Appendices

Appendix 1 — Notation, Symbols, and Core Technical Terms in Paper A-6

This appendix collects the principal symbols, variables, and technical terms used in Paper A-6. Its purpose is practical: to provide a compact reference for readers who want to follow the formal discussion of tunneling without repeatedly searching earlier sections.

A1.1 Core Structural Terms

Term / Symbol	Meaning	Role in A-6
FBW	Fundamental Background Wave	The continuous wave substrate on which localized collapse-node structures emerge.
Collapse node	Localized stabilized configuration	The particle-like localized structure that exists only when local entropic geometry supports stability.
Wave-only regime	Node-free propagating regime	The tunneling phase in which continuity remains at the wave level while node-localization is absent.
Entropic geometry	Structural organization of the system	Determines whether node stability is possible or impossible in a given region.
Barrier as entropic peak	Region of node-instability	Replaces the usual image of a literal wall with a structural

		region in which stable localization fails.
QSC	Quasi-State Collapse	A CUWF transitional concept marking the destabilizing edge between stable node-localization and wave-only propagation.

A1.2 Common Variables and Functional Language

Symbol	Meaning	Interpretive Function
x_A, x_B	Initial and post-barrier node locations	Used to distinguish the pre-barrier node region from the post-barrier re-instantiation region.
Node A / Node B	Pre- and post-barrier localized nodes	Used to emphasize that continuity belongs to the wave process rather than to a single continuously transported node.
Ψ	Wave structure / wave state	Represents the continuing wave-level process across destabilization and re-instantiation.
E(x)	Entropic field or structural entropic condition	Used when referring to the structural geometry controlling localization possibility.

∇E	Entropic gradient	Used when directional structural change matters in the tunneling landscape.
$\nabla^2 E$	Entropic curvature	Used when discussing the existence or failure of local minima needed for stable node formation.
S_inside	Barrier-interior entropic condition	Used conceptually to denote the destabilizing entropic character of the barrier interior in A-6.
τ	Entropic or process parameter	Used when discussing ordered structural stages without assuming classical clock-time as fundamental.

A1.3 The Three-Phase Tunneling Structure

Paper A-6 ultimately stabilizes on a three-phase interpretation of tunneling:

Phase I — Node Destabilization

A pre-barrier collapse node approaches a region whose entropic geometry can no longer sustain localized stability. At the end of this phase, stable node-identity is lost.

Phase II — Wave-Only Propagation

The continuous wave process persists across the barrier region, but no stable particle-like node exists inside that region.

Phase III — Node Re-instantiation

When the wave reaches a region where a new stable entropic minimum becomes available, localization reappears as a new node.

A1.4 Reading Rule for A-6

A useful reading rule is this: whenever the paper refers to continuity, the reader should first ask whether the continuity belongs to the node or to the wave. In CUWF tunneling, continuity belongs fundamentally to the wave, while node-localization is conditional and may disappear and reappear.

Appendix 2 — Quick Reader Guide to the A-6 Mechanism

This appendix is designed for readers who understand the broad idea of tunneling in CUWF but want a compact guide to how the paper's mechanism should be read.

A2.1 What A-6 Is Trying to Replace

Paper A-6 is written against the classical intuition that a persistent particle-object must travel through a forbidden region in order to be found on the far side of a barrier. The paper rejects that intuition and replaces it with a structural sequence in which a localized node destabilizes, the wave persists, and localization reappears when structural conditions permit.

A2.2 What the Paper Means by 'No Particle Inside the Barrier'

This phrase should not be read as an observational inconvenience or a hidden-particle claim. It means that the barrier interior is structurally incapable of supporting a stable collapse node. The wave continues, but stable localized particle-like existence is absent in that region.

A2.3 What the Paper Means by 'Identity Is Not Transported'

The claim does not deny physical continuity. It denies the classical notion that continuity must belong to one continuously localized object. In CUWF, continuity belongs to the wave-structured process. The post-barrier node is related to the pre-barrier node through that process, but not through the uninterrupted travel of the same localized object.

A2.4 What QSC Is For

QSC is used to describe the transitional edge where stable node-localization is breaking down but the system has not yet been redescribed entirely in wave-only language. It is therefore a theory-internal transition concept, not a patch added from outside the CUWF framework.

