LETTERS TO THE EDITORS

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"The Philosophy of Physical Science"

THE correspondence on this subject provides a most enlightening example of the present transition in scientific philosophy from the view that science is a description of an objective external world to the view that it is a formulation of the relations found between experiences. Thus, to Sir James Jeans[1], taking the older view, light is an objective entity the velocity of which is either finite or infinite, while Sir Arthur Eddington is interested only in the fact that, since our experiences could be correlated equally well or ill by postulating an infinite or an immeasurably large finite velocity, the possibility of the former can be ignored. It is not surprising that, as Sir James rightly complains, Sir Arthur has not answered his objections. They are meaningless in Sir Arthur's philosophy, and he cannot reply in applicable terms.

I have long been convinced that the view which Sir Arthur now accepts is necessary to make sense of modern (or even older) physics, and have ceased to regard the question as a controversial one. Nevertheless I am equally convinced that Sir Arthur has not grasped the true implications of the new conception, and that Sir James's objection, though stated in terms meaningless to Sir Arthur, is both valid and unanswerable. If we can imagine an alternative experience to that which a law requires, then that law is not logically necessary. There is no escape from that, and if the unexpected should happen, we have to decide between giving up the law and denying the experience. There is no question which is the scientific choice.

It is, however, most desirable to locate the fallacy in Sir Arthur's reasoning. His programme for science is as follows: (1) Construct a scheme of pure reason based on a few *a priori* postulates. (2) Make observations and describe them in terms of those postulates. (3) Draw up a table of correspondences between the elements of the rational scheme and the observations: since the scheme is logically coherent, the corresponding observations must then be logically necessary if the original postulates really lie "at the bottom of things". Hence (4) find criteria for determining that the postulates are so basic. Those criteria having been found, the logical necessity of experience is assured.

The fallacy is, I think, that such criteria cannot exist, because, "in our limited view, at the bottom of things" lies not necessary postulates but experience, and experience is not yet complete. Take any "law of Nature" (for example, the law of gravitation). Deduce where Jupiter will be observed at some instant next year, and suppose that, when the time comes, Jupiter is seen elsewhere. If the law is *a priori* inviolable, Sir Arthur's only explanation can be that observations of Jupiter are not the experiences to which it applies. But if there are criteria for establishing the correspondence between law and observation, he is denied this explanation. What, then, is left to him?

Sir Arthur may be right in believing that his "epistemological" method is a short cut to discovery. Many a theory fundamentally unsound has given valuable guidance to knowledge, and it is certainly to be hoped that "structuralism" will do so. But that is trivial compared with its truth or falsity. As Sir James says, if Sir Arthur's theory is right "its consequences are tremendous—to physics, to philosophy and to humanity". No effort can be too great to clear the matter up, and if, as I believe, Sir Arthur is profoundly wrong, no protest can be too strong against an illusion which would destroy the very fundamentals of science and throw us back intellectually (and therefore socially, since ideas determine the state of our social life) into the dark ages.

It may be added that Sir James Jeans is incorrect in saying that the finiteness of the speed of light is an essential part of the theory of relativity. If that speed had been infinite the truth of the theory would never have been doubted; we should not have expected optical experiments to reveal the Earth's speed. The difficulty was to reconcile the null result of the Michelson-Morley experiment with the *finiteness* of the speed of light. But if that speed will not perform the service which Sir James asks of it, it provides us with a very convenient way of contrasting the alternative viewpoints. Sir Arthur Eddington says: "It is *a priori* necessary that the velocity of light is finite; therefore our observations of Jupiter's satellites could have been predicted and could not have been otherwise." Sir James Jeans says: "It is a fact of Nature that the velocity of light is finite; therefore Jupiter's satellites appeared in the positions which Römer explained". The scientific statement I hold to be this: "Jupiter's satellites were observed in certain positions. Therefore, if we attribute the observations to light travelling from the satellites to us, and assume that the satellites move according to Newton's laws, we must assign a finite velocity to that light".

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[1] NATURE, **148**, 140, 255 (1941).

MAY I first correct a slip in my last letter? In contrasting the actual and imagined results of the Michelson-Morley experiment, I absentmindedly interchanged them. I should have written, "It is a logical impossibility that the experiment should give other than a null result in the conditions *described*; but . . ."

Prof. Dingle asks us to imagine Jupiter seen away from its predicted place. Is it not simpler to substitute Uranus, for which this experience actually occurred? Adams and Leverrier rejected both of Dingle's alternatives. They neither gave up the law of gravitation nor denied the experience. They inferred that the system *pointed out* to the observer was not the system *described* to the calculator, a planet present in the former being omitted in the latter. Or, in Dingle's phrase, they amended the table of correspondences. His argument seems to me to fail because it assumes that when the unexpected happens only two courses