The Duality Axiom: Consciousness, Collapse, and Single Reality

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A new Duality Axiom is proposed to solve the quantum measurement problem by defining consciousness as the mechanism for single reality selection.

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1. Introduction and Problem Definition

The foundational crisis in modern physics stems from the quantum measurement problem: the unexplained transition from a system existing in a multitude of possible states (superposition) to a single, definite outcome (actuality) upon measurement. Standard interpretations, such as the Copenhagen Interpretation, describe this transition but fail to provide a causal mechanism for the "collapse" of the wave function. The Many-Worlds Interpretation (MWI), while offering a deterministic view by proposing that all possibilities are realized in separate, parallel universes (plural actualities), creates a profound philosophical challenge known as the Single Reality Problem. This problem asks: If all outcomes are physically real, why do observers experience only one, singular, shared history?

This entry introduces the Duality Axiom, an ontological framework designed to bridge the gap between the infinite potential of quantum mechanics and the singular experience of classical reality. The Axiom's premise is that the selection of a single reality is not merely an observational artifact or a random event, but a necessary ontological act that imposes a dualistic constraint upon existence.

2. Critique of Existing Frameworks and the Ontological Gap

The development of the Duality Axiom rests on a rigorous critique of the current solutions offered by quantum theory. The Many-Worlds Interpretation posits that the universal wave function never truly collapses; instead, the measurement process causes the observer to become entangled with the system, splitting the universe into non-communicating branches corresponding to every possible outcome. While mathematically elegant, MWI's core failure lies in its inability to justify our unique, singular experience. The infinite proliferation of actualities, while coherent within the theory, lacks the mechanism for the ontological selection that defines the "here and now."

Furthermore, while decoherence is universally accepted as the physical process that rapidly transitions quantum coherence into classical appearance, it is not an ontological selector. Decoherence effectively isolates the quantum branches, ensuring they no longer interfere, thus generating the "plural actualities" predicted by MWI. However, decoherence offers no mechanism for annihilating all but one of these actualities to establish a single, shared reality (Existence). This conceptual gap—the transition from multiple decohered actualities to one observed reality—is the precise domain where the Duality Axiom applies.

3. The Duality Axiom and Core Terminology

The Duality Axiom asserts that the establishment of a singular, physical reality is dependent upon the defining relationship between Existence and its necessary opposite, Non-Existence.

The Axiom formalizes the consciousness-based collapse model by stating: To establish a single, shared reality (Existence), a conscious ontological act is required to select one actuality and relegate all others to Non-Existence to restore a unique, shared frame of reference.

To avoid terminological confusion that has plagued prior consciousness-based models, the Axiom strictly defines the relevant ontological states:

Potentiality: This refers to the physically real, pre-decoherence state of quantum superposition (e.g., an electron occupying all possible paths simultaneously). This is a coherent, blended form of reality, not Non-Existence.

Existence: This is the singular, definite, and shared physical outcome that is established by the conscious selection act. It is the reality we inhabit.

Non-Existence: This is the post-selection ontological status assigned to the unchosen, decohered actual branches. The function of the conscious act is to metaphysically annihilate all actualities not selected into the observer's Existence. It is crucial to note that Non-Existence is the fate of the discarded actuality, not the status of the initial Potentiality.

The philosophical underpinning is that just as one concept (e.g., Light) gains its definition only in contrast to its opposite (Darkness), the reality we experience (Existence) requires the definite relegation of all other possibilities (Non-Existence) to maintain its singular, verifiable nature.

4. The Role of Consciousness and Scope

Within this framework, consciousness is not merely an observer or a recording device; it functions as the ultimate ontological selector. It is the entity capable of applying the Duality Axiom, thereby performing the final, non-physical step in the measurement process that physics alone cannot complete.

This necessity directly addresses the scale of the collapse problem. If the universe had been able to maintain a state of global quantum coherence (universal Potentiality) up until the emergence of the first observer (a hypothetical scenario with no decoherence), the Axiom implies that this observer would have caused the Universal Collapse, defining the entire cosmic history into a single Existence.

However, due to the actual, rapid action of decoherence, the universal wave function has already been split into countless local, non-interfering actualities. Therefore, the conscious act is not one of initiating the split, but of performing the localized, final ontological selection—i.e., choosing among the already decohered branches—thereby preventing the infinite branching of reality and confirming the single, shared Existence we empirically verify. The Duality Axiom provides the necessary ontological closure missing from MWI, grounding the subjective experience of a single reality in a formal, dualistic constraint.

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