G. Reber

14.1/904

January 17, 1950

Messrs. J. G. Bolton and G. J. Stanley
Division of Radio Physics
Council for Scientific and Industrial Research
Chippendale
New South Wales, Australia

Gentlemen:

I have been greatly impressed by your series of publications upon discrete sources of galactic radio waves. The last one, in the June 1949 issue of the Australian Journal of Scientific Research, is a beautiful piece of work. It is readily apparent that your scheme of using the sea as a mirror is a very powerful technique for investigating galactic radio waves. The possibility of performing similar experiments is being considered here. Before any plans are made, I would like to secure information upon your experiences, or your considered opinion, upon the following matters.

1. On page 142 of the above-mentioned article you mention in the first paragraph that the reflection coefficient of the sea is less than unity. What is the cause of this effect; and how does it vary with angle of incidence and frequency? Please give some references which describe the phenomena in detail. Is it a function of wave height or wave length from crest to crest; or due to the finite conductivity of sea water?

2. Your articles about the Cygnus source in Nature (28th Feb. 1948, page 313) and in Australian Journal of Research (March 1948, page 65) show a considerable random variation in signal strength superimposed upon the interference pattern. The curves you display upon the Crab Nebula on pages 140 and 141 seem to lack this phenomenon. Is this due to the fact that the Crab Nebula is about 5 minutes of arc in diameter, or is this caused by different sea conditions near New Zealand? If possible, please amplify your conclusions given on page 64 of March 1948 publication. This variability phenomenon seems to be a nuisance which should be eliminated or mitigated if the maximum accuracy is to be achieved in the measurements.

About what percent of the observing hours show average variations having an amplitude of 0.1, 0.2, 0.5, and 1.0 times the steady component at 100 Mc? If possible, please give quantitative data upon point (ii) covering amplitude versus frequency. Is this variation dependent upon time of day, sea conditions, troposphere conditions, or ionosphere conditions? Is the average period of the variations a function of height above the sea, and if so, does the period decrease with height in proportion to the fineness of the interference pattern? It might be conceived that the variations would ultimately mask out the desired pattern if the two are of commensurate period.

3. What experience have you had with duct phenomena? On page 142 you point out that tides may be neglected as a small percent of the height of the observer. A low (50 to 100 feet) duct might also be taken into account if it is merely uniform over the whole visible sea. Thus the radio wave would be reflected from top of duct. However, if the duct should have an opening near the horizon, then part of the wave energy might be trapped in the duct at low angles of incidence. Is this a possible cause of low sea reflection coefficient? In general, ducts are caused by large masses of hot dry air moving from the land out over damp air and cool water which causes a temperature inversion and humidity discontinuity. Is this a cause of variability or does the duct phenomenon manifest itself in some other deleterious way? What percent of the time are ducts likely to be present? Perhaps this is an unfair question as ducts probably manifest themselves more at some places than others.

I realize that the above paragraphs are very inquisitive. However, before we go into any major venture we would like to know how big and how deep these and any other pitfalls are likely to be. Since you are the only ones having practical experience in this field, it is apparent that your advice and suggestions will be of great value in helping us to form some judgment upon the best way to proceed. Any information and comments upon the above or other matters will be greatly appreciated.

From considerations of geometry it appears that observations of a given source from different latitudes should provide much improved accuracy in the determination of declination. Consequently, we are eager to cooperate with you in some coordinated program of surveying the sky at radio frequencies. Please give my regards to Dr. Pawsey and tell him that I often think of the many pleasant conversations we had when he was in this country.

Sincerely yours,

G. R.

Grote Reber, In Charge
Radio Astronomy
Upper Atmosphere Research Section
Central Radio Propagation Laboratory

GR:hjb
(This letter sent air mail.)
cc: Dr. Brode