subject to the condition that the velocities of elastic waves do not exceed that of light, though his way of getting it is fallacious. With actual materials it also will be wrong. The change of k is of course one of the phenomena that could be covered by the general theory applied to elasticity.

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THE CLOCK PARADOX IN RELATIVITY*

By E. F. FAHY†

I have been following with great interest the discussions on the above topic which have been published in several journals. On reading a recent letter to *Nature* by Professor Herbert Dingle (1957) in reply to a previous letter by Sir Charles Darwin (1957), I noticed that it is feasible to perform astronomical observations which could provide an experimental basis for choosing between the two points of view. In fact, these observations may have already been made.

Dingle (1957), in the course of his analysis of the particular aspect of this problem which was introduced by Darwin (1957), concludes that " S_1 will not observe S_0's flashes to change until after he has fired his rocket ". It is evident from the context that the length of the delay is

$$t_1-\tfrac{1}{2}T_1=\tfrac{1}{2}T_1(1-\beta)/(1+\beta).$$

In the light of this result, consider an observer on this Earth who is interested in one of the distant nebulae. He sees a red-shift in the spectral lines and can think of himself as being a traveller who left that nebula many years ago, thereby interpreting the red-shift in terms of the velocity which he believes he gave himself at the beginning of his journey. He now decides that he will return to the nebula and builds a rocket which will take him from the Earth and produce a violet-shift in the nebula's spectrum equal in magnitude to the previous red-shift. Dingle's result indicates that this traveller will have to wait for a long time before he will observe the violet-shift; if D light years is the distance to the nebula, it indicates that the delay is about $D/2$ years.

On advancing the argument further, one arrives at the following aspect of the above situation, which is simpler from the experimental point of view. Consider any star which lies approximately in the plane of the Earth's orbit. Because of the Earth's orbital motion, an earth-bound observer would expect to

* Manuscript received February 17, 1958.
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find that any visible line in the spectrum of this star should oscillate about a mean position with a period of 1 year and an amplitude of approximately 0·5 Å. Dingle's result in this case indicates, however, that the oscillation in the spectrum would be many revolutions out of phase with the Earth's orbital motion; in the case of most stars, the phase difference would not be an integral number of revolutions. An effect of this kind should be observable, since it means that the observed oscillations in the spectra of the stars are, in general, out of phase with one another.

A similar argument, based on Professor Dingle's point of view, would lead to the result that the phases of the apparent oscillatory motions of the stars due to aberration should, in general, vary from star to star.

In both cases (Döppler effect as well as aberration) the other point of view predicts that there should be no phase differences.

I think that it would be pertinent to this discussion if an astronomer would tell us whether or not such phase differences exist.

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