# Section 7 — Entropic Geometry of Quantum Tunneling in CUWF

Quantum tunneling in CUWF is not treated as a probabilistic jump, a stochastic penetration, or a violation of classical constraint. Rather, it is understood as the deterministic evolution of an entropic landscape that governs when a collapse node can exist, when it must lose stability, and where a new node may later reappear.

Where Section 6 established the formal variables of the theory, the present section develops their geometric meaning. The aim is to show how the structural entropy field organizes the full tunneling sequence: the incoming wave geometry before the barrier, the entropic ascent toward collapse, the wave-only interval across the entropic peak, the relaxation of the wave beyond the barrier, and the selection of the next admissible collapse node. In this sense, Section 7 provides the geometric interpretation of the formal structure developed in the previous section and deepens the three-phase mechanism introduced in Section 6.

## 7.1 Mapping the Entropic Landscape of a Barrier

Let the structural entropy field be written as $S(x,t) = S[\Psi(x,t)]$, where the composite wave contains contributions from the particle wave, the barrier wave, and the Fundamental Background Wave:

$$\Psi\_total = \Psi\_particle + \Psi\_barrier + \Psi\_FBW.$$

A collapse node $N(x,t)$ can exist only when the entropic geometry satisfies the conditions for a local minimum: $\partial S/\partial x = 0$ and $\partial^2 S/\partial x^2 > 0$. These conditions define a stable entropic well. Inside a barrier, by contrast, destructive interference distorts the composite wave and raises structural entropy so that $S\_inside > S\_before$ and $\partial^2 S\_inside/\partial x^2 < 0$. The barrier is therefore not a physical wall but a local entropic peak in which node stability becomes impossible.

Geometrically, the tunneling landscape may be understood as follows: before the barrier, the wave can support an ordered entropic well; within the barrier, the wave enters an entropic ascent and then an entropic peak; beyond the barrier, the wave may relax into a new admissible well. Tunneling is therefore the evolution of the structural entropy field across these regions.

### 7.2 The Collapse Threshold: When Node A Must Vanish

Node A exists at $x = x_A$ only so long as the local entropic curvature remains positive. As the wave approaches the barrier, the curvature evolves toward instability: $\partial^2 S/\partial x^2 \to 0^+$, then $\partial^2 S/\partial x^2 = 0$, and finally $\partial^2 S/\partial x^2 \to 0^-$. Once the curvature crosses through zero, the entropic well disappears and the node can no longer be sustained.

This defines the collapse threshold. If $C_S(x,t) = \partial^2 S/\partial x^2 \leq 0$, then node N(x,t) cannot exist as a stable collapse configuration. Collapse is therefore not random and not probabilistic in the CUWF account; it follows deterministically from the geometry of the structural entropy field.

### 7.3 Wave-Only Propagation Through the Entropic Peak

Once Node A collapses, the wave remains. The collapse operator removes the node, but not the underlying continuity of $\Psi$. This is the central distinction of CUWF: wave continuity is unconditional, whereas node continuity is conditional upon the existence of an entropic minimum.

Inside the barrier, the composite wave may be expressed schematically as $\Psi_{coupled}(x) = \Psi_{particle}(x) \oplus \Psi_{barrier}(x)$, where the coupling denotes geometric interference rather than simple linear addition. In this region, the wave is still present, but the node is absent. The barrier interior is therefore a wave-only domain. This explains why no stable particle detection occurs inside the barrier, why no ordinary trajectory can be assigned there, and why tunneling-time observables behave non-classically.

 

### 7.4 Boundary Geometry and Entropic Relaxation After the Peak

Beyond the barrier, destructive interference ceases and the composite wave begins to relax. Structural entropy decreases, so that $S_{after} < S_{inside}$, and entropic curvature tends back toward positive values. If the post-barrier landscape contains a new entropic minimum, then $\partial S_{after}/\partial x = 0$ and $\partial^2 S_{after}/\partial x^2 > 0$ once again become satisfied.

At that point, the collapse operator may act to produce a new node, $N_B$. This node is not the transport of Node A through the barrier; it is the next admissible collapse of the same continuous wave under the recovered geometric conditions. What appears experimentally as post-barrier particle persistence is, in CUWF, re-instantiation rather than preserved object identity.

### 7.5 Node Selection Rule Beyond the Barrier

The position of Node B is not determined by a hidden trajectory through the barrier, but by the structure of the entropic landscape after the barrier. In schematic form, the next node appears at $x_B = \arg\min_x S(x, t + \Delta t)$. The node therefore forms at the next admissible entropic minimum selected by the geometry of the wave.

This selection rule makes clear that the wave determines the location of re-instantiation. Momentum conservation remains compatible with this account because momentum is encoded in the continuous wave, not in the persistence of an individual node.

### 7.6 Mathematical Comparison: Standard QM and CUWF

The contrast with standard quantum mechanics can now be stated compactly. In standard QM, what tunnels is the wavefunction amplitude; in CUWF, the collapse node extinguishes while the wave continues. In standard QM, the barrier is represented as a potential $V(x)$; in CUWF, it is interpreted as an entropic peak generated by wave–wave interference. In standard QM, the barrier interior carries a non-zero probability amplitude for particle presence; in CUWF, node existence is forbidden there because the entropic curvature is negative.

The two frameworks also differ in how they treat continuity, identity, and tunneling time. In standard QM, continuity is attributed to the wavefunction and particle identity is often treated as effectively preserved through the event. In CUWF, continuity resides fundamentally in the wave on the FBW, while node identity is not transported through the barrier. Correspondingly, tunneling is not traversal but node extinction, wave-only continuity, and node re-instantiation.

### 7.7 Summary of Section 7

Section 7 has recast tunneling as a deterministic geometric evolution across the structural entropy field. A barrier is an entropic peak rather than a wall; node collapse occurs when curvature crosses through zero; the wave survives continuously across the high-entropy region; and a new node forms only where a post-barrier entropic minimum reappears.

In compact form, the tunneling sequence is N_A ⟶ ∅ ⟶ N_B, with wave continuity linking the entire process. This geometric interpretation resolves the classical image of a particle passing through a forbidden region and prepares the way for Section 7, where the experimental signatures and falsifiable predictions of the CUWF account are developed.