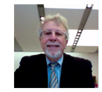
JACK SARFATTI <adastra1@me.com>
Fwd: John Cramer's very important paper on faster than light and back from the future entanglement signaling #1

January 1, 2013 9:31 PM



19 Attachments, 6.1 MB

XI. Issues and Summary

A summary of key unresolved issues follows:

1) Can the intrinsic nonlocality of quantum mechanics be used for observer-to-observer communication?

2) If nonlocal communication is possible, can it be used to send messages faster than the speed of light (i.e., across spacelike intervals)?

3) If nonlocal communication is possible, can it be used to send messages backward in time (i.e., across negative timelike intervals)?

4) If nonlocal back-in-time communication is possible, how can the paradoxes that result from this capability be resolved?

5) Is quantum mechanics perfectly linear, or are there small nonlinearities, perhaps consequences of quantum gravity, that could be exploited for faster-than-light or backward-in-time communication?

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Subquantum Information and Computation

Antony Valentini

(Submitted on 11 Mar 2002 (v1), last revised 12 Apr 2002 (this version, v2))

It is argued that immense physical resources - for **nonlocal communication, espionage,** and exponentially-fast computation - are hidden from us by quantum noise, and that this noise is not fundamental but merely a property of an equilibrium state in which the universe happens to be at the present time. It is suggested that 'non-quantum' or nonequilibrium matter might exist today in the form of relic particles from the early universe. We describe how such matter could be detected and put to practical use. Nonequilibrium matter could be used to **send instantaneous signals**, to violate the uncertainty principle, to distinguish non-orthogonal quantum states without disturbing them, to eavesdrop on quantum key distribution, and to outpace quantum computation (solving NP-complete problems in polynomial time).

Comments: 10 pages, Latex, no figures. To appear in 'Proceedings of the Second Winter Institute on Foundations of Quantum Theory and Quantum Optics: Quantum Information Processing', ed. R. Ghosh (Indian Academy of Science, Bangalore, 2002). Second version: shortened at editor's request; extra material on outpacing quantum computation (solving NP-complete problems in polynomial time)
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FROM THE APRIL 2010 ISSUE DISCOVER MAGAZINE

Back From the Future

A series of quantum experiments shows that measurements performed in the future can influence the present. Does that mean the universe has a destiny—and the laws of physics pull us inexorably toward our prewritten fate?

By Zeeya Merali | Thursday, August 26, 2010

Challenging the no-signal theorems from Stapp to Kent. See David Kaiser's book How the Hippies Saved Physics for the history.

*Professor, Department of Physics.

XII. Conclusions

Ultimately, the question of whether nonlocal communication is possible is an experimental one. The issue should be resolvable by testing for nonlocal communication and observing what experimental limits appear. In particular, are the limits of coherence/entanglement complementarity so severe that signaling is precluded? Currently there is at least one experiment in progress that aims at producing a coincidence free version of the ghost interference experiment. We eagerly await the outcome of such tests.

are: 1) what is the *causal* connection between states acting in such phenomena, and 2) can it possibly be used for sending state-to-state signals? The chapter takes a close look at quantum entanglement, quantum nonlocality, the experiments to explore them, and proposed experiments to test the causal and faster-than-light (FTL) communication issues evoked by such physics.

The question that will be investigated here is whether quantum nonlocality is the private domain of nature, or whether it can be used in experimental situations to send signals from one observer to another. As we will see, there is presently no compelling answer to this question. However, it is clear that if such nonlocal communication were possible, it would have far reaching implications. In particular, it would represent an enabling technology for superluminal and retrocausal signaling and communications.

It was later demonstrated [6,7] that the issues surrounding a violation of the Bell inequalities could be separated into violations of either *parameter independence* (i.e., the outcome probability of a measurement on one of a pair of entangled particles is independent of the choice of *parameters* of a measurement performed on the other member of the entangled pair) and violations of *outcome independence* (i.e., the outcome probability of a measurement on one of a pair of entangled particles is independent of the *outcome* of a measurement performed on the other member of the entangled pair). The observation of a violation of the Bell inequalities indicates a violation of either *parameter independence* or *outcome independence* (or both). Outcome independence is fairly evident in the quantum formalism, while parameter independence is more elusive and depends on specific assumptions. We will consider the implications of this dichotomy in the context of the "no-signal" theorems.

