that when the train is moving, both the light flashes reach M' together. Since he twice quotes for us the passage where Einstein says precisely the opposite, it is hard to see the justification for such an allegation. Einstein says quite clearly that M' will see one flash before the other, and this is based on the argument that M sees them arrive together. Since at that moment M and M' do not coincide, it is a physical impossibility for the flashes to reach M' together, and we hardly need to invoke Minkowski to tell us this. Now what is a physical impossibility in one frame of reference is still a physical impossibility in any other, so the statement that M' sees one flash before the other is an absolute statement for this experiment. Of course, there is no denying that if the conditions for simultaneity had been met in the frame of reference of the train, those flashes much indeed arrive at M' together. The impossibility of this is proof that the events were not simultaneous in the train's frame of reference. Which is precisely what Einstein said.

The other argument concerns the constancy of the speed of light. Dr Murray is one of the very numerous band who tell us that Einstein's "second postulate" says that the velocity of light is the same for all observers despite their mutual relative motions. It doesn't. This is a paraphrase of the conclusions reached from the experiment of the two similar laboratories passing in space and the light at the centre of each flashing as they draw level. This makes it a little difficult to support the contention that this is an "irrational assumption", or that Einstein "accepted it without evidence". We need to go rather further back in the argument to find what the "second postulate" really does say.

When he set out to save Maxwellian theory, Einstein encountered therein the concept of the aether. The characteristics of this where that light would be propagated through it at constant speed, and that any motion of the source through the aether would not alter this speed. The analogy of sound through air is apt. Einstein adopted these ideas in the form that in the absence of matter, light travels with a definite speed c that does not depend on the motion of its source. It is worth our while to take a further look at this assumption.

Suppose for a moment that we invert these characteristics, so that the light does not travel with constant speed, and that speed is dependent on the source's motion. In the first case, the speed would have to depend upon some function of time/distance. The alternative that it might be totally random belongs, I think; to the realm of science fiction, and it could hardly depend on the value of some local field, because there is no matter to anchor it to. The consequence of time/distance dependence is that any change in the position of the source would result in a change of the "local" value at every other point in space. No matter whether the observer's motion enters into the final equation or not, this change in value would be detected by that observer, who would thus be able to detect any motion of the source. The same thing happens if the value is altered by the source's motion. The "local" value will change, and though the observer would again be able to detect the source's motion. But to detect such motion is a violation of Newton's principle that no experiment exists that is capable of detecting absolute rest or uniform motion. This must be applied equally to the light and its source as it is to everything else. The conclusion is clear. The requirement that light travels at constant speed and that the speed is independent of the source's motion comes directly from Newton's principles, and in introducing his "second postulate" Einstein introduced no new information not already implicit in those principles. This puts the mathematical arguments into their correct perspective. As Dr Murray says, they are circular and do not constitute a proof of any assumption at all, only being a demonstration that the conclusions can be handled mathematically. I suggest that that is all they were ever intended to be.

In saving Maxwellian theory, Einstein found the way to save Newtonian theory. By the end of the 19th century the cracks were beginning to show: by now the evidence against it is overwhelming. Fortunately Einstein realised that the basic inconsistency in Newtonian theory that was causing all the trouble was that the existence of absolute space and absolute time was not compatible with Newton's principles. Fortunately for us, too, he produced in 1915 the necessary correction, otherwise the "baby with the bathwater" brigade would long ago have been screaming for us to abandon those principles, too. Of course it is a profound emotional shock to find that all those terrible consequences are only the logical outcome of Newton's principles, and I don't blame anyone for hoping they will go away if we pretend they are not there. It is interesting that many scientists are just as irrational as the rest of us.

Finally, Dr Murray is highly dogmatic about the non-existence of direct demonstations of the correspondence between the "workings of the world as it is" and the predictions of the theory. I would refer him to the experiments of Hafele and Keating in 1971, who set out to see if the predictions of theory about clocks could be confirmed. They were. (*SCIENCE* vol. 177, 1972, p.68ff).

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NEXT MONTH

Among the features in the July issue is a Z80-based telephone call-charge indicator which, among other facilities, provides a running total cost. It is usable anywhere in the world.

John Linsley Hood describes a mains power controller intended mainly for use with a photographic enlarger to ensure stability of light output, but useful for other application as well. It uses triacs to control the amount of a mains cycle passed to the load.

Ken Smith writes of his work with young people and electronics. His views are provocative and may raise a few hackles amongst those of a more conservative disposition.

Correction

Ivor Catt has asked me to point out an error in his letter on The Catt Anomaly in the May issue. On page 18, the penultimate line of the second paragraph should refer to the conductor, not the dielectric.

Amorphous metals, previously only possible to produce in strips on 0.05mm thick, have now been made 1mm thick using a technique known as rapid diffusion. The picture shows X-ray diffraction photographs of a nickel-zirconium sample. In A, typical X-ray reflexes of crystaline metals can be seen from an NiZr sample before annealing. After annealing, B, the sample is amorphous and causes diffusion.