Quantum communication with use of interferometry patterns

The no-communication theorem[1] states that transmission of information in a superluminal manner is impossible. It was shown by Peacock[2] however that if quantum superluminal communication is possible by using new methods that weren't tried yet, then superluminal communication does not defy the no- communication theory.

This paper attempts to achieve superluminal communication by using the collapse of the wave function: We know fully that the mere knowledge of "which way" information[3] causes the wave function to collapse. The superluminal communication will be achievable if we can cause the wave function to collapse from afar, and measure results from afar as well.

If we can cause the wave function to collapse from afar by measuring "which way" information, then if Bob and Alice have a system that Bob can either measure or erase the which way information by using a quantum eraser[4], then Bob can cause Alice's screen to either show an interferometry pattern or not to show one, from a great distance.

The first obstacle that must be removed from this proposition is the necessity of a coincidence counter. When measuring entangled photons coincidence counters must be used to isolate noise that its origin is from non- entangled photons. This rules out all forms of quantum entanglement in our effort to send "which way " information to a distance, as the creation of quantum entanglement involves noise that can only be isolated while using a coincidence counter.

A possibility left is to shine photons through a beam splitter, splitting photons to two paths A and B. After path B for instance, we can place another beam splitter that will send half of the photons to the original screen, and half of the photons to a faraway detector. The screen can be observed by Alice, and the detector can be observed by Bob. Bob can now turn on the

[1] Revision of the no-communication theorem can be found in: Peres, Asher, and Daniel R. Terno. "Quantum information and relativity theory." *Reviews of Modern Physics* 76.1 (2004): 93.

[2] Peacock, K.A.; Hepburn, B. (1999). "Begging the Signaling Question: Quantum Signaling and the Dynamics of Multiparticle Systems". *Proceedings of the Meeting of the Society of Exact Philosophy*.

[3] Dürr, S., Nonn, T., & Rempe, G. (1998). Fringe visibility and which-way information in an atom interferometer. *Physical review letters*, *81*(26), 5705. - The term "which way" information well-defined in paragraph 2.

[4] For a better understanding of quantum erasers: Scully, Marlan O., and Kai Drühl. "Quantum eraser: A proposed photon correlation experiment concerning observation and" delayed choice" in quantum mechanics." *Physical Review A* 25.4 (1982): 2208.

detector and by so measuring which way information, or he can turn off his detector and by so the "which way" information won't be measured.

However, this still can't be accounted for communication, as Bob still can't erase the "which way" information he had measured. The mere existence of the information may yet be considered as a measurement causing Alice's interferometry pattern to collapse in all cases.

To overcome this problem, after both ways A and B must lay another beam splitter, sending half of the photons to the screen and half of the photons to a detector. The detectors are now placed in a manner that they can measure which way the information came from as shown in Appendix A. However, if the detectors are turned off, then the information will be erased, as beam splitter 4 acts as a quantum eraser.

In this case, we don't have to use the coincidence counter, as if say counter 1 and counter 2 detected say 500 hundred photons each, even if we aren't sure about the correlations between counter 0 and counters 1 and 2, the mere fact that these counters had counted a sufficient number of photons gives us the guarantee that the photon passed only in **one** path, and not in **both** paths, even if we can't tell which way exactly did it chose to pass through.

This information is sufficient to cause the collapse of the wave function.

In order to increase contrast between the photons participating in the experiment and 'noise' photons, we may want to isolate these photons from the rest of the environment. We can do so either by using exotic photons (X ray, for example, however a laser can't be used in such a case) or by a polarizer polarizing all photons participating in the experiment, and reducing noise significantly, as all detectors and counters may be directed to counting and detecting polarized photons only.

In conclusion, sending which way information to afar and measuring it from afar without using quantum entanglement is possible in the way offered above, and may cause wave function collapse from afar, as a way of superluminal communication.