III. Quantum No-Signal Theorems

As Einstein asserted with his well-known "spooky actions at a distance" comment, the enforcement of quantum correlations across space-like and negative time-like intervals by nonlocality is very counterintuitive. It appears to imply the twin possibilities of superluminal communication between observers and of reverse causation through back-in-time communication between observers. However, over the years, a number of authors [11] have presented "proofs" that such nonlocal observer-to-observer communication is impossible within the formalism of standard quantum mechanics. These theorems assert that, in separated measurements involving entangled quantum systems, the quantum correlations will be preserved but there will be no effect apparent to an observer in one sub-system if the character of the measurement is changed in the other sub-system. Thus, it is asserted, nonlocal signaling is impossible.

As mentioned above, EPR experiments can be viewed [5,6] as demonstrating violations of outcome independence or parameter independence or both. Outcome independence cannot be used for nonlocal signaling, while parameter independence could be used for such signaling. Thus, any test of nonlocal signaling is, in effect, a test of the parameter independence of quantum phenomena and the no-signal theorems are "proofs" of parameter independence.

Do these no-signal "proofs" really have the status of mathematical theorems? Perhaps not. Recently it has been pointed out [12] that at least some of these "proofs" ruling out nonlocal signaling are tautological, assuming that the measurement process and its associated Hamiltonian are local, thereby building the final conclusion of no signaling into their starting assumptions. Standard quantum mechanical Bose–Einstein symmetrization has been raised as a counter-example, shown to be inconsistent with the initial assumptions of some of these "proofs." Therefore, at least from some perspectives, the possibility of nonlocal communication in the context of standard quantum mechanics remains open and appropriate for experimental testing.

To put it another way, the nonlocal connections of entangled photons lie along segmented, light-like world lines that transform properly under Lorentz transformations. Therefore, there is no conflict between nonlocal signaling and the Lorentz invariance of special relativity. On the other hand, the principle of causality (i.e., cause must precede effect in all reference frames) appears very likely to be violated (or at least violate-able) if nonlocal signaling is possible.

VII. Nonlocal Communication vs Signaling

As we have pointed out above, the possibility of nonlocal communication is an unresolved issue. It is perhaps likely that the coherence/entanglement trade-off is nature's way of preventing nonlocal signaling, but that has not been demonstrated. In this section, we will assume than nonlocal signaling is possible and will examine its implications. As will be seen, they are so far-reaching that they could be taken as a syllogism that nature would not allow such things and therefore nonlocal signaling must be impossible.

VIII. Superluminal and Retrocausal Nonlocal Communication

As mentioned, we will assume, for the sake of discussion, that nonlocal signaling is possible and will consider its implications for the speed of transmission of signals. For definiteness, schemes for doing this are based on the slit-imaging, coincidence-free version of the ghost interference experiment already described and shown in Fig. 7. In that system, the instant at which a nonlocal signal is sent is the arrival of the VLP photon at the fiber-optics system on the left, and the instant at which the signal is received is the arrival of the HLP photon at the camera at the bottom of the diagram. Assuming the workability of this scheme, both the instants of sending and receiving can be delayed, in principle, by the introduction of delay paths (e.g., runs of fiberoptic cables) in the system. In particular, the send and receive instants, occurring at widely separated locations connected by runs of fiber-optics, could be tuned to occur simultaneously in any desired reference frame. This would constitute a direct demonstration of superluminal signaling.

Additionally, the "send" instant could be made to occur well *after* the "receive" instant in the system, constituting a direct demonstration of retrocausal signaling. This is shown in Fig. 8. Here the cleanup two-slit system S_2 becomes the entrance for two 10-km long runs of fiber-optics that are carefully matched to have identical exit phases at S_3, the end of the fiber runs where the light enters the optical switching arrangement described above. If the index of refraction of the fiber is 1.5, light transiting the 10-km path requires about 50 μs. In the presence of detection noise or the degradation of pattern visibility because of compromises between entanglement and coherence, considerably more photon detection events, say 100, might be required.

