7. THE RADIO LUMINOSITY FUNCTION AND THE NUMBER FLUX-DENSITY RELATIONSHIP FOR THE DISCRETE SOURCES.

M. Ryle

Observations have been made at Cambridge with a radio telescope whose resolving power and sensitivity would permit the detection of a source similar to Cyg A or 3C295 at a redshift $(\Delta\lambda/\lambda) \approx 3$ (velocity of recession $\approx 0{\cdot}9\ c$).

By relating: (*a*) the number of sources observed in different ranges of flux-density S; (*b*) the isotropy found in their distribution at $|b| > 20°$; and (*c*) their contribution to the background emission, we can show that in areas away from the galactic equator, only a few per cent of the observed sources are within the galaxy. From the upper limit of the extra-galactic component of the background emission, we conclude that most of the sources observed in a given range of S must have an emission at 178 Mc/s greater than 10^{24} watts $(c/s)^{-1}$ ster^{-1} (about 1000 times that of M31); their determination is independent of assumptions about the nature of the sources.

If most sources are supposed to have $M_p \approx -20{\cdot}4$, as suggested by Minkowski's analysis of positive identifications, the results of a further search in the positions of several hundred sources on the 48-inch Sky Survey prints suggest that most of the sources must have an emission greater than 10^{26} watts $(c/s)^{-1}$ ster^{-1}. A similar result is given by the new observations of surface brightness at Jodrell Bank, on the assumption that the sources have a physical extent similar to that of Cyg A.

From these determinations of the radio luminosity, we can derive limits to the expected number-flux-density relationship according to different world models. The new observations, when corrected for the effects of partial resolution of extended sources, clustering, etc., give a relationship:

$$\log N = 50{\cdot}1 - 1{\cdot}8 \log S \text{ for } 2 < S < 100 \times 10^{-26} \text{ watts } (c/s)^{-1}\ m^{-2}$$

This relationship does not appear to be compatible with that predicted by the steady-state model if the sources have the same large-scale distribution as the galaxies. It appears necessary to introduce evolutionary effects, and the observations could, for example, be explained on an Einstein-de Sitter model if the average source emission has decreased from 5×10^{26} to 10^{25} watts $(c/s)^{-1}$ ster^{-1} over the past 5×10^{9} years.

DISCUSSION

H. Bondi. I am impressed with Minkowski's agreement with the Mills counts.

F. Hoyle. If you have a mixture of intrinsically weak and strong sources, the proportions counted depend on the flux density level.

B. Y. Mills. We are happy Cambridge now agrees with the Sydney observations. But we still differ over interpretation. I think the slope is between $-1{\cdot}6$ and $-1{\cdot}7$, but a value of $-1{\cdot}8$ is compatible with our range of uncertainty.

T. Gold. Earlier Cambridge observations were interpreted over-optimistically. What is the difference between the new catalogue, as yet unpublished, and the old one? Why was a different value of slope obtained formerly when it was claimed that overlap of sources could not change the slope?

M. Ryle. This depended on the 2C catalogue, which was wrong. With 3C we found an uncorrected slope of $-3{\cdot}0$ which is compatible with our present value of $-1{\cdot}8$.

https://doi.org/10.1017/S0251107X00023312 Published online by Cambridge University Press