Relativity and time signals

"The theory is so rigidly held that young scientists dare not openly express their doubts"

by **L. Essen,** D.Sc., C.Eng., F.R.S.

Perhaps best known for his quartz ring clock — which revealed variations in the earth's rotation — L. Essen's main activity during his 44 years with NPL was the measurement of frequency and time, "but with sidelines" he admits. He built the first caesium clock in 1955, later used with the US Naval Observatory to define the atomic second. One of his early sidelines was a determination of the velocity of light by cavity resonator which showed Michelson's value to be 17 km/s too low. (Which illustrates a peculiarity of Nobel prizes — Michelson got one, Essen didn't.)

He's always been interested in relativity, and repeated the Michelson-Morley experiment with quartz crystal in 1937 and with radio waves in 1955, when he first pointed out a basic error in the theory. "No one has attempted to refute my arguments," Dr Essen told us, "but I was warned that if I persisted I was likely to spoil my career prospects."

ONE OF THE EARLIEST applications of radio was the transmission of time signals as an aid to sea navigation and today signals are used to synchronise atomic time throughout the world for navigational and other purposes. The comparison of distant clocks by radio is now a precise and well known technique. This was not the case in 1905 when Einstein published his famous paper on relativity and there is some excuse for the mistakes he made in the thought-experiments which he described in order to determine the relative rates of two identical clocks in uniform relative motion. But there is no excuse for their repetition in current literature.

The mistakes have been exposed in published criticisms[1] of the theory but the criticisms have been almost completely ignored; and the continued acceptance and teaching of relativity hinders the development of a rational extension of electromagnetic theory. It could be argued that the truth will eventually prevail but history teaches us that when a false view of nature has become firmly established it may persist for decades or even centuries. We cannot afford to wait that long. The energy reserves are dwindling rapidly and if there is to be a scientific breakthrough to solve the crisis it will possibly be in worthwhile therefore making another attempt to weaken the strangehold of relativity by explaining the basic mistakes in still greater detail.

Measurement of time and the comparison of clocks

The passage of time is measured by counting the number of repetitions of some regular periodic event such as the revolution of the earth, the swings of a pendulum, the vibrations of a piece of quartz, or the radio waves emitted by an atom. Whichever event is chosen the result of the count is converted for convenience into one-second ticks which are then counted on a clock dial and expressed as hours and minutes.

"The general public is misled into believing that science is a mysterious subject which can be understood by only a few exceptionally gifted mathematicians."

The only way of comparing distant clocks is to transmit the ticks by radio so that at each station there are two clock dials, one counting the ticks from the local clock, and the other the ticks from the distant clock. In practice a continuous count may not be necessary because the result may be known approximately from experience or may be given by a coded message on the transmission, but the principle remains the same. The relative rates of the clocks are found by comparing the rates at which the readings on the two dials increase, and the complication of synchronizing the two clocks before the start of the measurement does not arise.

Einstein's prediction

Einstein predicts, to use his own words, that "the time marked by the moving clock, viewed in the stationary system, is slow by ... ... $\frac{1}{2}(v/c)^2$ second per second", where v is the relative velocity between clocks, and c is the velocity of light. In practical terms the only meaning that can be attached to this rather vaguely worded statement is that the reading on the clock dial recording the ticks from the distant moving clock increases more slowly, by $\frac{1}{2}(v/c)^2$ s/s than the reading on the dial recording the ticks from the local clock. According to Einstein's relativity postulate either of the clocks can be regarded as the moving one and the full prediction is therefore

clock B, viewed at A, goes slower than clock A by $\frac{1}{2}(v/c)^2$ s/s—(1)

clock A, viewed at B, goes slower than clock B by $\frac{1}{2}(v/c)^2$ s/s—(2)

This result is not logically impossible but it has an important consequence which does not appear to have been appreciated by Einstein or subsequent writers on the subject. More ticks are transmitted than are received and this process continues indefinitely whether the clocks are approaching or receding from each other, the effect being proportional to v^2. This loss of ticks is inexplicable but it is inherent in Einstein's prediction. However being unaware of the consequence, relativitists, including Einstein, later make the more reasonable assumption that all the transmitted ticks arrive at the other clock in the course of the measurement. They thus unknowingly make two contradictory assumptions and naturally they obtain paradoxical results.

Einstein's prediction contains no mention of the ordinary Doppler effect, which is proportional to v/c. This is eliminated by Einstein's definition of time — a point which is not discussed by relativitists. The measurements will in practice include the term for the Doppler effect but for simplicity the prediction is given here exactly as Einstein gave it.

The clock paradox

Einstein described the following thought experiment. Two identical clocks, A and B say, are side by side. One of them B moves in a straight line at uniform velocity away from A to a point x. Einstein states that, in accordance with his result (1), B will be slow compared with A. Now this is not in accordance with (1), the phrase "viewed at A" having been omitted. The clock B continues to travel in a number of straight line paths until it arrives back at A, when it will be found to read less than A.

Einstein calls the result peculiar but gives no explanation.

The paradox is not immediately obvious because Einstein gives only half of the result. Although accelerations must be applied to obtain the round trip, no correction is made for them and they are not even mentioned. As far as the experiment is concerned the clocks are in uniform relative motion and either clock can be taken as the moving one. The full result is

clock B goes slower than clock A by $\frac{1}{2}(v/c)^2$ s/s
clock A goes slower than clock B by $\frac{1}{2}(v/c)^2$ s/s

which is obviously paradoxical.

