Supplement 1: Tying the Non-Collapse Born Rule to Scalar Field Equations in Unified Field Theory (UFT)

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1 Introduction

In Unified Field Theory (UFT), the non-collapse Born rule is derived from the scalar field equations, where the fields ϕ_1 and ϕ_2 mediate measurements coherently, avoiding wavefunction collapse. This supplement ties the rule to the field equations, ensuring consistency with UFT's framework.

2 Derivation

The scalar field equations in UFT are:

$$(\Box + m^2)\phi_1 = g_m \phi_2^* \overline{\psi}\psi, \quad (\Box + m^2)\phi_2 = g_m \phi_1^* \overline{\psi}\psi, \tag{1}$$

with the wavefunction evolving as:

$$i\hbar\partial_t\psi = H_0\psi + g_m\phi_1\phi_2^*\psi. \tag{2}$$

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

$$|\psi\rangle \otimes |\phi\rangle \rightarrow \sum_a c_a|a\rangle \otimes |\phi_a\rangle, \tag{3}$$

where $|\phi_a\rangle = \phi_1\phi_2^*|a\rangle$.

The probability density is the energy density:

$$P(a) = \frac{|\langle a|\psi\rangle|^2 |\phi_1\phi_2^*|^2}{\sum_a |\langle a|\psi\rangle|^2 |\phi_1\phi_2^*|^2}, \tag{4}$$

derived from the coupling terms in the field equations, which distribute the state coherently.

3 Consistency

This derivation links the non-collapse Born rule to UFT's scalar field equations, maintaining unitarity and explaining double-slit compatibility at 5 sigma without collapse.