# Faster than Radar

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## Abstract

Since the introduction of Einstein's Special Theory of Relativity, in 1905, it has been generally assumed that no physical interaction between bodies can take place faster than the constant speed of light, $c$, in vacuo. Speculations as to how to break that 'light barrier' are common among the anti-Einstein (Dissident) community. However, according to Relativity, for anything to travel 'faster than $c$' its proper time would have to run backwards, which most people regard as nonsense. In this paper we show that quantum instantaneity and relativistic time-delay are not, as it seems, contradictory but are complementary components of any light interaction. A consequence of this is that information about distant objects may be obtainable immediately, without any assumption of 'superluminality' and without any conflict whatsoever with the standard relativistic time-equation.

## 1. The double-ended quantum

The conventional conception of RADAR is that of a pulse of transmitted electromagnetic energy travelling from a source at the speed of light, $c = 2.99792459 \times 10^8$ metres per second (*in vacuo*) and then reflected by the target back to the source at the same speed to signal the position of the target in relation to the source. Thus, the travelling-time of the signal, from source to the target and back is twice the distance in metres divided by $c$.

Radar is, of course, a low-frequency form of light. Now light is not something wandering around *ad lib*. in the void. That is to say, there are no interactions between light and the vacuum as such. Light is an interaction that takes place specifically between the atoms of bodies separated by distances that are sometimes very large. These interactions, for all frequencies of the light-spectrum (including, of course, radio) are quantised in ultimately irreducible units of $h$, the product of energy and time, known as Planck's constant of action.

Every quantum of light-interaction, then, has to be a completely consummate, double-ended event, taking place between the distance-separated atoms, *instantaneously*. That is to say, in relativistic terms, the proper time $t_P$ of a distant quantum of action is intrinsically zero, regardless of how small or great the distance. In other words, no quantum interaction can take place unconsummated. There is no such thing as a one-ended quantum interaction. But also in relativity, the relative time, or observer time $t_R$, of that same interaction, when $t_P$ is zero, is the delayed-time $s/c$, according to the relativistic equation:

$$t_R = [(s/c)^2 + t_P^2]^{½} \quad (1).$$

Note that there is no contradiction implied by the fact that light is both instantaneous *and* time-delayed, since the two distance-time components exist together in the *same equation*, the one being $s/t_P$ = infinity, and the other, $s/t_R = c$.

Now from the requirement that every quantum of distant interaction has to be consummated it follows that for a light pulse of just one quantum, unless there is a billet instantly prepared for that quantum at some distant point, that quantum cannot be transmitted. In other words, the condition for that irreducible quantum interaction to take place is that both the distance and the disposition of the absorbing atom are resonant in terms of numbers of half-lengths $\lambda/2$, where $\lambda$ is the quantum $h$ divided by the emission energy $e$. (This is manifest in the well-known Thomas Young two-slit experiment, where it is plain that the quantum interactions between source and screen take place only at points on the screen where those geometrical path-conditions between it and the source are fulfilled.)

In principle, then, it should be possible, by manipulating the conditions for the receptivity of quanta at the distant end to directly inhibit their production at the source. Imagine, then, an ideal situation in which we have a radio transmitter and a receiver designed to resonate together in a very narrow and uniquely confined frequency band. Let the transmitter send a signal to the receiver at a distant point. Let there be an identical transmitter placed at that distant point alongside the distant receiver and an identical receiver situated at the source. With the distant transmitter-receiver coupled together, so that the received signal will be immediately re-transmitted back to the source, this situation matches that of a radar signal being sent out and bounced back, with the usual overall time-delay, $2s/c$ from which, of course the distance and direction of the object are determined by the radar operator.

However, in this same ideal situation, let us now imagine that these special transmitters and receivers are the only ones in this universe operating on that very narrow and unique frequency. In this case, it should be possible for someone at the distant receiving end, simply by switching off the receiver, to block the signal at its source. In other words, without a receiver tuned to that signal the transmitter wouldn't be able to transmit. So, by modulating the receiver at the distant point with, say, a sequence of Morse-code-like on and off switchings, it should be possible for the distant receiver-operator and the transmitter-operator at the source to switch roles, with the information (the signal) flowing from the distant receiver to the local transmitter in a direction opposite to that of the flow of energy. Let this be called retrograde or backwards signalling.

This means, of course, that the source operator has *instantaneous*, on-the-spot information about the distant receiver, as to whether it is in the off or the on mode. For instance, if the transmitter were tuned to some specific frequency in the spectrum of an atom, the operator, by scanning the heavens, should be able to obtain an instantaneous on-the-spot map of the distribution of those particular atoms throughout the stars and galaxies. Unlike radar, which would take millennia to do the same, this retrograde signalling technique would be absolutely direct and immediate. That is to say, as opposed to the transmission and reflection of a radar beam taking a time of $t_R = 2s/c$ according to the equation (1), the time $t_P$ for this retrograde signal would be zero according to that same equation.

