May 10, 1946
212 W. Seminary Ave.
Wheaton, Illinois

Dr. C. H. Townes
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Ref: 117C-CHT-CMH

Dear Dr. Townes:

Thank you for your letter of the 7th. The curves shown in my various articles are in amplitude. Power is proportional to intensity which is proportional to amplitude squared. Thus half power points (.707 amplitude) on curves from sun are about 10° wide. This leaves about 3° for size of sun at 160mc.

My results at 160mc are in only the horizontal plane of polarization. The total radiation from galaxy or sun is assumed to be of random polarization so measured power is doubled to compensate. The number 2 in numerator of formula (1) of Ap.J. 1944 takes care of this.

Mirror efficiency of 85% is obtained by integrating a theoretical response function for the aperture of a circular wave guide (drum) over the solid angle subtended by mirror. A long winded and not too meaningful ditty on this can be found in Electronic Industries, July 1944, page 101.

More recent close inspection of antenna circuits shows the match to input of amplifier was not too good; thus some more energy may have been present than was measured. Further, diffraction theory indicates the acceptance cone of mirror to be larger than the values given which would reduce the apparent amount of energy present. However close inspection of the data on the milkyway up near the top shows that it has a width of about 8½ degrees. Thus the resolving power must be that great. All in all, this business is not a highly exact science and I'm afraid that systematic errors of perhaps 2:1 may be included in the results. Errors as great at 10:1 are very unlikely however.

This spring I did the experiments at 480mc all over again and merely confirmed my earlier results. The intensity of the radiation encountered seems to be about 9 times that at 160mc so apparently the

Rayleigh-Jeans relation holds for the sun. This time however I shifted the plane of antennas around to verticle and got the same answer. Thus the radiation from the sun is apparently of random polarization. I read thru Southworths article a couple of times but if he said anything on this point I missed it. You might ask him. The width of the half power points at 480mc didn't go down to a third of 10° but came out about 5°. This again seems to leave 2 or 3 degrees for size of sun. Southworths results also show the sun to be wider than ½° for some reason or other. In my opinion the corona may be the cause.

In regard to quoting my results at 480mc; I'd rather have you desist for a couple of months as perhaps something better is in the offing. At present I have a new 480mc amplifier in the later stages of construction. By the 4th of July it should be working; and if it is as much better than the old one as I hope it is, then new and interesting results should be available.

I'm glad you did include the clipping as the reference did escape me. What issue of the Phys. Rev. was it in? and page? We now have a wealth of possible intensity-frequency functions. Rayleigh-Jeans calls for $I \propto f^2$; my 1942 IRE article suggests $I \propto f^0$; my 1900 IRE article suggests $I \propto f^{-1}$ (for some reason Southworth seems to like this one), and now you call for $I \propto f^{-2}$. If I can only get something from Sagittarius at 480mc this summer it may be possible to sort out one from the array.

Below are a few references you may find interesting.

"Solar Radiation", Hey & Stratton, Nature, Jan. 12th, 1946, Vol 157, pp47 & 48.
"Bursts of Energy from the Sun", Appleton, Nature, Nov. 3, 1945, Vol 156, pp 534 & 535.
"Cosmic Noise at 64mc", Hey, Phillips & Parsons, Nature, March 9th, 1946, Vol 157, pp296 &297.
"Radio Energy from the Sun", Pawsey, Payne-Scott & McCready, Nature, Feb 9th, pp158 &159
"Solar Radiation", Nature, Vol 156, Sept. 1st, 1945 pp 273 & 274.
"Sensitivity limits of receivers", H. Käppeler, Bull. Ass. Suisse Elect., Nov. 29th 1944 pp 707-713. Vol 35.

This last reference I haven't been able to get a copy of so I don't know what is in it.

Yours very truly,

Grote Reber