December 19, 1953
Wailuku, Maui
Territory of Hawaii
U. S. A.

Dr. J. L. Pawsey
Radiophysics Laboratory
C. S. I. R. O.
Chippendale, N.S.W.
Australia

Dear Pawsey:

Today I am leaving for a few weeks in the States. I should be back here about the middle of January.

Further consideration has been given to the extraordinary ray business and more ionosphere data of Hobart and Christchurch have been plotted and examined. The critical frequencies over New Zealand may drop a bit lower than those over Tasmania but only for an hour or so which has small meaning. The Hobart data exhibits characteristics to be expected of a station near the agonic line. The criticals drop rapidly after sunset, have a long flat bottom and rise rapidly at sunrise. This U shape characteristic is much more desirable than the V shape of Christchurch data which is typical of a station farther from the agonic line. The V will be tipped to left or right depending upon whether the station is east or west of the agonic line in the southern hemisphere. These considerations indicate Tasmania to be preferable to New Zealand.

So far, all I've been able to secure is an abstract of the Storey paper. However I intend to examine it closely when I am in the States.

If a horizontal dipole is used as antenna, it will look at about 10,000 circular degrees of sky. Now if an extraordinary ray can get thru the ionosphere at an angle up to 5 degrees from the line of the earths field, it will be possible to look thru the ionosphere over a cone with an area of 100 circular degrees. Thus the antenna will look at 99% ionosphere and 1% the heavens. According to your work the E layer has a temperature of about 300° abs. Nothing seems to be available on the F layer. Using the E layer value, we have the product of 300° times 10^4 cir. deg. = 3×10^6 relative energy units from the ionosphere. The center of the galaxy may have an effective temperature of $1{,}000{,}000^{\circ}$ abs. or more as it goes by the hole overhead. Thus the product of $1{,}000{,}000^{\circ}$ times 10^2 cir. deg. = 10^8 relative energy

units from the galaxy. This is large compared to 3×10^6. Consequently, it seems likely the experiment should succeed even if the hole is much smaller than 100 circular degrees and the temperature of the galaxy is less than 10^6 degrees abs. Now for the pessimistic side.

The big "if" is the absorption which may be present in large and unknown amounts due to mechanisms we are not presently aware of. Even with a successful experiment we can only get one sweep across the center of the galaxy without moving all the apparatus to another location. Nothing seems to be known about the true size of the hole along the earths field. Mitra has some equations which I cannot evaluate. Thus the apparent temperature of the galaxy will be ambiguous and inversely proportional to this unknown.

Considering all the above the affair looks both good and bad with no certainty either way. I'm still in favor of the gamble if you are.

However you decide on this matter, I am much interested in coming to Australia and helping with your new cross type antenna next summer. By peculiar chance my thoughts had been gradually going down the same line of reasoning although they had not progressed to anything solid. You might be interested in getting out the Bell Technical Journal for April 1936. R. M. Foster has a foto of a beautiful model of the acceptance pattern of a cross antenna as his figure 13. It is very easy to imagine the center pylon appear and disappear, as if by magic, when the cross is switched. The remaining part of the model would of course remain fixed.

Wishing you the seasons greetings, I am

Sincerely yours,

Grote Reber