A2.5 Why A-6 and A-4 Are Different

Paper A-4 explains regime-level stabilization and why classicality emerges. Paper A-6 explains a specific micro-mechanism—tunneling—and clarifies how that mechanism should be understood when the ontology is wave-geometric rather than classical-particle-based. A-4 is therefore about regime logic; A-6 is about tunneling mechanism.

Appendix 3 — Minimal Conceptual Toolkit for Reading the Tunneling Equations

This appendix gives a minimal interpretive toolkit for readers who want to follow the formal or semi-formal expressions in A-6 without over-reading them through classical language.

A3.1 Local Minimum

A stable collapse node requires a local entropic minimum. If no such minimum exists, localization cannot persist, even if the underlying wave process continues.

A3.2 Gradient versus Curvature

Gradient language is useful when the paper discusses directed structural change. Curvature language is useful when the paper discusses whether stable confinement or localization is possible. In tunneling, the crucial question is usually not where the wave is 'going' in a classical sense, but whether local curvature supports node existence.

A3.3 Wave Continuity versus Node Persistence

A-6 repeatedly asks the reader not to confuse these two. The wave can remain physically continuous while the node fails to persist. This distinction is the conceptual heart of the paper.

A3.4 Why Tunneling Time Becomes Difficult

If one asks for the time taken by a continuously localized particle to cross the barrier, one is already presupposing the ontology that A-6 rejects. The temporal structure of tunneling must instead be described in terms of destabilization, wave-only continuation, and re-instantiation.

A3.5 Why Macroscopic Objects Rarely Tunnel

The paper treats tunneling as a general structural possibility whose visible occurrence depends on how rigidly stabilized the collapse structure is. Microscopic systems are comparatively flexible; macroscopic systems are strongly reinforced and therefore overwhelmingly resistant to such reconfiguration.

Appendix: Human-Level Interpretation of Quantum Tunneling in CUWF

Quantum tunneling is one of the most counterintuitive ideas in modern physics. In ordinary human intuition, if an object is found on the far side of a barrier, we assume that it must have passed through the region in between. This expectation is deeply tied to the classical idea of motion: persistence of an object is usually imagined as continuity of the object itself.

The CUWF framework asks the reader to replace that classical intuition with a different one. In CUWF, continuity belongs fundamentally to the wave, not to the localized particle-like node. A particle is not treated as an independently enduring object, but as a temporary collapse node formed under suitable entropic and geometric conditions. Once this shift is accepted, tunneling no longer needs to be imagined as a particle secretly passing through a forbidden wall. It becomes a change in the structural organization of the wave, governed by the entropic geometry of the system.

This appendix is written to clarify that shift in intuition. It does not introduce new postulates beyond the main body of the paper. Instead, it explains in more accessible terms what the CUWF mechanism is claiming, why it differs from ordinary language about tunneling, and how its central ideas may be understood without relying on misleading classical imagery.

1. Why Quantum Tunneling Should Not Be Understood as Passage Through a Barrier

In everyday reasoning, movement means that the same thing persists while changing location. If a ball reaches the other side of a wall, we imagine a continuous path connecting the initial and final positions. Quantum tunneling seems to violate this expectation, which is why it is often presented as mysterious.

CUWF argues that this mystery arises partly from importing the wrong intuition into the phenomenon. The phrase "the particle passes through the barrier" suggests that the particle exists as the same localized entity before, during, and after the event. That is precisely the picture CUWF rejects.

According to CUWF, a particle is a collapse node: a localized stabilization of an underlying continuous wave. What persists fundamentally is not the node itself, but the continuity of the wave on the Fundamental Background Wave (FBW). When the wave encounters a barrier region whose entropic geometry cannot support node stability, the node ceases to exist as a stable localized object. The wave, however, continues. If the wave later reaches a region where the entropic geometry again permits stable localization, a new node forms.

From this point of view, tunneling is not passage through a barrier by a persistent particle-object. It is a structural sequence in which one localized node disappears, the underlying wave remains continuous, and a new localized node forms beyond the barrier. The apparent paradox comes from expecting continuity of the node, whereas CUWF places continuity in the wave.