IX. Paradoxes and Nonlocal Communication

The setup described above, with its retrocausal communication link, raises some time-communication paradoxes. First, let us consider the issue of "bilking." Suppose that we construct one million linked systems of the type shown in Fig. 8. Then the transmitted message would be received 40 sec before it was sent. Now suppose that a tricky observer receives a message from himself 40 sec in the future, and then decides not to send it. This produces an inconsistent timelike loop, which has come to be known as a "bilking paradox." Could this happen? If not, what would prevent it?

There are discussions of such bilking paradoxes in the physics literature by Wheeler and Feynman [17] who were considering the retrocausal aspects of the advanced waves of absorber theory, and by Thorne and colleagues [18] who were considering the paradoxes that might arise from timelike wormholes. The general consensus of this work is that nature will forbid it and require a consistent set of conditions. Thorne and co-workers showed that "nearby" to any inconsistent paradoxical situation involving timelike wormholes there is always a self-consistent situation that does not involve a paradox. As Sherlock Holmes said, "When the impossible is eliminated, whatever remains, however improbable, must be the truth." These speculations assert that equipment failure producing a consistent sequence of events is more likely than producing an inconsistency between the send and receive events. The implications of this are that bilking itself is impossible, but very improbable events could be produced ...

The other issue raised by retrocausal signaling might be called the "immaculate conception" paradox. Suppose that you are using the setup described above, and you receive from yourself in the future the manuscript of a best-selling novel

with your name listed as the author. You sell it to a publisher and become rich and famous. And when the time subsequently comes for transmission, you duly send the manuscript back to yourself, thereby closing the timelike loop and producing a completely consistent set of events. But the question is, just who wrote the novel? Clearly, you did not; you merely passed it along to yourself. Yet highly structured information (the novel) has been created out of nothing. And in this case, nature should not object, because there was no bilking and you produced no inconsistent timelike loops.

It is not known how to resolve either of these paradoxes. All that can be said is the following:

1) If nonlocal signaling is impossible, then it needs no resolution, but better more "air-tight" proofs of the impossibility of nonlocal signaling would be needed.

2) If nonlocal signaling is possible and can be used to form timelike loops, then paradoxes become important subjects for further experimental testing, study, and theoretical treatment.

The Landau-Ginzburg equation for spontaneous symmetry breaking to emergent Glauber coherent ground states is an example of nonlinear quantum mechanics.

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X. Nonlinear Quantum Mechanics and Nonlocal Communication

So far, we have focused on the possibility that nonlocal communication may be possible within the framework of standard quantum mechanics. However, even if nonlocal communication is impossible in standard quantum mechanics, there could also be another path to nonlocal communication.

The no-signal theorems described in Section III are based on the formalism of standard quantum mechanics. Such "proofs" become invalid if quantum mechanics is allowed to be slightly "nonlinear," a technical term meaning that when quantum waves are superimposed they may generate a small cross term not present in the standard formalism. Steven Weinberg, Nobel laureate for his theoretical work in unifying the electromagnetic and weak interactions, investigated a theory that introduces small nonlinear corrections to standard quantum mechanics [19]. The onset of nonlinear behavior is seen in other areas of physics (e.g., laser light in certain media) and, he suggested, might also be present but unnoticed in quantum mechanics itself. Weinberg's nonlinear quantum mechanics subtly alters certain properties of the standard theory, producing new physical effects that can be detected through precise measurements.

Two years after Weinberg's nonlinear quantum mechanics theory was published, Joseph Polchinski published a paper demonstrating that Weinberg's nonlinear corrections upset the balance in quantum mechanics that prevents superluminal communication using EPR experiments [20]. Through the new nonlinear effects, separated measurements on the same quantum system begin to "talk" to each other and FTL and/or backward-in-time signaling becomes possible. Polchinski describes such an arrangement as an "EPR telephone."

The work by both Weinberg and Polchinski had implications that are devastating for the Copenhagen representation of the wave function as "observer knowledge." Polchinski has shown that a tiny nonlinear modification transforms the "hidden" nonlocality of the standard quantum mechanics formalism into a manifest property that can be used for nonlocal observer-to-observer communication. This is completely inconsistent with the Copenhagen "knowledge" interpretation.

