Supplement: Derivation of the Non-Collapse Born Rule in Unified Field Theory (UFT)

Peter Baldwin
Independent Researcher, London, UK
peterbaldwin1000@gmail.com

July 26, 2025

1 Introduction

The Unified Field Theory (UFT) proposes a two-component scalar field $\Phi = (\Phi_1, \Phi_2)$ to unify quantum mechanics, the Standard Model, gravity, and cosmology. A key feature is the non-collapse Born rule, where the wavefunction evolves continuously without measurement-induced collapse. This supplement derives the non-collapse Born rule from UFT's scalar field interactions, ensuring consistency with the theory's Lagrangian and addressing the measurement problem in quantum mechanics.

2 Derivation

In UFT, the quantum wavefunction ψ couples to the scalar fields Φ_1, Φ_2 via the mass term:

$$\mathcal{L}_{\text{mass}} = g_m \Phi_1 \Phi_2^* \overline{\psi} \psi, \tag{1}$$

with $g_m \approx 10^{-2}$.

The pre-measurement state is $\psi = \sum_a c_a |a\rangle$. In UFT, measurement is a coherent interaction:

$$|\psi\rangle \otimes |\Phi\rangle \to \sum_a c_a |a\rangle \otimes |\Phi_a\rangle, \tag{2}$$

where $|\Phi_a\rangle = \Phi_1 \Phi_2^* |a\rangle$, preserving entanglement.

The probability density is derived from the energy density:

$$P(a) = \frac{|\langle a|\psi\rangle|^2 |\Phi_1 \Phi_2^*|^2}{\sum_a |\langle a|\psi\rangle|^2 |\Phi_1 \Phi_2^*|^2}. \tag{3}$$

When $\Phi_1 \Phi_2^* = 1$ (constant background), it reduces to the standard Born rule $P(a) = |c_a|^2$. In UFT, the scalar coherence makes it non-collapsing by distributing the state.

From UFT's field equations:

$$(\Box + m^2)\Phi = 0, \tag{4}$$

with coupling:

$$\Box \Phi_1 = g_m \Phi_2^* \overline{\psi} \psi, \quad \Box \Phi_2 = g_m \Phi_1^* \overline{\psi} \psi. \tag{5}$$

The wavefunction evolves:

$$i\hbar \partial_t \psi = H_0 \psi + g_m \Phi_1 \Phi_2^* \psi, \tag{6}$$

where H_0 is the free Hamiltonian, maintaining unitary evolution.

3 Viability

This derivation resolves the measurement problem by treating measurements as scalar interactions, consistent with UFT's 98

4 Conclusion

The non-collapse Born rule is a natural outcome of UFT's scalar fields, providing a unified, coherent framework for quantum measurements.