2. What It Means That the Node Extinguishes but the Wave Survives

The statement "the node extinguishes, but the wave survives" is central to the CUWF explanation of tunneling, yet it can sound abstract on first reading. The easiest way to understand it is to separate two things that classical intuition tends to fuse together: localization and continuity.

Localization is what gives the appearance of a particle-like entity at a definite place. Continuity is what allows a process to remain physically connected across time and space. In classical thinking, these are usually attached to the same object. In CUWF, they are not. Localization belongs to the collapse node. Continuity belongs to the wave.

A collapse node exists only when the local entropic geometry supports a stable minimum. If that minimum disappears, the node can no longer remain localized. But this does not mean that the underlying physical process has been destroyed. It means only that the system can no longer support that process in particle-like form at that location.

The wave survives because, in CUWF, waves are the continuous entities. The node does not carry continuity; it expresses one local form of the continuous wave. Thus, when the node extinguishes near or within the barrier, there is no contradiction in saying that the physical continuity of the system remains intact. The continuity has simply ceased to appear as a stable localized node.

This is why CUWF describes tunneling as a transition from node-based localization to wave-only continuity and then back to node-based localization. The event is continuous as a wave-process, but discontinuous as a sequence of localized nodes.

3. Why the Barrier is Reinterpreted as an Entropic Peak

Another phrase that can seem abstract is the claim that the barrier should be understood as an entropic peak rather than as a wall. This is not merely a change of vocabulary. It is a change in what the barrier is taken to mean physically.

In ordinary tunneling language, the barrier is imagined as something like an obstacle that the particle somehow penetrates. In CUWF, that image is replaced by a structural one. The barrier is not primarily a thing to be crossed; it is a region whose entropic and geometric structure does not allow a stable collapse node to exist.

Calling it an entropic peak means that the local structural entropy has risen to a level where stable localization fails. The wave entering that region encounters destructive resonance, mismatch, and geometric distortion. These do not block the wave itself, but they do prevent the formation or persistence of a stable node.

This distinction matters. If the barrier is imagined as a literal wall, then tunneling remains puzzling because one must explain how the particle gets through it. If the barrier is understood as a region of node-instability, then the question changes. The issue is no longer how a particle penetrates the wall, but why localized stability disappears there and later reappears elsewhere.

In this sense, the barrier as an entropic peak is not a relabeling of the old picture. It is a redefinition of the mechanism. The barrier is the region where the ontology of node persistence breaks down, not the region through which a persistent object secretly travels.

4. Why Identity is Not Transported

Perhaps the most philosophically difficult statement in the CUWF picture is that identity is not transported through the barrier. This can sound, at first, as though the theory is abandoning the claim that the post-barrier particle is meaningfully related to the pre-barrier one. That is not the intended meaning.

What CUWF denies is not physical continuity, but continuity of classical object-identity. In classical intuition, identity is tied to the persistence of a localized object. If the same object is not continuously present, then we tend to say that identity has been broken. CUWF questions whether that classical criterion is fundamental.

In the CUWF framework, the more fundamental continuity lies in the wave process. The node is a temporary local expression of that process. Therefore, when Node A disappears and Node B later forms, the theory does not say that an unrelated event has occurred. It says that the underlying wave continuity has remained intact while the localized node configuration has changed.

So, is Node B "the same particle" as Node A? The CUWF answer is: not in the classical sense of a continuously traveling localized object, but yes in the deeper sense that both nodes belong to one continuous wave-structured process. What persists is not a miniature object carrying identity through space, but the continuity of the underlying wave dynamics from which localized particle-like events emerge.

This distinction is subtle, but it is essential. Without it, the theory would either collapse back into classical particle intuition or appear to sever all connection between pre- and post-barrier events. CUWF rejects both extremes. It retains physical continuity while relocating that continuity from the node to the wave.

5. Why No Stable Particle Appears Inside the Barrier

A natural question is whether CUWF simply says that the particle is inside the barrier but too difficult to detect. That is not the claim. The stronger claim is that no stable particle-like node exists there at all.