Finally there is also the possibility of a nonlinear form of quantum mechanics that reduces to linear quantum mechanics in the limiting case of weak gravity or no gravity. Using the wave picture, it is possible to formulate a Laplace–Beltrami wave equation for curved space. The Laplace–Beltrami operator on the left-hand side contains information about the spacetime geometry (the metric tensor) and operates on the wave function. On the right-hand side, is the same term found in the flat space Klein–Gordon wave equation. In flat space (no gravity), this "curved-space" wave equation reduces to the Klein–Gordon wave equation. In addition, some theoretical physicists have studied Dirac-like wave operators on curved space to handle spin.

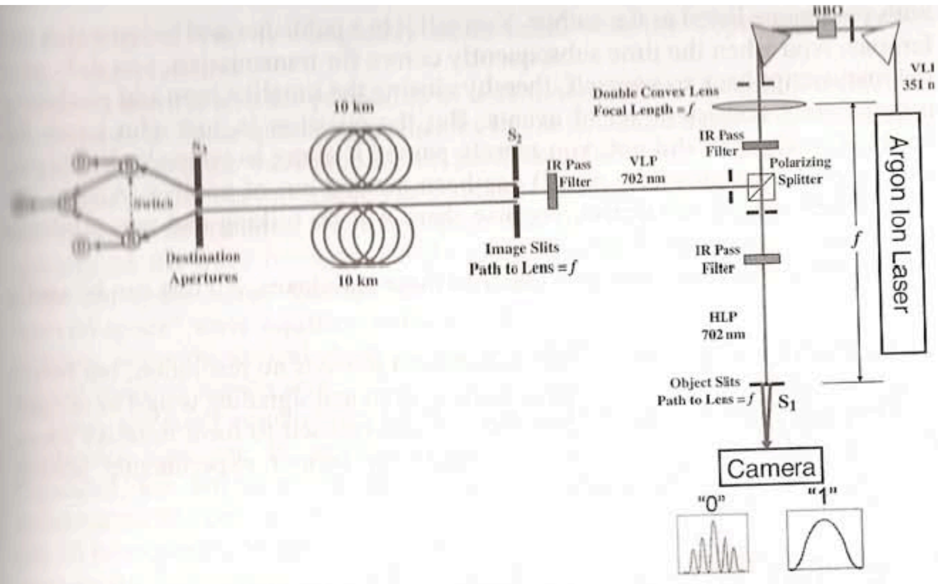

Fig. 8 Slit-imaging coincidence-free version of the ghost interference experiment to demonstrate superluminal and retrocausal signaling.

Nonlocality: The situation, apparently present in quantum mechanics, that correlations between parts of a system can be established independent of the separation of the parts in time and space.

Retro-Causal: Situations in theory or in the real world in which the effect precedes the cause, in violation of the principle of causality.

References

[1] Freedman, S. J., and Clauser, J. F., "Experimental Test of Nonlocal Hidden-Variable Theories," *Physical Review Letters*, Vol. 28, 1972, pp. 938–942.

[2] Aspect, A., Dalibard, J., and Roger, G., "Experimental Realization of Einstein-Podolsky-Rosen-Bohm Gedankenexperiment: A New Violation of Bell's Inequalities," *Physical Review Letters*, Vol. 49, 1982, pp. 91–95; Aspect, A., Dalibard, J., and Roger, G., "Experimental Test of Bell's Inequalities Using Time-Varying Analyzers," *Physical Review Letters*, Vol. 49, 1982, p.1804.

[3] Schrödinger, E., "Discussions of Probability Relations between Separated Systems," *Proceedings of Cambridge Philosophical Society*, Vol. 31, 1935, pp. 555–563; Vol. 32, 1936, pp. 446–451.

[4] Einstein, A., Podolsky, B., and Rosen, N., "Can Quantum-Mechanical Description of Physical Reality Be Considered Complete?," *Physical Review*, Vol. 47, 1935, pp. 777–785.