Such, at any rate, is the ideal situation. The question remains as to whether these principles may pertain in practice. Where, for instance, may we find any evidence of this kind of retrograde information-flow occurring in nature? One answer is provided by the Thomas Young two-slit experiment. In that well-known situation, energies transmitted from the source at the de Broglie wavelengths $\lambda = h/mv$, notoriously appear to 'know', ahead of time, which areas of the end-screen to 'steer for' and which to avoid, so as to consummate the source-screen quantum interaction. [1] This may be taken as direct empirical evidence of the existence of instantaneous retrograde information flow.

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[1] See Pope, N.V., 'The Tantalising Two-Slit Experiment' *Recent Advances in Relativity Theory,* **2**, *Material Interpretation*, eds., M.C. Duffy and M. Wegener, Hadronic Press Inc., USA. (2002)

In practice, however, it is impossible to determine, at the source, the directions 'steered' by the quanta towards their destinations. This, of course, is because, according to the Heisenberg uncertainty relation, the momentum of the quantum cannot be measured or observed without changing it, which makes any *en route* detection of the quanta impossible, even in principle. As is well known, to place any form of detector at one or the other of the slits – or, indeed, anywhere in the track, is effectively to block the interactions at that point and randomise the pattern of interference at the screen, as if there were just the one slit for the conduction of quanta.

The only way, then, in which this retrograde, teleblocking of the quanta could be registered at the source would be for all possible alternative outlets for the source-energy, other than the one in question, to be completely eliminated. As the relativistic equation (1) clearly shows, it would not matter at what distance this impediment was applied. The source would be enclosed, in effect, within a perfect cosmical 'vacuum flask'. In such a situation the source energy would have nowhere to go. As someone has said, if the sun were the only object in the universe it would not be able to shine.

The principle, here, remains the same, that if energy has nowhere to go, then it simply cannot leave. That, at least, is *logically* undeniable. Is there, then, any possibility of confining a beam of energy along some channel in which it is impossible for the transmitter of that energy to interact with anything other than a specifically controlled receiver at the opposite end? Optical fibres and microwave conduits spring to mind. However, it is unlikely that the refractive index of the fibre or the tuning of the microwave guide would remain constant if end-blocked in that way. As a colleague of this author's has put it, the conduit for such a transmission would be less like an iron pipe and more like a loose-knit fisherman's sock. Blocking the energy at the end would merely succeed in squirting it out all over.

Yet it remains true, in principle, that since there can be no such thing as a one-ended quantum jump, then regardless of the fact that its relative time $t_R$ is the delayed-time $s/c$, the quantum has an intrinsic transition-time $t_P$ of zero. This means that in this case, the quantum is 'there as soon as it starts out' – or, obversely, if there is no *there* to accommodate it, then it cannot 'leave'. And if this is true in principle, that instantaneous retrograde signalling really does take place, then, as the two-slit experiment confirms, it should somehow or other be observationally verifiable.

Another approach to this problem of verification has been suggested.[2] In the two-slit situation, by modulating the interference pattern at one point on the screen or at one of the slits, observer *O* should be able to send instantaneous signals to an observer *P*, at some other point by creating a compensatory increase or decrease in the luminous energy at that point. That is certainly feasible, since this is virtually what happens between atoms in the two-slit experiment. However, in that case, since the signalling of the change in the fringe pattern, between O and

[2] This was by this author, from 1982 until recently, as indexed in Philosophical Glimpses, a record of correspondence held at the County Archives, Swansea, ref. D/D NVP/1-17, http://www.swansea.gov.uk A similar approach has been made by Raymond Jensen of the Department of Mathematics, University of Notre Dame. This was in terms of instantaneous information transfer between the tracks of 'correlated photons' (corresp. unpublished, 2005).

P is proper-time-instantaneous, the situation is the same as that of the transition of quanta between the source-atom and the end-screen atom in the two-slit experiment. The trouble with this approach is that in all such cases, for $t_P = 0$, in (1), the observational time $t_R$ between O and P is *s/c* as in ordinary light-transmission between distant points. So this kind of approach achieves nothing.

The same applies, unfortunately, to any form of signalling involving an instantaneous proper time $t_P$ over any distance *s* between different points, whether these points be on the screen, between source and screen, between slit paths or whatever. It seems, then, that the only possible way of utilising the instantaneous quantum interaction between distant atoms for signalling purposes is by means of the ‘retrograde’, or ‘teleblocking’ principle described above, involving the blocking and unblocking of the far end of a quantum interaction. The trouble with this, as the two-slit experiment attests, is that the quanta that are debarred from interacting with one point on the screen end up in greater proliferation at the more receptive areas, so that the overall energy remains the same. This suggests that no ‘glitches’ may be measured in the supply of energy at the source, so that there seems to be no possibility of instantaneous ‘backwards signalling’ on that score.

