CORRESPONDENCE

No Rebuttal

SIR,—The August 16 issue of *Nature Physical Science* contains comments on our article "Rapidly Changing Radio Images" (*Science*, 173, 525; 1971). Our theoretical models are accurately presented, but we are unhappy about the commentator's view that our work rebuts suggestions in the papers by Knight *et al.* (*Science*, 172, 52; 1971) and by Whitney *et al.* (*Science*, 173, 225; 1971) that 3C279 is behaving "in a manner unacceptable in the theory of general relativity". That objects might actually be moving at speeds faster than c is given by Whitney *et al.* as the last of nine possible interpretations of their observations and is at once dismissed by them. That the red-shift-distance relation might not apply to 3C279—another possibility which they listed—is an explanation that some find attractive and that would in any case not constitute "unacceptable" behaviour. But phase velocity effects, the general class to which our own models belong, are among the first discussed by Whitney *et al.* and are accompanied by specific examples. If there was a "hue and cry over a false scent", it ought therefore not to be ascribed to the observers, whatever the press reports might have indicated. And the "true trail" (if it so turns out) did not remain unposted.

Yours faithfully,

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Our Correspondent writes:

It is unfortunate that Dr Cavaliere and his colleagues have taken the comments in my article (*Nature Physical Science*, 232, 133; 1971) as applying to the interpretation placed by Knight *et al.* and Whitley *et al.* on their own observations. As well as reporting the work of Cavaliere *et al.*, my intention was to caution against too ready a belief in the press reports based on the preliminary announcement of the fruits of long-baseline interferometric studies of 3C279, and not to suggest that the published work of the observers is incorrect. The tone of the first sentence of my article, stating that "there has been little . . . consternation amongst cosmologists" does, in my opinion, adequately represent the aim of the article—to explain to non-astronomers why cosmologists were not as excited as the press about the reports of Knight *et al.* (*Science*, 172, 52; 1971) and Whitney *et al.* (*Science*, 173, 225; 1971).

Photons on Photons

SIR,—I was fairly nonplussed to read "First Steps to Photon-Photon Collisions" (*Nature Physical Science*, 232,

1; 1971). Although it is true that the concept of studying photon-photon interactions at storage ring facilities is of interest, the implication that this concept has rescued such facilities from a future of mediocrity is certainly incorrect.

The study of time-like electromagnetic currents is just as necessary as the study of space-like currents. I shall mention just two examples. First, experiments on inelastic electron-nucleon scattering in the space-like region have yielded startling results and supplied support to the concept of a grainy substructure in nucleons. To extend these studies to the time-like region is obvious, necessary, and exciting. Second, after years of experimental work in the space-like region and theoretical study, the electromagnetic form factors of the nucleon are still not understood. It is crucial, though possibly not sufficient, that the hadronic form factors be measured in the time-like region.

Storage ring projects, present and planned, have extensive programmes planned to study time-like currents through the single-photon annihilation process. It is my personal opinion that these programmes will not be significantly altered by the realization that the two-photon process leads to large cross-sections at high energies.

Yours faithfully,

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