It is the theoretical side of physics which is so necessary to free us from preconceived ideas. But theory alone is not enough. It is difficult to see how the theorist could invent all the living realities which it is his business to analyse. The experimental facts must come first. Eddington seems to take rather an extreme view of this case, as if it were possible, by epistemology and epistemology alone, for the theorist to deduce all the essential relations—all the fundamental constants in relativity, quantum theory and non-Euclidian geometry—without reference to any facts. It is probably a matter of theoretical power and efficiency whether this can be achieved, but there is a tendency towards it.

Although experiment is necessary, it is encouraging to realize that a large number of experiments are very often unnecessary, inasmuch as further experiments tend to confirm the previous ones; and it is often found that an experiment on a matter which seems entirely outside the original scheme is merely the same experiment as the previous one repeated, and that if we had sufficient theoretical power, we should realize that the two experiments imply the same thing. There is a tendency, therefore, to reduce experimentation in proportion as our theoretical power increases. If we could rely on this completely, only one experiment, to find out which point the curve goes through, so to speak, would be necessary. (I have been accused of drawing curves through one point only!) All that is necessary is to fix, say, the value of the ordinate at some specified value of the abscissa.

It is encouraging to think that experimenting, although necessary at the present moment, and probably the quickest way of getting results, should become less and less necessary as our theories improve. It may be that we shall reach a final state, as implied by Eddington, in which all the constants of nature are interrelated, and can be fixed from epistemological considerations alone.

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A CORRESPONDENCE between two men of such astronomical mental calibre as Jeans and Eddington, firing long-range shots at each other, should, I suppose, be read in silence and with respect by the ordinary man in the street. It is indeed very enjoyable in these days to have such a discussion, but first of all we must thank Jeans for the very human confession that he had been "re-reading" Eddington's book. It is comforting to think it was not just our fault we did not get it all the first time.

Jeans sums up Eddington's contention in paragraph 2 by saying that "all those laws of Nature that are usually classed as fundamental, as well as the values of the constants of Nature, can be foreseen 'from epistemological considerations, so that we can have *a priori* knowledge of them' ". "*A priori*" knowledge is given, quoting Eddington again, as "knowledge which we have of the physical universe prior to actual observation of it". From this it is fair to say that Eddington claims that fundamental laws are objective, yet in his answer towards the end he states that there is no such thing as a truly objective law. Eddington should, therefore, challenge Jeans's summary of his main contention, yet he does no such thing.

I have always regretted the Michelson-Morley experiment. Things were perfectly satisfactory before their distressing negative results. I feel we are not at the end of this story, just as we are not at the end of the story that the red shift in the spectrum means receding speed, unless we tie ourselves to the Hilaire Belloc creed and "never, never let us doubt, what nobody is sure about". To say that without the Michelson-Morley experiment we should find ourselves "faced with a universe far more complicated than we have lately imagined" can only be agreed to by those who can dart with such facility from physics to metaphysics.

Finally, a protest against 'plugging' the word 'epistemological'. It is neither pronounceable nor understandable.

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SIR JAMES JEANS proposes the finiteness of the velocity of light as a test case. I answer: Certainly this is *a priori* knowledge, but of a rather trivial kind. We know *a priori* that the velocity of light is not infinite, just as we know *a priori* that the velocity of light is not blue or hexagonal or totalitarian; it is not the sort of thing to which these terms could apply. The alternatives "exceedingly large" and "actually infinite" concern only the abstract quantities which are the theme of pure mathematics; this is equally true of the alternatives "exceedingly small" and "actually zero". No such alternatives exist for physical quantities defined in terms of observation. When an *observer* sets out to determine the velocity of light, an infinite result is not among the possible alternatives; and if he announces that he has found the velocity to be, not merely exceedingly large, but actually infinite, we know *a priori* that the announcement is untrue.

In so far as the existing relativity theory rests on the assumption that the velocity of light is not infinite it is safe from experimental contradiction. In regard to the aspect in which it is not so immune, Jeans's remarks seem to me mainly reiterative, since he again ignores the difference between identification by description and identification by pointing. It is a logical impossibility that the Michelson-Morley experiment should give a null result in the conditions *described*; but the possibility imagined is that a bogey, supposed to have been laid, has come to life again, so that the conditions described are not those which have been *pointed out* to the experimenter. Similarly, it might have turned out that the velocity of light did not agree with the ratio of electrical units; in that case we should have had to await the discovery of Hertzian waves before we could see how electromagnetic wave theory applied. When Dirac's "holes" were first put forward they were identified with protons; but brute facts were discordant, and the hole theory went up in smoke. That was because the hole described was not the proton pointed out. Later the positron was discovered, and it was seen how the hole theory applied.

Since these letters will be read by many who are unfamiliar with the basis of the epistemological theory, it seems desirable to explain briefly why a scheme of laws arrived at in an *a priori* way is expected to coincide with the scheme arrived at by analysis of observational knowledge. The development of fundamental physics must go on and on, either steadily