Yet the principle remains logically sound, that *if there is nowhere for the quantum to go, then it cannot leave*. So the question remains as to how to apply this seemingly valid logical principle of teleblocking in practice. Perhaps it can be answered by a homely comparison with electrical circuitry.

**2. Teleblocking in an electrical circuit**

In Figure 1, below, is depicted a telegraph line, which may be of any length whatsoever. In the circuit at A, is an electrical battery, and at each of the distance-separated stations, A and B, is a detector, or sounder, and switches arranged as illustrated.

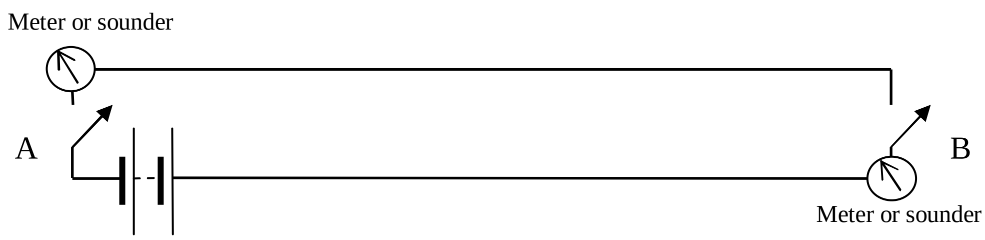


**Figure 1**

Now it is common knowledge that with either one or the other, or both, of the switches open, neither of the detectors will register a current, and that as soon as both switches are closed the current will be registered by both detectors. On the other hand, if one of those switches is left open, say at B, then the signaller at the opposite end, A, will know that immediately because his detector registers nothing in response to his closing of his switch. It would be the same, of course, for B in his attempts to signal to A if the switch at A were left open. In principle, then, it should be possible by the opening and closing of the switch at, say, B, for A to tell, instantly, by the response of his own detector to his opening and closing of his switch, whether, in that instant, the switch at B is on or off. The same would also apply in the case of B sending to A.

Let us, then, envisage a situation where the switches are designed to vibrate on and off at a set frequency, so that at their distance apart they vibrate either in or out of phase with each other. From what we already know, each signaller should be able to tell instantly the on/off state of the other's switch, without having to wait for the return light signal or radar signal, which might take years or even centuries to arrive. But we also know, from the time-formula (1), that for an intrinsic quantum time $t_p = 0$ of the transition, the length $s$ of the conductor divided by $c$ is an observationally delayed time $t_R$. So although the sender of the signal at, say, A, is instantly aware of the on or off state of the switch at B, the question of whether or not there will be a current registered by A's detector will depend on whether or not the distance-time $s/c$ and the vibration time which is the inverse of its opening and closing frequency are in-phase or out-of-phase over the length of the circuit. This, of course, is precisely what we find in the two-slit light-interference experiment, where the only places on the final screen which can interact with the source are those which, in those distance-time terms are resonant with the source frequency.

But now an interesting question arises. If each of the signallers can tell instantly, that is, 'right now', what is the state of the switch at the opposite location, then should it not be possible to circumvent the usual time-delay of the signal due to its 'travelling-time' over the distance and swap information instantaneously? The answer is no, because due to relativity, 'right now' for each signaller is indeterminable. Only in a presumed God's-eye-view of oneself being both – or indeed, all – observers at once can they have the same 'right now'. In observer time they are all separated by distance-times $s/c$ – as well as being, in some cases, time-dilated due to motions relative to one another,

So there is no possible way of circumventing the usual time-delay in the sending and receiving of signals, whether they be light-signals, radar signals, electrical signals or whatever. But this does not rule out the possibility of each observer obtaining, for himself, direct, on-the-spot, here-and-now information of distant states, such as those of switches in the electrical example and atomic resonances in the two-slit example, ahead of any radar-like transaction with those objects. And, surely, what is possible in principle must also be also possible in practice.

## Conclusion

It appears, then, that despite the time-delay that is conventionally interposed between distant objects and our observations of them, due to the 'finite speed of light', there is a definite possibility to be explored of obtaining instantaneous knowledge of distant events and situations. This follows on two counts: one is that the law of the conservation of energy forbids that there can be any delay between a quantum of energy leaving one atom and arriving at another; the other is that all quantum information obtained at the distance-time ratio $c$ is proper-time-instantaneous and reciprocal. This means that information about distant situations and conditions due to the distant blocking of quantum interactions, which we have called *teleblocking*, is infinitely faster than can be obtained by radar.