CORRESPONDENCE

Special Relativity

SIR,—I refer to Professor Dingle's paper on "The Case Against Special Relativity" (*Nature*, 216, 119; 1967).

It is, I think, implicit in Professor Dingle's argument that equation (3) is derived by an observer at rest in the AH frame who initially synchronizes A, B and H to zero but not N. He later, again at rest at H in the AH frame, reads B and H when they are adjacent. He thus determines the ratio of the rates of clock A to clock B from the point of view of an observer at rest in the AH frame.

It is similarly implicit that equation (4) is derived by an observer at rest in the NB frame who initially synchronizes NB and A to zero but not H. Later at rest at N in the NB frame he reads N and A when they are adjacent. He thus again determines the ratio of the rates of clock A to clock B but this time from the point of view of an observer at rest in the NB frame.

It is entirely in accord with the principle of relativity that one of these ratios is the reciprocal of the other, for the clock which moves relative to the observer always goes slower. It does not alter the argument if one observer sets all the clocks and makes all the observations by accelerating back and forward between the two frames.

Yours faithfully,

J. H. FULLERTON

11 Purley Bury Avenue,
Purley, Surrey.

SIR,—Without detracting from the completeness of Professor McCrea's reply to Professor Dingle, may I suggest a simple way of pointing the fallacy in the latter's argument?

Professor Dingle's rate-ratios (3) and (4) both purport to refer to the same observer A; (3) is correct, but (4) is false and is actually the rate-ratio as observed by B, for the following reasons. The following arguments can be levelled against it.

(i) The time-interval $(0, t_2) = (0, at_2')$ is an interval on A's clock—for any observer.

(ii) The time-interval $(0, t_2')$ is the difference between the reading "zero" on B's clock, and the reading t_2' on N's clock. For A, this difference is physically meaningless, since for A these two clocks are not synchronized. According to the theory, A observes a constant difference between their readings.

However, if the readings are regarded as observations by B, the intervals are valid, so that as stated before, formula (4) is the rate-ratio as observed by B and is, naturally, the reciprocal of that observed by A.

Yours faithfully,

W. BARRETT

Department of Mathematics,
University of Leeds.

"Snags in Space"

SIR,—Your conference report of October 21 (*Nature*, 216, 215; 1967) refers to certain difficulties which have arisen in decoding a fraction of the data from the scientific experiments on board the Ariel III satellite. The statements in your report arose from a discussion of these difficulties at a meeting which was concerned with the apparatus rather than the scientific results, and which may therefore have given an unbalanced impression of the performance of the experiments as a whole. We wish to offer some corrections.

The first point is the reference, in the conference and in your report, to "interference" from the Birmingham experiments. This might be thought to be some type of spurious signal generated in the apparatus of the Birmingham electron density or electron temperature experiments, but in fact no such signals are present in the intended frequency bands of any of the seven high gain radio receivers associated with other experiments on board the satellite. What is observed instead is an unusual form of cross modulation, by way of the plasma sheaths surrounding the satellite and Birmingham experiment sensors, which appears to occur between the audio-frequency signals of the Birmingham experiments and the input stage of the Jodrell Bank galactic radio noise experiment.

If it had been anticipated in advance that such a cross modulation were likely to occur, it might have been avoided either by modifying the switching sequence programme of the Birmingham experiments or by changes to the input stages of the Jodrell instrument; but it is not profitable to speculate, after the event, on the possibility that the problems with which we are faced could have been avoided by more detailed consideration at the development stage. The cross modulation is a form not previously known and the knowledge we stand to gain relating to its exact mechanism will offset to some small extent any loss of expected data.

There are considerable periods when the effects of the ionospheric cross modulation are negligible. At these times we have been able to demonstrate the anticipated effect of the ionosphere on the cosmic radio background showing as a progressive reduction in radiation resistance of the loop antenna as the electron density increases. At the upper end of the frequency sweep, at 4·2 MHz, where the effects of the geomagnetic field are small, it is easy to show that the values of electron density measured by the Birmingham experiment are in close agreement with values obtained from measurements of the radiation resistance which must refer to ionosphere propagation conditions over a large volume in the vicinity of the spacecraft. This encourages us to believe that both experiments are working exactly as planned and that the radio astronomical experiment will fulfil at least part of its intended purpose.

Some misunderstanding must also have arisen concerning the Meteorological Office experiment. You state that "The Birmingham experiments have also upset the attempt by the Meteorological Office to measure the concentration of molecular oxygen in space". This is simply not true. There is a quite marginal amount of cross modulation present in the Meteorological Office data, but this can readily be allowed for in the analysis and does not significantly affect the quality of the measurements of molecular oxygen concentration.

J. SAYERS

University of Birmingham.

F. G. SMITH

Nuffield Radio Astronomy Laboratories,
Jodrell Bank.

K. H. STEWART

Meteorological Office,
Bracknell.

This account is substantially in agreement with that published in *Nature* two weeks ago. The term "interference" is that used in the abstracts circulated at the meeting. The report also described the interference with the Meteorological Office experiment as "not too severe", but it is good to know that even that was an exaggeration.
Editor, *Nature*.