July 18th, 1946
212 W. Seminary Ave,
Wheaton, Illinois

Dr. C. H. Townes
Bell Telephone Labs.
Murray Hill, New Jersey

Dear Dr. Townes:

Thank you for your letter of the 8th. Yes, I didn't read your letter of May 7th very carefully or I would not have passed over the word "received" without properly noting its significance.

In general, I believe we are in agreement. By apparent intensity I mean the power at the input terminals of the amplifier. By absolute intensity I mean watts/sq.cm.,cir.deg.,sq.bd. arriving from the sky. For cosmic static from Sagittarius, present data indicate that the absolute intensity is $I \propto f^0$ and the apparent intensity is $I \propto f^{-2}$. This agrees with your theory.

By letter of May 10th I indicated the sun at 480mc to be wider than 0.5 degree. It now seems as if this excess width was due to instrumental defects involving internal noise. The early results at 160mc suffered from the same trouble. My present apparatus has very low internal noise so that the solar radiation stands out well above the apparatus noise. Careful measurement has turned up a rather surprising situation.

If I measure the width of the trace at 0.707 amplitude points the sun shows an apparent width of 0.7 degree. If I then correct the trace for internal noise the sun shows an apparent width of -0.4 degree. The trace repeats day after day to $\pm$ 0.1 degree. These results are based on an acceptance pattern width computed from diffraction theory. If it were possible to make actual measurements the acceptance pattern would probably be found to have less width than theory predicts. How this can be I do not understand.

The above results seem to confirm the idea that the main energy received from the sun is radiated from the photosphere according to the Rayleigh-Jeans relation. Over and above this constant minimum amount may be a temporary enhanced effect due to some type of solar activity. Such I have not been able to find as yet.

The above information in this letter I believe to be reasonably certain and you may use it if you wish.

Any fully satisfactory explanation of cosmic static from the milkyway must account for not only Jansky's data at 30.6mm but also Friis & Feldman's data at 9.6mm.

I have pondered quite a bit over their data in the July 1937 issue of Proc. IRE (page 897, Table VIII page 911 and page [illegible]) but have come to only two conclusions. First, a considerable amount of cosmic static energy is arriving from the region of Cygnus at this low frequency. Second, the milkyway in relation to this disturbance is quite narrow; being less than 40° wide for 4:1 down in intensity.

These men are part of your organization. Perhaps you could get in touch with them and find out how to reduce their data to give absolute intensity. It is my hunch that if such a figure can be obtained, it will be found the radiation at 9.6mm is at least as great as at 30.6mm. This low frequency should provide a critical test to any theory which predicts a rapid decrease in intensity at the lower frequencies.

The antenna these men used had a vertical acceptance pattern only about 4° wide at the half power points. Thus it was very good for this purpose. If you could arrange to have a few more measurements made on quiet days I believe that very interesting results could be secured. It would not be necessary to use the phasing apparatus but merely point the antenna up, so that the ionosphere would not influence the results, and take intensity readings versus time as the earths rotation caused the antenna to scan across the milkyway.

Best regards,

Grote Reber