FTL by Down−converting (Revised)

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FTL by Down−converting (Revised)

A method is proposed here to achieve faster than light (FTL) communication by the use of down−converters. A down−converter splits a photon into two photons each having half the energy of the original photon.

Suppose we have a sender Alice, a receiver Bob, and an intermediary facilitator Charlie. Charlie uses a beam splitter to create two beams of laser light: L the left beam and R, the right beam. Charlie then down−converts the L beam to create beams L1 and L2, and similarly creates beams R1 and R2 from the beam R. Beams R2 and L2 are normal path or "signal" photons through the down−converter, while beams R1 and L1 are called "idler" photons. "Beam" here means a flow of individually detectable photons sent in very short intervals so as to provide a useful rate of communication. Charlie directs beams L1 and R1 to Alice and beams R2 and L2 to Bob. The corresponding photons arrive at both Bob and Alice at nearly the same time, but here assume Alice receives hers first, but just barely before Bob.

Bob directs beams R2 and L2 such that they can create an interference pattern in a set of detectors arranged so it is feasible to rapidly and with high probability determine whether an interference pattern is present or not. The signal photon beams R2 and L2 can create such an interference pattern because they are the two paths from a beam splitter.

Alice can direct her idler beams L1 and R1 at will, in a co−linear fashion, to opposing sides of a half silvered mirror, but at an angle of 45 degrees. Fig.1, which requires fixed font (e.g courrier) to view, shows this configuration. Half of L1 and half of R1 then goes to a detector DL. Similarly, half of L1 and half of R1 then goes to a detector DR. The beams emerging from both sides of the mirror are thus fully mixed, and the which−path information for all photons is lost. In this case Bob must see an interference pattern. If Alice then diverts her beams directly to detectors, the which−way information is then restored to 100 percent available, and Bob must see a bimodal distribution.

Full Mirror

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R1−−−>−−−−−−−−−−−−−\
             |
             | Half Mirror
L1−−−−>−−−−−−−−−−−−\−−−−−−−−−−−−−−−−−−−−−−DL
             |
             |
             DR
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Fig. 1 − Alice's which−path scrambler

Bob will in fact see such an interference pattern provided the which−path information is lost for idler beams R1 and L1.[1] If Alice does place detectors directly in both her idler beams, then this is equivalent to knowing which path each of Bob's photons have traveled, and thus Bob can observe no interference pattern. This known−path−no−interference result has been characteristic of numerous versions of the two slit or two path interference experiments.[2] If Alice detects directly and sees an idler she knows which path the corresponding signal photon took to Bob, and the interference wavefunction instantly collapses. Bob, when his photons arrive shortly after Alice's corresponding photons, knows the current state of Alice's detectors by whether he sees an interference pattern or not.

Since Alice and Bob could be light years away from each other, and since Alice thus might have years from the time Charlie released the photons to make the choice to detect or not detect her photons, faster than light communication from Alice to Bob is clearly a possible result. It might be said that the communication can not be verified for years, but such verification is in this case not necessary. Bob does not require verification or comparison to Alice's results to know the immediate state of Alice's detectors, or to immediately detect a change of state of those detectors, with sufficient speed and reliability to establish a practical communication channel. Further, a similar channel can be established from Bob to Alice, thus permitting immediate error detection and correction or retransmission.

Assuming that beams adequate for fast communication can be generated and the resulting interference detected sufficiently fast, achieving high data rate FTL communication at short range then primarily boils down to how fast Alice can switch from a detecting mode to a non−detecting mode. This might be as simple as her redirecting beams R1 and/or L1, or by switching on and off the information from her detectors. This experiment then, in addition to achieving FTL communication, may be useful for determining exactly of what an observation consists.

An experiment requiring the simplest possible message would involve sending a data bit (actually only a change of state) via a one−way FTL communication channel and returning it via a second one−way return FTL communication channel, and repeating this process to establish an oscillation. A fiber pair from Charlie to Bob and Charlie to Alice could be used, if desired, to create a single FTL communication channel. A similar set of fiber pairs would be used for the return channel. To demonstrate FTL communication it is then necessary to transmit over a sufficient distance D that the oscillation frequency, f, is faster than the oscillation frequency F = c/D that can be achieved by light. A 10 km communication link (each way) need only cycle faster than about 15 kHz to break the light speed barrier. Assuming a sample of 100 photons to be sufficient for determining interference, a photon transmission and detection rate of 1.5 million photons per second is required. However, it is not known what precisely constitutes an observation. It may be that individual photon detection is not even necessary, but rather mere beam intensity determination is sufficient.

References:

[1] Kim et al, Phys. Rev. Lett., Vol 84, no. 1, pp 1−5
[2] Brian Green, *The Fabric of the Cosmos*, (New York, Alfred A Knopf, 2004), pp 193−197

Regards,

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