



DEPARTMENT OF PHYSICS

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January 12, 1978

*Posted 13/1/78 \$2.00, Rec'd 23/1/78*

Dear Dr. Reber:

You will find enclosed a copy of our introduction to your paper which will appear in the Source Book in Astronomy and Astrophysics 1900-1975 which is in the typesetting stage at the Harvard University Press. As you can see from the Table of Contents, which is also enclosed, we have attempted to provide a brief historical background for each of 133 articles covering a broad spectrum of topics. We are anxious to avoid any crucial misinterpretations or omissions which we may have inadvertently made in our work, and for this reason we solicit your response to the enclosed introduction. Here we are not searching for lengthy correspondence on matters of style or emphasis, but rather for an immediate response to possible inaccuracies or crucial omissions of historically important papers or events. Because the edited manuscript is now being typeset, corrections would best be made by short additions at the end of a paragraph, or by a short paragraph at the end of the introduction. Additional references are easily added by numbers and end insertions. Because of our production schedule, we must receive any corrections by February 14, 1978. We are, of course, interested in more lengthy comments on the historical aspects of your special area which might be used in a future volume that will provide a thorough historical perspective rather than a brief historical introduction.

Sincerely yours,

Kenneth R. Lang  
Assistant Professor of Astronomy

KRL:dd

6. On the Discovery of Extraterrestrial Radio Waves

a) A Note on the Source of Interstellar Interference ✓

Karl G. Jansky ✓

(Proceedings of the Institute of Radio

Engineers 23, 1158-1163 (1935)) ✓

b) Cosmic Static ✓

Grote Reber ✓

(Astrophysical Journal 100, 279-287 (1944)) ✓

These two papers report the first exploration of the heavens at wavelengths far beyond those normally visible to the eye. Before the discovery of cosmic radio sources, astronomical investigations had depended solely on observations with telescopes operating at optical wavelengths of about  $10^{-5}$  cm.

centimeters

In the early 1930's radio waves were, however, being used extensively for communications across distances as large as the Atlantic Ocean; and at that time the Bell Telephone Laboratories assigned to Karl Jansky the task of investigating the atmospheric static that interferes with radio communications. For this purpose he built a rotating "merry go-round" array, which detected signals coming at the long radio wavelengths of 14.6 m. In his first report on these studies\* Jansky documented a steady hiss of static of unknown origin that seemed comparable in intensity to the radio noise produced by lightning discharges in distant thunderstorms. By observing the variation of the intensity of this

meters

"unknown" radio signal as a function of direction and time of arrival, Jansky established in the following year that the radio source must lie outside of the solar system.<sup>\*\*</sup> The most intense radio emission was found to be coming from the direction of the center of our Galaxy, and further analysis of the data showed that weaker radio waves were coming from all directions in the Milky Way. In the present paper he concludes that the source is in the stars themselves or in the interstellar material in the Milky Way.

Jansky's radio techniques were so much outside the traditional methods of astronomy that no observatory started an investigation of his discovery. The next steps were taken by an amateur, Grote Reber, who built a parabolic antenna in his backyard to pursue these findings. By 1940 Reber had confirmed Jansky's discovery of cosmic static from the Milky Way,<sup>\*\*\*</sup> and in this paper he gives the first contour maps of the radio emission at a wavelength of 1.87 m. He also detected discrete sources of radio emission that lie in the direction of the galactic center, Cygnus, and Casseopeia, *7 meters*  
~~together with a marginal detection of a source in the nearby spiral nebula, Andromeda.~~

Jansky's experiment, which led to the discovery of an entirely new radio universe, was the first of several unexpected discoveries that have characterized radio astronomy. Thirty years later Arno Penzias and <sup>Robert</sup> R.W. Wilson, also working at the Bell Telephone Laboratories, accidentally discovered the microwave remnant of the primeval "big-bang" explosion of our Universe. Similarly, the pulsars were accidentally discovered by a group of Cambridge radio astronomers

while observing the scintillations of extragalactic radio sources  
in the interplanetary medium.

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- \* Proceedings of the Institute of Radio Engineers 20, 1920-1932 (1932). ✓
- \*\* Proceedings of the Institute of Radio Engineers 21, 1387-1398 (1933). ✓
- \*\*\* Proceedings of the Institute of Radio Engineers 28, 68-70 (1940). ✓