3/22/1955 Bob

Comments on the relative value of a 300-foot antenna compared to a 150-foot antenna.

I. 21 cm. line research:

The smaller beamwidth and greater gain of a 300-foot antenna would undoubtedly be of great value for certain types of investigations, some of which might be:

a) Studies of the detailed, small scale cloud structure of interstellar hydrogen. Interstellar line observations indicate that the cloud complexes can be quite different in 2 regions less than 1° apart.

b) Possible studies of very small, local structures, such as globules. Low temperature stars with extensive atmospheres might give a detectable signal also- Aurigae for example, with an atmospheric temperature of less than 2000° K.

c) Other galaxies

d) Absorption effects associated with discrete sources.

There are undoubtedly other problems which will arise that will require the highest obtainable resolution. However, all of these things, with the exception of d) above, are of a speculative nature and would not seem to indicate an urgent immediate need for a 300-foot telescope in addition to a 150-foot one. All of the items listed above could be attacked with a 150-foot antenna- it is difficult to say at present just how much advantage a 300-foot telescope would have. The problem of 21 cm. radiation from other galaxies is a particularly important one--but again it is hard to say how much more valuable the larger dish would be.

My own feeling is that the decision on a larger dish could well be delayed until results of the 150-foot and other large dishes under construction begin to come in and we see how things develop. More urgent than the need for a larger dish is the need for top quality electronic equipment for the 150-foot dish, and continued development of the electronic equipment.

For galactic 21 cm. line research there is definitely a greater need for better electronic equipment than for a 300-foot dish in addition to a 150-foot dish. The full capabilities of a 150-foot dish will be realized only with the best of receivers.

II. Discrete sources.

A 300-foot antenna would have four times the gain and half the ~~bandwidth~~ beam of a 150-foot antenna. The greater gain would increase the number of detectable sources by a factor of about 10 (judging from the number of sources of different intensities known at present) while the decreased ~~bandwidth~~ beam would improve

position accuracy and reduce the confusion caused by the presence of two or more sources in the antenna beam at once. Thus the 300-foot antenna would both increase the number of observable sources, and the accuracy of measurements.

There does not seem to be any urgent need to increase the number of observable sources. At least 300 sources have now been observed, and Ryle's large interferometer is finding new ones at a great rate. In addition, a large pencil beam interferometer is not a particularly suitable instrument for survey or detection work because of the small area covered by the antenna beam. The urgent need today, and this should remain true for some years, is for accurate measurements of position, size and intensity at various wavelengths of the sources already known.

A 150-foot antenna should make possible high quality observations of several hundred sources, at wavelengths from 3 cm. to 10 meters. A 300-foot antenna would increase the accuracy obtainable, particularly at wavelengths greater than about 1 meter, where the beamwidth of a 150-foot antenna is greater than 2°. For sources well above the limit of detection (and this would include all the sources known at present) the increased accuracy obtainable from a 300-foot dish would probably be significant only at the longer wavelengths.

Again I think it might be more profitable to delay action on a 300-foot dish and concentrate on receivers and auxiliary equipment for the 150-foot dish specifically designed for maximum precision in measurements of position, and intensity at different wavelengths.

In this connection, it seems to me that an interferometer, or a couple of smaller antennas that could be used individually or together as an interferometer, might be a more useful companion instrument to the 150-foot antenna, than a 300-foot dish, at least for some time. It will be much easier to evaluate the need for still larger antennas a few years from now than it is now.

David S. Heeschen
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