[5] Bell, J. S., *Physics*, Vol. 1, 1964, p. 195; "On the Problem of Hidden Variables in Quantum Mechanics," *Review of Modern Physics*, Vol. 38, 1966, p. 447.

[6] Jarrett, J. P., "On the Physical Significance of the Locality Condition in the Bell Argument," *Noûs*, Vol. 18, 1984, p. 569.

[7] Shimony, A., "Events and Processes in the Quantum World," *Quantum Concepts in Space and Time*, Penrose, R., and Isham, C. J. (eds.), Clarendon Press, Oxford, 1986, pp. 182–203.

[8] Wu, C. S., and Shanknov, I., "The Angular Correlation of Scattered Annihilation Radiation," *Physical Review*, Vol. 77, 1950, p. 136.

[9] Tittel, W., Brendel, J., Zbinden, H., and Gisin, N., "Violation of Bell Inequalities by Photons More Than 10 km Apart," *Physical Review Letters*, Vol. 81, 1998, pp. 3563–3566.

[10] Pagels, H., *The Cosmic Code*, Simon & Schuster, New York, 1982.

[11] Eberhard, P. H., "Bell's Theorem Without Hidden Variables," *Nuovo Cimento*, Vol. B38, 1977, p. 75; "Bell's Theorem and the Different Concepts of Locality," *Nuovo Cimento*, Vol. B46, 1978, p. 392; Ghirardi, G. C., Rimini, A., and Weber, T., "A General Argument Against Superluminal Transmission Through the Quantum-Mechanical Measurement Process," *Lett. Nuovo Cimento*, Vol. 27, 1980, pp. 293–298; Yurtsever, U., and Hockney, G., "Signaling, Entanglement, and Quantum Evolution Beyond Cauchy Horizons," *Classical and Quantum Gravity*, Vol. 22, 2005, pp. 295–312.

[12] Peacock, K. A., and Hepburn, B., "Begging the Signaling Question: Quantum Signaling and the Dynamics of Multiparticle Systems," *Proceedings of the Meeting of the Society of Exact Philosophy*, 1999, quant-ph/9906036.

[13] Strekalov, D. V., Sergienko, A. V., Klyshko, D. N., and Shih, Y. H., "Observation of Two-Photon 'Ghost' Interference and Diffraction," *Physical Review Letters*, Vol. 74, No. 17, 1995, pp. 3600–3603.

[14] Dopfer, B., "Zwei Experimente zur Interferenz von Zwei-Photonen Zuständen, Ein Heisenbergmikroskop und Pendellösung," PhD Thesis, University of Innsbruck, 1998; Zeilinger, A., "Experiment and the Foundations of Quantum Physics," *Review Modern Physics*, Vol. 71, 1999, S288-S297.

[15] Abouraddy, A. F., Nasr, M. B., Saleh, B. E. A., Sergienko, A. V., and Teich, M. C., "Demonstration of the Complementarity of One- and Two-Photon Interference," *Physical Review A*, Vol. 63, 2001, 063803.

[16] Zehnder, L., "Ein neuer Interferenzrefraktor," *Z. Instrumentenkunde*, Vol. 11, 1891, p. 275; L. Mach, "Über einen Interferenzrefraktor," *Z. Instrumentenkunde*, Vol. 12, 1892, p. 89.

[17] Wheeler, J. A., and Feynman, R. P., "Classical Electrodynamics in Terms of Direct Interparticle Action," *Review of Modern Physics*, Vol. 21, 1949, pp. 425–433.

[18] Echeverria, F., Klinkhammer, G., and Thorne, K. S., "Billiard Balls in Wormhole Spacetimes with Closed Timelike Curves: Classical Theory," *Physical Review D*, Vol. 44, 1991, pp. 1077–1099.

[19] Weinberg, S., "Precision Tests of Quantum Mechanics," *Physical Review Letters*, Vol. 62, 1989, pp. 485–490.

[20] Polchinski, J., "Weinberg's Nonlinear Quantum Mechanics and the Einstein-Podolsky-Rosen Paradox," *Physical Review Letters*, Vol. 66, 1991, pp. 397–401.