

*A Radio-astronomical Test of the Ballistic Theory of Light Emission*

GENTLEMEN,—

Storey and Lawrence's letter<sup>1</sup> shows a complete misapprehension of the point at issue: the observations they cite have no bearing on it.

Lorentz's electromagnetic theory coupled with the Lorentz transformation contains all the electromagnetic requirements of Einstein's special theory. The equation,  $c=\lambda\nu$ , with  $c$  an absolute constant, derives from it and stands or falls with it. It was this theory that Ritz challenged; he was not concerned with Einstein, whom he scarcely mentioned. Einstein's contribution was to unite Lorentz's electromagnetic theory with kinematics by modifying the latter. The Lorentz transformation then became a set of kinematical equations, involving only space, time and velocity *measurements* instead of coordinates, while the characteristics of light called *frequency* and *wavelength* belonged only to electromagnetic theory.

What I should like to do is to test the Lorentz transformation kinematically using ordinary projectiles. That is impossible yet, so we must use light, but we must measure its velocity directly, without using a relation that already assumes it to be constant. If the Newtonian velocity composition formula is right, light cannot have the same velocity with respect to a source and receiver in relative motion; this was Ritz's contention, so I had to consider the grounds on which it had been rejected, and found them inconclusive. Hence the Lorentz-Einstein and Ritz theories both remain in the field. I therefore suggested a kinematic test. A laboratory experiment would be best, in which the relative motion of source and receiver is indubitable. The aberration test is definitive only if it gives an abnormal constant. But it is simpler, so I proposed it.

All arguments about "wavelength" and "frequency" necessarily depend on a picture of light-structure that is inherently inconsistent. This applies to both optical and radio emission: the former is simpler, so I will discuss only that. What a grating measures is the "wavelength",  $\lambda$ ; the derivation of the necessary formula demands that. The photo-electric effect uses the formula,  $E=h\nu$ , in which  $\nu$  is the "frequency". But we do not measure  $\nu$ ; we divide  $\lambda$  into  $c$ , assumed constant. Hence comparison of grating with photoelectric measurements simply returns to us the constant we put into it.

The purely metaphorical character of even "wavelength" is shown by the following consideration. When the grating moves towards the source of light there is a Doppler shift. It cannot mean a change of wavelength for the light is not changed. It could be a change in the *frequency of reception* of the light elements, whatever they are, but only if the *velocity* of reception also changes, and this Einstein's theory forbids. What, then, has changed?

This shows the total irrelevance of all such observations as Storey and Lawrence cite. The essence of the matter is that the problem is a purely kinematical one, and everything that depends on the hypothetical structure of the projectile used is quite beside the point. I indicated this in the paper in question.

For the same reason, the distinction between group velocity and phase velocity mentioned by Holmberg<sup>2</sup> is irrelevant. That distinction, so far as light is concerned, is purely hypothetical. Only one velocity has ever been measured, and it is that velocity that is used in calculating the theoretical

“frequency”. It is that velocity that is equal to the ratio of the electrical units, and it is that velocity that is postulated as constant in the special theory of relativity. Dr. Holmberg is quite correct in saying that, according to the usual wave picture of light, in an aberration measurement (indeed, in all methods yet used for measuring the velocity of light) it is the “group velocity” that is measured, but that the product of “wave-length” and “frequency” must be equal to the “phase velocity”, about which, if there is any such thing, we know precisely nothing. But all that this contributes to the problem is another example of the inconsistency of the usual wave picture.

I must again protest against the attitude to this matter that is ascribed to me. I have no “theory” or “hypothesis”, as Dr. Holmberg assumes: I simply want to get at the facts in order to decide between hypotheses which, so far as experiment is concerned, are now equally admissible. Also, I do not, as Storey and Lawrence say, “hope that a difference will be revealed between  $V$  and  $c$ ”, except in so far as that would increase our definite knowledge. Their final sentence is lamentable. We observe a red-shift; we have no means of testing recession; hence it is an assumption that the one is caused by the other. Storey and Lawrence call recognition of this simple fact an “arbitrary assumption”. One can only hope that, for the good of science, they will go into meditation for a while, and ponder on the difference of attitude proper towards scientific theories and baseball teams.

I am, Gentlemen,

Yours faithfully,

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#### References

- (1) L. R. O. Storey and R. S. Lawrence, *The Observatory*, **79**, 150, 1959.
- (2) E. R. R. Holmberg, *The Observatory*, **79**, 223, 1959.

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#### REVIEWS

**The Unity of the Universe**, by D. W. Sciama. (London: Faber and Faber, 1959.) Pp. 186+18 plates+56 figures. Price 21s.

This excellent book is an elementary, but closely reasoned, summary of our knowledge of the universe and of the case for the steady-state cosmology, based on Mach's principle. The first third of the book explains the techniques and results of measurements of the distances and velocities of stars and galaxies and is followed by an analysis of the inferences to be drawn from two basic observational facts: the darkness of the night sky and the existence of inertia. There follow descriptions of the author's own very elegant field theory, incorporating Mach's principle, and of the clock paradox, general relativity, the formation of galaxies (which are shown to arise most naturally and with the right order of magnitude of masses and clustering tendency once the continual creation of matter is accepted) and the origin of the elements.