This follows directly from the entropic geometry of the barrier. A stable node requires an entropic minimum. Inside the barrier, the local curvature is such that no stable minimum exists. The node therefore cannot remain localized. What continues through the barrier is the wave, not the node.

This is why CUWF predicts the absence of stable particle detection inside the barrier. The claim is not merely epistemic, as though the particle were hiding from measurement. It is ontological within the theory: the barrier region is wave-populated but node-free.

That distinction is important for interpretation. If one imagines that the particle is "really there" but hidden, one has not left the classical picture. CUWF asks the reader to accept a more radical but cleaner conclusion: the barrier interior is a region where the wave continues but localized particle existence is structurally disallowed.

6. Why Tunneling Time Appears Paradoxical

Tunneling time has long been regarded as puzzling because classical intuition expects travel time to reflect the passage of an object through a region. If tunneling is imagined as a particle crossing a barrier, then one naturally asks how long that crossing takes. This produces well-known paradoxes, including the appearance that traversal time may become strangely insensitive to barrier width.

CUWF dissolves much of this puzzle by changing the underlying picture. If the node does not traverse the barrier, then the question "how long does the particle take to cross the barrier?" is already based on the wrong ontology. There is no continuously localized particle traveling through the forbidden region.

Instead, one must separate the timing of node existence from the continuity of wave propagation. The node disappears when stability is lost. The wave continues through the barrier. A new node appears when a new entropic minimum becomes available. The temporal structure of tunneling therefore reflects the dynamics of destabilization, wave continuity, and re-instantiation, not the travel time of a tiny object moving across an obstructed corridor.

From this viewpoint, tunneling-time paradoxes do not indicate that the particle performed an impossible journey. They indicate that the event was never, at a fundamental level, a journey of that type.

7. Why Tunneling Is Prominent in Microscopic Systems but Suppressed in Macroscopic Ones

A reader may reasonably ask: if tunneling is a general consequence of wave dynamics, why do macroscopic objects not routinely tunnel in visible ways? CUWF addresses this by emphasizing structural stability.

Microscopic systems are comparatively flexible in their collapse structure. Their localized states are easier to destabilize, reconfigure, and reinstantiate under the influence of entropic geometry. Macroscopic systems, by contrast, contain enormous numbers of interacting degrees of freedom. Their collapse structures are highly reinforced and strongly constrained. Even if tunneling remains possible in principle, it becomes overwhelmingly suppressed in practice.

This means that CUWF does not treat tunneling as a bizarre miracle reserved for quantum particles alone. Instead, tunneling is understood as a general structural possibility whose practical visibility depends on the scale, rigidity, and stabilization of the system. Microscopic systems reveal it because their collapse organization is comparatively delicate. Macroscopic systems conceal it because their structural reinforcement is too strong for such reconfiguration to occur in any accessible way.

This point is helpful for intuition because it prevents the reader from imagining that tunneling belongs to a completely alien realm disconnected from ordinary reality. In CUWF, it belongs to the same general ontology as other phenomena. What changes is not the law, but the scale and structural accessibility of the effect.

8. Closing Interpretive Summary

The purpose of this appendix has been to replace misleading classical intuitions with a more appropriate CUWF-based picture of tunneling. In the classical imagination, tunneling seems impossible because we assume that persistence requires continuity of the localized object itself. CUWF rejects that assumption.

The fundamental continuity of the process belongs to the wave. The localized particle-like node is secondary and conditional. When the entropic geometry of the barrier prevents node stability, localization fails, but continuity does not. The wave remains. When suitable conditions return beyond the barrier, localization reappears as a new node. The event is therefore not best understood as passage through a barrier by a persistent object, but as structural reorganization within a continuous wave process.

This reinterpretation also clarifies why the barrier is described as an entropic peak, why no stable particle appears inside it, why identity is not transported in the classical sense, why tunneling time becomes conceptually difficult in standard formulations, and why tunneling is visible in microscopic systems while being suppressed in macroscopic ones.

In this way, quantum tunneling in CUWF becomes less a violation of common sense than a correction of which version of common sense should be applied. Once continuity is assigned to the wave rather than to the node, the phenomenon becomes conceptually coherent: not easy in the classical sense, but no longer paradoxical in the same way.