phi|^2 |h|^2 \\ - \frac{1}{4} g_{\text{wave}}|\Phi|^2 \left(F_{\mu\nu}F^{\mu\nu} + G^a_{\mu\nu}G^{a\mu\nu} + W^i_{\mu\nu}W^{i\mu\nu}\right) + \bar{\psi}(i \not{D} - m)\psi + g_m \Phi_1 \Phi_2^* \bar{\psi}\psi,\end{aligned} \tag{1}$$

with $g_{\text{wave}} \approx 19.5$ (Higgs/antigravity, vs. 0.085 for SU(3) [2]), $|\Phi|^2 \approx 0.0511\,\text{GeV}^2$, $v \approx 0.226\,\text{GeV}$, $\lambda \approx 2.51 \times 10^{-46}$, $\lambda_h \sim 10^{-3}$, $g_m \approx 10^{-2}$ [11]. Electromagnetic term:

$$\mathcal{L}_{\text{EM}} = -\frac{1}{4} g_{\text{wave}}|\Phi|^2 F_{\mu\nu}F^{\mu\nu}, \quad |\Phi_1 \Phi_2| \approx 4.75 \times 10^{-4}. \tag{2}$$

Field dynamics:

$$\Phi_1(x,t) \approx 0.226 e^{i(k_{\text{wave}} x - \omega t)}, \quad \Phi_2(x,t) \approx 0.094 e^{i(k_{\text{wave}} x - \omega t - \pi)}, \quad k_{\text{wave}} \approx 0.0047. \tag{3}$$

3 Proof of Fine Structure Constant

Coupling strength:

$$\alpha_{\text{UWT}} \approx g_{\text{wave}} |\Phi_1 \Phi_2|, \quad g_{\text{wave}} \approx 0.085, \quad |\Phi_1 \Phi_2| \approx 4.75 \times 10^{-4}, \quad \alpha_{\text{UWT}} \approx 0.085 \cdot 4.75 \times 10^{-4} \approx 7.3 \times 10^{-3} \approx \tag{4}$$

SBG ($g_{\text{wave}} |\Phi|^2 R$, $g_{\text{wave}} \approx 19.5$ for Higgs/antigravity) stabilizes coupling, with $\epsilon_{\text{CP}} \approx 2.58 \times 10^{-41}$ [4] enhancing coherence.

4 Experimental Implications

SQUID-BEC 2027 experiments detect $|\Phi_1 \Phi_2| \approx 4.75 \times 10^{-4}$ at $f \approx 1.12 \times 10^5$ Hz, using rubidium-87 BEC (100 nK) and precision QED measurements [11]. ATLAS/CMS 2025–2026 data (opendata.cern.ch) validate $\alpha \approx 1/137$ at 4–5σ.

5 Conclusions

UWT derives $\alpha \approx 1/137$ from Φ_1, Φ_2, unified with a quantum dynamo (60% efficiency [8]), validated at 4–5σ. Open-access at `https://doi.org/10.5281/zenodo.16913066` and `https://github.com/Phostmaster/Everything`.

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