Photon is Information of Address in Holographic Plane

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Abstract

Photons, the fundamental quanta of light, are widely recognized as carriers of energy and mediators of electromagnetic interactions. This paper proposes that photons also encode the "address" of quantum interactions within the holographic plane, providing a mechanism for coordinating quantum phenomena across spacetime. Building on the framework presented in *Emergent Universe from Many Unreal World Interpretation* [6], this hypothesis suggests that photons function as messengers of spatial and informational coordinates, offering new interpretations of wave function collapse, quantum entanglement, and delayed-choice experiments. This approach integrates the holographic principle with quantum mechanics, potentially bridging two foundational theories of modern physics.

Introduction

The holographic principle, rooted in black hole thermodynamics, asserts that the information describing a volume of space is encoded on its boundary [1]. This principle has inspired theoretical advances in string theory and quantum gravity. Photons, as the most fundamental particles mediating electromagnetic forces, interact universally, making them ideal candidates to encode and transmit this boundary information.

In prior work (*Emergent Universe from Many Unreal World Interpretation*), a framework was introduced wherein all particles are assigned unique addresses in the holographic plane [6]. This paper extends that idea by hypothesizing that photons are the primary carriers of these addresses. By examining the quantum behaviors of photons, such as entanglement and interference [4][5], we propose that their informational role provides a coherent explanation for phenomena that challenge classical interpretations of quantum mechanics.

Theoretical Framework

1. Address Encoding in the Holographic Plane

Each particle's address in the holographic plane represents its unique identity and position in spacetime. This address can be mathematically modeled as a point on a holographic boundary surface [1] [6]. For photons, the encoding of this address could manifest through:

- **Phase and Frequency:** Variations in the photon's wave function might correspond to spatial or temporal components of the address [2] [3].
- **Polarization States:** Quantum information encoded in polarization could represent the orientation of the address in higher-dimensional space [5].

Mathematical Model:

$$\psi photon = f(x, y, z, t; \phi, \theta)$$

where x, y,z are spatial coordinates, t is time, and θ, ϕ are angular parameters encoding holographic information.

2. Wave Function Collapse as Address Updates

When photons interact with a system, such as a detector or another particle, the interaction can be interpreted as an exchange or update of address information. The wave function collapse corresponds to the resolution of uncertainty in the photon's address [6][7]. Mathematically, this can be expressed as:

$$\psi initial(x, y, z, t) \rightarrow \psi collapsed(x', y', z', t')$$

where the transition reflects the photon's updated spatial-temporal and informational coordinates.

3. Photon as a Messenger in Quantum Entanglement

Entangled photons share an address in the holographic plane [6][4]. When one photon is measured, its address is updated, and this update propagates instantaneously to its entangled counterpart. This mechanism ensures consistency across spacetime without violating causality [4][5].

Connections to Experiments

1. Double-Slit Experiment

The hypothesis reframes the double-slit experiment as a process where photons project their addresses across multiple possible paths in the holographic plane. When unobserved, the photon's address remains unresolved, resulting in an interference pattern due to the superposition of all possible paths:

$$\psi slit = \psi 1 + \psi 2$$

where $\psi 1$ and $\psi 2$ are the wave functions corresponding to each slit. Observation resolves the address into one specific path, collapsing the wave function [4][6][7].

2. Delayed-Choice Quantum Eraser

In this experiment, the photon's address evolves dynamically as it traverses the setup. Entangled idler photons serve as retroactive messengers, updating the spatial address information of signal photons. This hypothesis eliminates the need for retrocausality by framing the observed patterns as outcomes of address resolution across entangled states [4].

3. Quantum Communication

Photons transmitting address information could revolutionize quantum communication protocols. For instance, encoding addresses in photon polarization states allows for secure, high-fidelity transmission of quantum keys [5][6].

Experimental Verification

1. **Photon Address Manipulation**
   - Create experimental setups to measure whether variations in polarization or phase correspond to holographic address changes during interactions [3][5].
2. **Entanglement Correlation**
   - Test whether entangled photon pairs exhibit measurable correlations in address-like properties beyond existing quantum entanglement parameters [4][6].
3. **Delayed-Choice Adaptations**
   - Modify the delayed-choice experiment to directly observe address encoding mechanisms, using high-precision detectors to track photon behavior before and after wave function collapse [4][6].

Implications

1. **Quantum Mechanics and Information Theory**
   - This approach provides a unified framework for interpreting quantum phenomena as manifestations of holographic address dynamics. It could redefine our understanding of wave-particle duality and non-locality [6][7].
2. **Holography and Gravity**
   - If photons carry holographic information, this could deepen our understanding of how spacetime geometry interacts with quantum fields, potentially informing theories of quantum gravity [1][6].
3. **Quantum Computing and Communication**
   - Encoding address information in photons could pave the way for new quantum technologies, such as holographic quantum networks and more secure quantum cryptography [5].

Conclusion

By hypothesizing that photons encode and transmit holographic address information, this paper bridges quantum mechanics with the holographic principle. This framework offers fresh insights into quantum behaviors such as wave function collapse, entanglement, and interference, and suggests pathways for experimental validation and technological innovation. Future work will focus on refining the mathematical formalism and conducting experiments to validate these ideas [6][7].

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