

October 29th, 1948
213 W. Seminary Ave.
Wheaton, Illinois

Dr. C. R. Burrows
Cornell University
Ithaca, New York

Dear Dr. Burrows:

I have your letter of the 23rd and I must say your program is certainly an ambitious one. You are quite right that increased resolving power is of great importance in this work and the most effective way to secure high resolution is to employ frequencies in the microwave region. Unfortunately I'm afraid you have overlooked a few technical difficulties as follows.

To a first approximation the surface brightness per frequency interval of the milkyway may be considered constant independent of frequency. Now holding the mirror size constant and increasing the frequency n times will increase the resolving power n times. The area in the sky delivering power to the mirror will decrease to $1/n^2$ times. The power at the input terminals of the amplifier will be $1/n^2$ times. Thus for equal apparent sensitivity at n times the frequency the receiver must have n^2 times the absolute sensitivity. Actually the evidence at hand indicates the surface brightness per frequency interval of the milkyway is an inverse function of frequency. Likewise it is well known that the absolute sensitivity of receivers progressively decreases as the frequency is raised. Thus it appears very unlikely that any positive results will be had at frequencies above 1000mc. By the same token, the best possible receiver at 1000mc will probably produce only marginal results.

For the past several years I have been in touch with my friends at Bell Tel. Labs. They have repeatedly scanned the milkyway with the best apparatus they could devise at various spot frequencies from 3000mc to 30,000mc and found nothing. The above statements are based on the fact that cosmic static is a continuous spectrum which is the basic situation now known to exist. If this is all the phenomenon consists of the situation would be hopeless indeed. Actually the pessimism must be tempered with a few other speculations as follows.

It is well known that a great amount of gaseous material is present in space. This material may react in a large variety of ways. Thus it is a fair guess

that somewhere in the available range of 1000mc to 30,000mc there exist strong emission lines or bands whose intensity is far above the background continuum. To locate these hypothetical lines will require the use of a search receiver which continuously covers the above frequency range. The antenna need be only a simple horn with a wide acceptance pattern pointed in the direction of Sagittarius which is quite an extended source and offers the best possibility of producing such emission lines. If your organization sees fit to construct such a search receiver and the above hypothetical emission lines or bands are found; then I believe a general survey of the sky may be profitably carried out at the frequency of such emission lines using apparatus of high resolving power. Provided the above hopes materialize I will be pleased to loan the use of my apparatus for carrying out such a survey.

In regard to solar work, you are no doubt familiar with the temporary enhancement of several thousand times produced by spots and reported upon in Nature by various experimenters over the frequency range 30mc to 200mc. Here again I must be pessimistic as my recent measures at 480mc indicate the enhancement to be present only in an amount of 20% or so over the ever present black body continuum. The microwave works of Dicke and Southworth failed to find any enhancement due to spots. The letter by Pawsey in Nature, Feb 9th, 1948, page 158, I especially recommend on this matter. Apparently the phenomenon has a very rapid inverse frequency-intensity function. Actually from an astronomical point of view the hunting of both cosmic static and enhanced solar radiation appears much better at low than high frequencies. If you have sources of information which show strong microwave radiation from the sky I will be very interested to learn the details.

I will be pleased to have you and Mr. Seeger visit my observatory at your convenience. Please advise me a few days in advance of your arrival so that I may be certain to be here and have my apparatus functioning. Wheaton is a small residential community 25 miles west of Chicago served by the Chicago North Western and Chicago Aurora Elgin railroads. Since no hotel facilities are available here I suggest you secure accommodations in Chicago. During your visit I will be pleased to show you my apparatus, explain its functioning and consult with you on any and all phases of the

general endeavour. While I don't know the details of your thinking, perhaps I can interest you in some low frequency experiments which have promise as well as astronomical significance.

Sincerely yours,

Grote Reber

c.c: E.R.Piore, ONR