There is no problem if the experiment is carried out correctly. The ticks from B are received on a dial at the position of A; and another dial travels with B to receive the ticks from A. At the end of the experiment the dials will record the result (1) and (2) as they must do since a thought experiment cannot give a result that contradicts the initial postulates.

Consequences of Einstein's mistake

The paradox result follows from a simple "experimental" error but it was accepted by Einstein and has been accepted by relativists ever since and it is important to consider the consequences. It is based on the assumption that no ticks are lost. This assumption is reasonable but it contradicts the prediction (1) and (2). By accepting the result they thus reject the relativity theory. They still accept the existence of the second-order time contraction but it is now a real physical effect just as in the Lorentz theory from which Einstein started.

Introduction of gravitation and acceleration

In 1918 Einstein published a paper[3] which took the form of a discussion between a relativist and a critic. The relativist admits that the paradox result contradicts his initial postulates.

"Students are told that the theory must be accepted although they cannot expect to understand it. They are encouraged right at the beginning of their careers to forsake science in favour of dogma."

He then describes a thought experiment in which gravitational fields are switched on and off at different points of the path of the moving clock as it makes a round trip; and concludes that the result obtained earlier by assuming that acceleration has no effect is due to the gravitational fields. It is not surprising that this paper with its damaging admission, its irrational assumptions and its "experimental" mistakes is seldom mentioned in the literature. Many writers on relativity nevertheless advance a similar argument. They conceal the paradox, as Einstein did, by giving only one half of the result, and justify this by pointing out that the two clocks are not symmetrical, overlooking the fact that they have made them symmetrical, as far as the experiment is concerned, by assuming that accelerations have no effect. Without this assumption they would not be able to obtain any result at all. Vague suggestions are then made that the result is due to the accelerations.

Does it matter?

It has been explained how Einstein, in the course of his paper, rejects the relativity postulate and returns to the Lorentz theory, which is still found to be useful. It might be asked therefore whether the mistakes are important. I suggest that they are immensely important. Students are told that the theory must be accepted although they cannot expect to understand it. They are encouraged right at the beginning of their careers to forsake science in favour of dogma. The general public are misled into believing that science is a mysterious subject which can be understood by only a few exceptionally gifted mathematicians. Since the time of Einstein and of one of his most ardent supporters Eddington there has been a great increase in anti-rational thought and mysticism. The theory is so rigidly held that young scientists who have any regard for their careers dare not openly express their doubts.

Experimental checks

It is often claimed that the special theory of relativity has been confirmed by experiment. In fact no experiment has been carried out in which symmetrical measurements have been taken at each of two stations moving relatively to each other with the required high velocity; and there has therefore been no check at all on the relativity aspect of the theory, which is of course its essence. Any checks that have been made can only relate to the Lorentz theory to which Einstein returns by accepting the paradox result. Moreover even with this limited interpretation the checks are always far from convincing.

This is true for example of a recent experiment[4] in which four atomic clocks were compared with similar clocks at an observatory after they had travelled round the world in both an eastward and westward direction. It was claimed that the result provided an unambiguous resolution of the clock paradox. Now the paradox result was deduced, mistakenly, from the special theory which was concerned only with uniform relative velocity, but the results predicted for this experiment were based on gravitational and kinematic effects. It does not seem therefore to have any connection with the clock paradox, as described by Einstein. The untreated results given in the paper indicate that the average clock lost 132ns (nanoseconds or 10^{-9}s) for the eastward journey and gained 134ns for the westward journey, but since the difference between individual clocks was as much as 300ns little, if any, significance can be attached to these average values. The authors do not use all the results and apply a statistical analysis, details of which are not given, to those they do use. They conclude that the average clock loses 59ns on the eastward flight and gains 273ns on the westward flight in close agreement with the predicted values. These criticisms were rejected by *Nature* but subsequently published elsewhere[5].

"... the continued acceptance and teaching of relativity hinders the development of a rational extension of electromagnetic theory."

A hope for the future?

There are fortunately a few writers who are breaking with tradition and developing new ideas which may be fruitful. In this country there are two small volumes[6] by H. Aspden and in France R. L. Vallee has published[7] a theory of energy which appears to be gaining in spite of much opposition. A society, the S.E.P.E.D. has been formed for the promotion of his ideas. One important conclusion he reaches is that space contains an unlimited amount of high frequency energy which could possibly be extracted and used with safety and efficiency.

References

1. Einstein, A. 1905 Translation in The Principle of Relativity, Methuen, London, 1923.
2. Essen, L. The special theory of relativity — a critical analysis. Oxford science research paper 5, Clarendon Press, Oxford, 1971.
   Essen, L. Einstein's special theory of relativity. *Proc. Royal Institution*, vol. 45, page 141. 1972.
3. Einstein, A. *Naturwissenschaften*, vol. 48. 1918, p.697.
4. Hafele, J. C. and Keating, R. E. *Science*, vol. 177, 1972, pp166-8.
5. Essen, L. *Creation Research Quarterly*, vol. 14, 1977, p.46.
6. Aspden, H. Physics without Einstein, Sabberton Publications, Southampton, 1969.
   Aspden, H. Modern Aether Science, Sabberton Publications, Southampton, 1972.
7. Vallee, R. L. L'energie electromagnetique, materielle et gravitationelle. Masson et cie, 1971. Refer to S.E.P.E.D. 16 Bis rue de Jouffroy 75017 Paris.