[original insight]

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Is it possible to transfer quantum information non-locally?

Open Quantum Collaboration^{*†}

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Abstract

We discuss whether the quantum superposition of space, warp drive, and entanglement do transfer internal quantum information non-locally. In addition, the extra dimensions are conjectured to explain the aforementioned properties.

keywords: entanglement, quantum information, warp drive, non-locality, extra dimensions

The most updated version of this paper is available at

<https://osf.io/ksjh9/download>

Introduction

1. *Is it possible to transfer quantum information non-locally?*
2. *What would be the speed of internal quantum information transfer?*
[1, 2]
3. *Is (2) non-local?*

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Quantum superposition of space

4. Suppose that an electron is in quantum superposition of space.
5. $\mathcal{S}$ = the set of possible positions
6. Let $A, B, C, \dots \in \mathcal{S}$.
7. The quantum state of the electron is given by

$$|e\rangle = \alpha_1 |A\rangle + \alpha_2 |B\rangle + \alpha_3 |C\rangle + \dots$$

8. If the electron collapses at A , it does not collapse at $B, C, \dots$
9. How is the *internal information* of **collapse** traveling, and what is its speed?
10. By *internal information* we mean the collapse information being “transferred” from A to $B, C, \dots$

Entanglement

11. This *quantum resource*, **entanglement**, is intrinsically *connected* to *quantum superposition* [3, 4].
12. The Bell state, for example,

$$|\psi\rangle = a |00\rangle + b |11\rangle,$$

is a non-local quantum correlation of a superposition of states.

13. So, the same arguments discussed previously can also be applied for entanglement.
14. More discussion on the relation of entanglement and spacetime/gravity can be found here [5–10].

Warp Drive

15. The general theory of relativity allows warp drive; in other words, it is indeed possible, according to the laws of physics, to travel within spacetime with superluminal speed [11].
16. (15) is possible due to the quantum properties of spacetime; there are limits on the light-speed limit [12].

Extra dimensions

17. Conjecture 1: *Suppose the information about the collapse of an electron is traveling in the extra dimensions.*
18. Conjecture 2: *Suppose the extra dimensions are neither spacelike nor timelike.*
19. Subconjecture 2a: *From (18), we assume that the extra dimensions can violate causality (in spacetime), i.e., things can travel faster than light by using quantum resources [13,14].*

Final Remarks

20. **Non-locality** may be the **result** of *degrees of freedom* due to the **extra dimensions**.

Open Invitation

*Review, add content, and **co-author** this paper [15,16].*

*Join the **Open Quantum Collaboration** (<https://bit.ly/ojmp-slack>).*

Send your contribution to mplobo@uft.edu.br.

Open Science

The **latex file** for this paper together with other *supplementary files* are available [17].

Ethical conduct of research

This original work was pre-registered under the OSF Preprints [18], please cite it accordingly [19]. This will ensure that researches are conducted with integrity and intellectual honesty at all times and by all means.

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