
Section 1 Introduction: Rethinking Quantum Tunneling Through the CUWF Framework

Quantum tunneling is conventionally treated in standard quantum mechanics as a classically forbidden process in which a particle is nevertheless detected beyond a barrier. Although the formalism successfully predicts transmission probabilities, it does not provide a physical mechanism explaining how a particle traverses the barrier interior, why no stable detection occurs within that region, or why tunneling-time observables display paradoxical features such as the Hartman effect.

The Chayut Universe Wave Function (CUWF) approaches this problem from a different ontological basis. In CUWF, a particle is not a permanently existing object moving through space, but a collapse node: a temporary and localized stabilization of an underlying continuous wave defined on the Fundamental Wave Basin (FWB). The continuity belongs to the wave; the discreteness belongs to the node. Quantum tunneling must therefore be understood not as the passage of a persistent particle through a barrier, but as a structural reconfiguration of wave–node dynamics across an entropic landscape.

Within this framework, a barrier is reinterpreted not as a wall penetrated by a particle, but as a region of elevated structural entropy in which collapse-node stability becomes impossible. As the incoming wave interacts with the structured wave geometry of the barrier, destructive resonance raises local entropy and destabilizes the initial node. The tunneling event then proceeds as a three-phase process: node destabilization as the entropic landscape becomes unfavorable, wave-only propagation through the entropic peak, and node re-instantiation at the next admissible entropic minimum beyond the barrier.

This reinterpretation provides a unified physical explanation for several longstanding tunneling puzzles. It explains why no stable particle is detected within the barrier, why the event does not require the literal traversal of a persistent object, why tunneling-time paradoxes arise when node behavior is mistaken for particle transport, and why the observable post-barrier particle need not be treated as the same continuously traveling object in the classical sense.

The purpose of this paper is to establish the conceptual, mathematical, and physical foundations of quantum tunneling within the CUWF framework. The sections that follow develop the core CUWF ontology, define the barrier as an entropic structure, formalize the three-phase tunneling mechanism, derive its geometric and dynamical implications, and extend the analysis to experimentally testable predictions and many-body tunneling phenomena.