view, that the distances are of cosmological order, leads to the first of the four curious coincidences discussed by Kellermann[3].

By adding optical data it would be possible to carry the argument further. Redshifts are not available, however, for more than a small fraction of the sources. The data discussed by Schmidt concern only 26 very high-flux sources. The redshifts z of these sources, plotted against the 178 MHz flux S_{178}, are shown in Fig. 1. The absence of a significant correlation between redshifts and fluxes can be interpreted in two ways: the optical redshifts are not distance indicators, or the 26 sources in question constitute a fluctuation.

In the first case, issues striking at the root of our most cherished cosmological beliefs would be involved. In the second case it is meaningless to attempt to base far reaching cosmological conclusions on a very small sample of 26 sources constituting only a fluctuation.

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F. HOYLE

California Institute of Technology,
Pasadena, California

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Reply to Hoyle

HOYLE's assertion that only 5 sources per steradian are missing at the bright end[1] is based on the apparent Euclidean nature of the source counts. My derivation of the steady-state source counts[2] expected if radio galaxies have cosmological redshifts shows that the Euclidean slope of −1.5 is not reproduced at the count levels of interest.

The large scatter in the diagram of redshift versus radio flux density shown by Hoyle[1] is usually interpreted as caused by the large range of absolute radio luminosities—an interpretation not mentioned by Hoyle. The tight correlation between the redshift and the optical flux density of radio galaxies[3] is quite similar to that observed for the brightest galaxy in clusters of galaxies[4]. There is at present no attractive alternative to the conclusion (or, in Hoyle's words, the cherished cosmological belief) that in both cases the tight correlation is caused by a velocity-distance relation and hence that the redshifts are cosmological.

M. SCHMIDT

Hale Observatories,
California Institute of Technology,
Carnegie Institution of Washington,
Pasadena, California

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Multistatic Incoherent Scatter Measurements of Ionospheric Drift Velocity

THE observed behaviour of the ionospheric F-region has proved difficult to understand, and one of the principal difficulties has been that, until recently, there was little reliable information about the true plasma drift velocities. Apparent horizontal drift speeds have been measured for many years by means of the "fading" method[1]: interpretation of data from these experiments is complex[2], and it is now clear that the results give only the drift of large electron density irregularities which, although of considerable interest in itself, is not necessarily the same as the drift of the plasma as a whole. Plasma velocity measurements have been made by plotting the movements of luminous chemical tracers released in the ionosphere from rockets or gun launched projectiles[3,4]. Information from this type of experiment is of good quality, but is necessarily limited in quantity. An alternative technique is incoherent scatter radar, which measures the doppler shift of the scattered signal and determines one component of the ion drift velocity; the advantages of this method are that measurements can be pursued systematically as functions of time over a wide range of heights and that systematic errors can be minimized by careful equipment design. Incoherent scatter drift measurements were first made by Carru *et al.*[5], who measured one component of the velocity, aligned nearly parallel to the direction of the geomagnetic field. A large body of similar measurements from the French installation now exists, and has been used to study thermospheric dynamics[6]. The incoherent scatter radar at Jicamarca, Peru, has measured the field perpendicular component near the magnetic equator[7], and the vertical component has been measured by the Millstone Hill radar in Massachusetts[8].

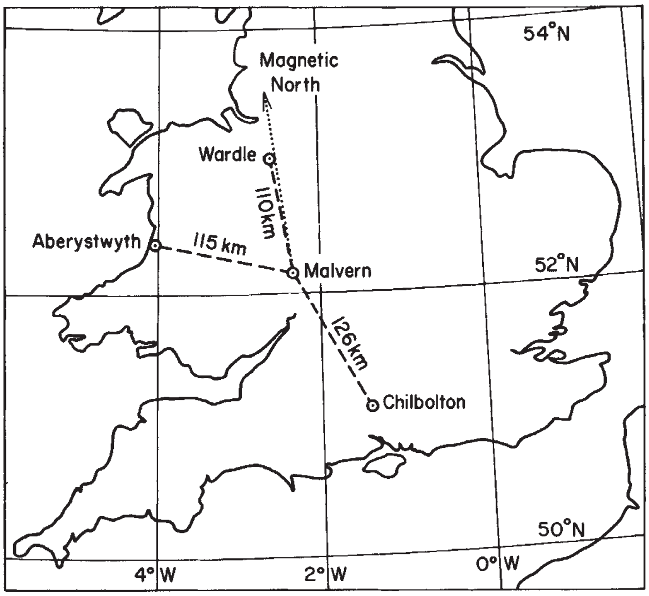

Fig. 1 Locations of the transmitter at Malvern and receivers at Chilbolton, Aberystwyth and Wardle. The angle between magnetic north and the Malvern-Wardle line, actually only 1°, is slightly exaggerated for clarity.

The field aligned component of ion drift is attributable to plasma diffusion and neutral air winds; above 150 km, the field perpendicular component is due only to electrostatic fields. It is therefore desirable to measure all components of drift velocity. Some work has been reported in which a steerable monostatic radar has been pointed obliquely in several directions successively, so as to measure more than one velocity component. Thus Evans[9] has determined both horizontal components of the velocity vector and Harper[10] has been able to measure all three orthogonal components. These measurements are necessarily made at different points in the ionosphere at different times, and while the mid-latitude ionosphere generally varies sufficiently slowly in space and time that the measurements can be treated as coincident, it would be more satisfactory to make measurements simultaneously in the same scattering volume. We present here multi-component incoherent scatter drift measurements which are coincident in space and time; these were achieved by receiving the scattered signals at more than one site.