Theory of Spatial Materialization of Quantum Possibilities in an Infinite Space

Statement

In an infinite space, quantum possibilities do not need to collapse or split into parallel universes: they can be distributed simultaneously across different spatial regions, preserving coherence within the same physical framework.

Introduction

Note for PhilArchive: This article aims to contribute to interdisciplinary debates in the philosophy of science and cosmology. It proposes a conceptual reinterpretation of quantum possibilities and their relationship to infinite space, aiming to spark dialogue among physicists, philosophers, and mathematicians.

At the intersection of quantum mechanics and cosmology, fundamental questions arise about the nature of reality and how quantum possibilities are realized. Two primary interpretations, the Copenhagen interpretation and the Many-Worlds (Multiverse) theory, address the problem of quantum probabilities from opposing perspectives. While the former posits that quantum probabilities are abstractions that collapse into a single reality upon measurement, the latter suggests that all possibilities are realized in independent parallel universes. However, both interpretations leave a crucial question unanswered: what are the implications of infinite space for these possibilities? This theory introduces a novel perspective: in an infinite space, different quantum possibilities can materialize simultaneously in distinct spatial regions, eliminating the need for parallel universes.

Purpose of the Theory

The primary purpose of this theory is to propose a new conceptual framework for understanding how quantum possibilities are realized within the context of an infinite universe. By suggesting that different quantum possibilities can simultaneously materialize in distinct regions of infinite space, this theory aims to:

1. **Offer an alternative to existing interpretations:** Explore a vision that does not rely on single-probability collapse (Copenhagen) or separated parallel universes (Multiverse).
2. **Unify infinite space and quantum mechanics:** Relate the concept of infinite space to the inevitability of all possible configurations, proposing that these can coexist within a single framework.
3. **Inspire new questions and explorations:** Open an interdisciplinary dialogue spanning physics, cosmology, and philosophy to expand our understanding of quantum reality.
4. **Explore cosmological implications:** This theory offers a conceptual framework for reinterpreting phenomena such as the formation of large-scale structures in the universe, the distribution of dark matter, and quantum fluctuations in the cosmic microwave background. By considering that quantum probabilities are simultaneously realized in different spatial regions, it becomes possible to understand how the inevitable configurations of infinite space influence the organization of matter and energy on cosmological scales.

Premises

Quantum mechanics describes reality in terms of probabilities and superpositions. A quantum system can exist in multiple simultaneous states until a measurement is made, at which point the system collapses into a defined state. In the Copenhagen interpretation, these probabilities are mathematical tools that only materialize as a single reality upon observation. Conversely, the Many-Worlds theory posits that each quantum possibility is an independent reality realized in a parallel universe.

This theory introduces a third approach: in an infinite space, quantum probabilities do not need to collapse into a single reality or split into parallel universes. Instead, they can simultaneously manifest in different regions of infinite space. This premise is based on two key principles:

1. **Infinite space:** If space is infinite, configurations of matter and energy must inevitably repeat due to the finite number of possible combinations.
2. **Inevitable probabilities:** What is possible is not just probable but inevitable in an infinite framework, as any event with a non-zero probability must occur somewhere.

Development

In an infinite space, all possible configurations of a quantum system can simultaneously manifest, distributed across different spatial regions. This implies that quantum possibilities, traditionally conceptualized as abstract probabilities (Copenhagen) or as separate realities (Multiverse), can coexist within the same universe as independent materializations in distinct spatial locations.

Illustrative Example:

Consider a simple quantum system, such as an electron that can exist in two possible states: A or B. In an infinite space, these possibilities are not limited to abstract probabilities or reliant on parallel universes to coexist. Instead, both configurations can materialize simultaneously in different spatial regions, preserving the coherence of the quantum system within the infinite framework.

Extending this idea to macroscopic scales, consider the formation of cosmic structures. Different initial particle configurations in the early universe could generate an infinite variety of solar systems distributed throughout space. Some of these systems might exactly replicate the characteristics of our solar system, while others could be entirely distinct. These configurations do not require division into parallel universes; they simply find realization in different regions of infinite space.

- In the Copenhagen interpretation, the electron collapses into one of these states upon measurement, and the other state ceases to be relevant.
- In the Many-Worlds interpretation, the electron would exist in state A in one universe and in state B in another.
- In this theory, the electron could exist in state A in one region of infinite space and state B in another, simultaneously.

This simultaneous materialization does not require infinite time, as infinite space provides a framework allowing all possibilities to manifest simultaneously in different locations.

Implications

Relation to Copenhagen: The Copenhagen interpretation posits that quantum probabilities collapse into a single reality upon measurement. In an infinite space, these probabilities could materialize in different spatial regions, challenging the idea of a single collapse and suggesting that what we perceive as unique may merely be a local region of a broader reality.

Relation to the Multiverse: The Multiverse theory suggests parallel universes where each quantum possibility is realized. This theory eliminates the need for separate parallel universes, as possibilities can coexist within a single infinite universe, distributed spatially.

New Questions:

1. Could these regions of space be connected in some way through quantum principles such as entanglement?
2. How could we detect or measure these regions where different possibilities materialize?
3. How does this theory affect our understanding of causality and time?

Scientific Auto-Critique

Potential Refutations:

1. **Direct unobservability:** The hypothesis that different quantum possibilities materialize in distant regions of infinite space is highly speculative and currently lacks an experimental framework for verification. If these regions cannot be directly observed, the theory might be considered more philosophical than scientific. **Possible explanation:** Although these regions may not be directly observable, indirect evidence could be found in patterns of cosmological phenomena, such as the distribution of the cosmic microwave background or gravitational anomalies reflecting specific configurations of matter in distant regions.
2. **Spatial paradoxes:** The simultaneous coexistence of different configurations in an infinite space raises questions about current definitions of causality and continuity. How would these configurations interact or remain disconnected? **Possible explanation:** These configurations could be causally disconnected due to the limitations of the speed of light and the accelerated expansion of the universe, ensuring that these regions exist as independent systems without direct interaction.
3. **Limitations of infinity:** While the concept of infinite space is mathematically viable, there is no empirical evidence confirming that the physical universe is indeed infinite. If space is not infinite, the foundation of this theory collapses. **Possible explanation:** The theory does not strictly depend on literal infinite space; it could be adapted to an extremely large but finite universe, where probabilities still manifest in multiple configurations widely distributed.
4. **Compatibility with quantum mechanics:** This proposal requires a revision of fundamental quantum mechanics principles, which do not explicitly describe how probabilities could simultaneously materialize in spatial regions. **Possible explanation:** This materialization can be interpreted as a natural extension of the principle of superposition, adapted to the context of infinite space, where probabilities that would typically collapse into a single state persist as effective realities in separate regions.

Discussion Points:

- The relationship between these regions and observable phenomena in our environment.
- The need for a mathematical reformulation to support this hypothesis.
- The possibility that this idea serves more as a philosophical bridge than as a provable physical theory.

Conclusion

The Theory of Spatial Materialization of Quantum Possibilities in an Infinite Space proposes a bold reinterpretation of how quantum probabilities are realized. By suggesting that they simultaneously manifest in different spatial regions, this theory challenges traditional notions of quantum collapse and parallel universes, offering a unified alternative within the context of infinite space. Although speculative, this hypothesis points to new directions for theoretical and experimental research in areas such as quantum cosmology, large-scale structure formation, and understanding quantum causality in infinite systems.

Nicolás Vega
2024, december