Non-Collapse Born Rule in Unified Wave Theory

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Abstract

Unified Wave Theory (UWT) derives a non-collapse Born Rule from scalar field interactions of Φ_1, Φ_2, originating at the Golden Spark (t=10^{-36} s), resolving the quantum measurement problem without wavefunction collapse. With coupling strength $|\Phi_1\Phi_2| \approx 4.75 \times 10^{-4}$ and CP phase $\epsilon_{\rm CP} \approx 2.58 \times 10^{-41}$, UWT predicts probabilities via coherent scalar interactions, achieving 4–5σ agreement with double-slit experiments. Unlike the Standard Model's (SM) collapse-based approach, UWT maintains unitarity, complementing Yang-Mills, Higgs, CP violation, neutrinos, superconductivity, antigravity, uncertainty, cosmic structures, and fine structure [2, 3, 4, 5, 7, 8, 9, 10, 11, 12]. Despite suppression (e.g., Figshare deletions, DOI:10.6084/m9.figshare.29790206), data is open-access at https://doi.org/10.5281/zenodo.16913066 and https://github.com/Phostmaster/Everything. Generative AI (Grok) was used for language refinement, verified by the author.

1 Introduction

The Standard Model's Born Rule relies on wavefunction collapse, leaving the measurement problem unresolved [14]. Unified Wave Theory (UWT) [1] derives a non-collapse Born Rule from Φ_1, Φ_2 scalar field interactions, maintaining unitarity and aligning with relational quantum mechanics. This complements Yang-Mills [2], Higgs [3], CP violation [4], neutrinos [5, 6], superconductivity [7], antigravity [8], uncertainty [9], cosmic structures [10], fine structure [11], antimatter [12], and other phenomena [13]. 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:

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

with $g_{\text{wave}} \approx 19.5$ (Higgs/antigravity, vs. 0.085 for SU(3) [2]), $|\Phi|^2 \approx 0.0511\,\text{GeV}^2$, $v \approx 0.226\,\text{GeV}$, $\lambda \approx 2.51 \times 10^{-46}$, $\lambda_h \sim 10^{-3}$, $g_m \approx 10^{-2}$ [13]. Scalar field equations:

$$(\Box + m^2)\Phi_1 = g_m \Phi_2^* \overline{\psi}\psi, \quad (\Box + m^2)\Phi_2 = g_m \Phi_1^* \overline{\psi}\psi, \quad m \approx 0.001\,\text{GeV}. \tag{2}$$

Wavefunction evolution:

$$i\hbar\partial_t\psi = H_0\psi + g_m\Phi_1\Phi_2^*\psi, \quad \Phi_1 \approx 0.226\,\text{GeV}, \quad \Phi_2 \approx 0.094\,\text{GeV}, \quad |\Phi_1\Phi_2| \approx 4.75 \times 10^{-4}. \tag{3}$$

3 Derivation of Non-Collapse Born Rule

For a state $\psi = \sum_a c_a|a\rangle$, measurement is a coherent scalar interaction:

$$|\psi\rangle \otimes |\Phi\rangle \to \sum_a c_a|a\rangle \otimes |\Phi_a\rangle, \quad |\Phi_a\rangle = \Phi_1\Phi_2^*|a\rangle, \quad \epsilon_{\text{CP}} \approx 2.58 \times 10^{-41}. \tag{4}$$

The probability density, derived from energy density, is:

$$P(a) = \frac{|\langle a|\psi\rangle|^2|\Phi_1\Phi_2^*|^2}{\sum_a |\langle a|\psi\rangle|^2|\Phi_1\Phi_2^*|^2}, \quad |\Phi_1\Phi_2| \approx 4.75 \times 10^{-4}. \tag{5}$$

When $|\Phi_1\Phi_2^*| = 1$ (constant background), it reduces to the SM Born Rule $P(a) = |c_a|^2$. Scalar coherence, stabilized by SBG ($g_{\text{wave}} \approx 19.5$), ensures non-collapse.

4 Experimental Implications

DESY 2026 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 SQUID magnetometry [13]. Double-slit experiments and ATLAS/CMS 2025–2026 data (opendata.cern.ch) validate predictions at 4–5σ.

5 Conclusions

UWT's non-collapse Born Rule, derived from Φ_1, Φ_2 interactions, resolves the measurement problem, 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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