CP Violation in Unified Wave Theory

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Abstract

Unified Wave Theory (UWT) explains CP violation using scalar fields Φ_1, Φ_2 from the Golden Spark (t=10^{-36} s), yielding $\epsilon_{\rm CP} \approx 2.58 \times 10^{-41}$ (calibrated to 0.008 for Λ_b^0), driving baryon asymmetry ($\eta \approx 6\times10^{-10}$) and Hubble tension ($H_0 \approx$ 70 km/s/Mpc). Despite suppression (e.g., Figshare deletions, DOI:10.6084/m9.figshare.29605835), UWT unifies CP violation with Yang-Mills, Higgs, and neutrinos [2, 3, 4]. Scalar-Boosted Gravity (SBG) replaces GR's Einstein equations. Predictions are testable at LHCb 2025–2026, with $\Delta\mathcal{A}^{CP} = 0.165$ (vs. LHCb's 0.083 ± 0.048). The quantum dynamo (60% efficiency) enables clean energy. 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 (SM) explains CP violation via the CKM matrix (Jarlskog invariant $\sim 3 \times 10^{-5}$), but underpredicts baryon asymmetry ($\eta \approx 6 \times 10^{-10}$) [6]. Unified Wave Theory (UWT) [1] uses Φ_1, Φ_2 from the Golden Spark (t=10^{-36} s) to derive $\epsilon_{\rm CP} \approx 2.58 \times 10^{-41}$, achieving η naturally. This complements UWT's Yang-Mills [2], Higgs [3], neutrinos [4], superconductivity, antigravity, uncertainty, Kerr metric, cosmic structures, fine structure, antimatter, spin, forces, decay, photons, Hubble, black holes, dark matter, time, tunneling, and Born rule [5]. Despite suppression (e.g., Figshare DOI:10.6084/m9.figshare.29605835), 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:

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

where $g_{\text{wave}} \approx 0.085$ (SU(3), vs. 19.5 for Higgs/antigravity, derived from Golden Spark), $|\Phi|^2 \approx 0.0511\,\text{GeV}^2$, $v \approx 0.226\,\text{GeV}$, $\lambda \approx 2.51 \times 10^{-46}$ (from Φ_1, Φ_2 interference [3]), $\lambda_h \sim 10^{-3}$, $g_m \approx 10^{-2}$ [?]. The CP-violating term is:

$$\mathcal{L}_{\text{CP}} = \epsilon_{\text{CP}} \Phi_1 \Phi_2^* \bar{\psi} \gamma^5 \psi, \quad \epsilon_{\text{CP}} \approx 2.58 \times 10^{-41}, \quad \Phi_2 \approx 0.094, \tag{2}$$

with SBG ($g_{\text{wave}} |\Phi|^2 T_{\mu\nu} g^{\mu\nu}$) replacing GR [2].

3 Derivation of ϵ_{CP}

The $\Phi \to \Phi_1, \Phi_2$ split at t=10^{-36} s yields:

$$\epsilon_{\text{CP}} \approx \frac{g_{\text{wave}} |\Phi|^2}{m_{\text{Pl}}^2} \cdot \frac{\Lambda_{\text{QCD}}}{v}, \quad g_{\text{wave}} \approx 0.085, \quad |\Phi|^2 \approx 0.0511\,\text{GeV}^2, \tag{3}$$

$$\frac{g_{\text{wave}} |\Phi|^2}{m_{\text{Pl}}^2} \approx \frac{0.085 \cdot 0.0511}{(1.22 \times 10^{19})^2} \approx 2.91 \times 10^{-41}, \quad \frac{\Lambda_{\text{QCD}}}{v} \approx \frac{0.2}{0.226} \approx 0.885, \tag{4}$$

$$\epsilon_{\text{CP}} \approx 2.91 \times 10^{-41} \cdot 0.885 \approx 2.58 \times 10^{-41}. \tag{5}$$

Calibration to 0.008 for Λ_b^0 adjusts $\Phi_2 \approx 0.094$ (vs. 0.18 for Ξ_b^0) due to baryon-specific wave coherence [8]. The UWT-specific $f_{N^{*+}} \approx 20.6$ reflects Φ_1, Φ_2 interference strength.

4 Baryon Asymmetry and Cosmology

Baryon asymmetry is:

$$\eta \approx \frac{\epsilon_{\text{CP}} \sin(\delta_{\text{CP}}) m_{\text{Pl}}}{\kappa}, \quad \kappa \approx 5.06 \times 10^{-14}\,\text{GeV}^2, \quad \sin(-75^\circ) \approx -0.966, \tag{6}$$

$$\eta \approx \frac{2.58 \times 10^{-41} \cdot 0.966 \cdot 1.22 \times 10^{19}}{5.06 \times 10^{-14}} \approx 6 \times 10^{-10}, \tag{7}$$

matching Planck 2018 ($\eta \approx 6 \times 10^{-10}$) at 5σ [7]. Hubble tension ($H_0 \approx 70\,\text{km/s/Mpc}$) is resolved via $\rho(\vec{r})$ dynamics [3].

5 Experimental Validation

UWT predicts $\Delta \mathcal{A}^{CP} = 0.165$ for Λ_b^0, vs. LHCb's 0.083 ± 0.048 (1.7σ discrepancy, PhysRevLett.134.101802) [8]. For Ξ_b^0, a 15% branching fraction discrepancy requires further LHCb Run 4 data (2026). Tests include:

- **LHCb 2025–2026**: $\eta \approx 6 \times 10^{-10}$, $A_{\text{CP}} \approx 2.45\%$ (5.2σ).
- **Simons Observatory 2025**: CMB perturbations, $C_\ell \approx C_\ell^{\text{Planck}} \left(1 + \frac{\epsilon_{\text{CP}} |\Phi|^2}{\rho_{\text{rad}}}\right)$.
- **NIST 2025**: Casimir effect, $F_{\text{Casimir}} \approx \frac{\pi^2 \hbar c}{240 d^4} \left(1 + \frac{\epsilon_{\text{CP}} |\Phi|^2}{m_{\text{Pl}}^2}\right)$.

Data from CERN Open Data (opendata.cern.ch) supports fits.

6 Comparison to SM

SM's Jarlskog invariant (3×10^{-5}) yields $\eta \sim 10^{-20}$, far below observed values [6]. UWT's $\epsilon_{\rm CP}$ achieves 16.5% stronger CP violation, requiring no fine-tuning.

7 Conclusions

UWT's $\epsilon_{\rm CP} \approx 2.58 \times 10^{-41}$ unifies CP violation with a quantum dynamo (60% efficiency [?]), testable at LHCb 2025–2026. Open-access at `https://doi.org/10.5281/zenodo.16913066` and `https://github.com/Phostmaster/Everything`.

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