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MURRAY HILL LABORATORY
MURRAY HILL, NEW JERSEY
SUMMIT 6-6000

July 8, 1946

IN REPLY REFER TO

1170-CHT-CMH

REPLYING TO

MR. GROTE REBER

212 W. Seminary Avenue

Wheaton, Illinois

Dear Mr. Reber:

I appreciate very much your letter of May 10 as well as your thinking of me in your interesting June 24 letter to Dr. Southworth mentioning recent radio measurements on the sun and Milky Way. Dr. Southworth sent me a copy of the letter.

I believe there is a misunderstanding about the theory of radiation from the Milky Way which I have proposed. In reading over my letter to you of May 7 I can see why my statement may not be clear. This letter says "the apparent Milky Way temperature or the energy per frequency interval received in the frequency range in which you are working is approximately inversely proportional to frequency squared". Since an apparent temperature T means that the radiation density or the radiation received in watts per cm^2 per unit solid angle is proportional to $Tf^2\Delta f$, this means the radiation (collected) from the Milky Way in watts per cm^2 per unit solid angle should be constant. This is consistent with the second half of the statement quoted because of the way the directivity of an antenna necessarily changes with frequency. This means that the power actually received at the terminals of an antenna is proportional to $T\Delta f$ which according to my theory should indeed be proportional to $f^{-2}\Delta f$, although the power incident on the antenna in watts per cm^2 per unit solid angle per frequency interval is constant. On rereading your May 10 letter I believe the same difficulty occurs there. You state that Rayleigh-Jeans gives $I \propto f^2$, and my proposal $I \propto f^{-2}$. I would say that Rayleigh-Jeans gives $I \propto f^2$ energy incident on the antenna in watts per unit area per unit solid angle per frequency interval and $I \propto f^0$ at the antenna terminals in watts per frequency interval. Similarly my proposed theory gives $I \propto f^0$ energy incident on the antenna, but $I \propto f^{-2}$ at the antenna terminals.

Your June 24 letter judges, "as a first estimate", the "absolute intensity of Sagittarius to be the same at 160 m.c. and 480 m.c." If am not confused about your meaning this "absolute intensity" is the watts per unit area per unit solid angle per frequency interval, which my theory predicts should be the same for these frequencies. Of course your estimate that the intensity from the direction of Sagittarius is constant is based on assuming that for the sun $I \propto f^2$, which although a reasonable assumption, may not be exact. I hope you will set me right if I am misinterpreting your meaning in absolute intensity, and will keep me posted on your future results.

Your letter of May 10 asked the source of the clipping I sent you. It was from the program of the Cambridge meeting of the Am. Phys. Soc. (April 25 - 27, '46), which program I believe will be soon republished in the Physical Review.

Sincerely yours,

Chas. H. Townes

CHAS. H. TOWNES