2-21-48

This program was sustaining material of CBS networks originating in Washington. Stations may or may not use sustaining material as they choose. As it so happened the Washington outlet (WTOR) of CBS had sold the time for advertising records. Thus it did not need sustaining material. Consequently, even tho the program originated in Washington it was not broadcast in Washington. The program was probably broadcast by CBS stations in outlying areas which needed sustaining material.

G.R.

ADVENTURES IN SCIENCE

Radio program presented Saturday, Feb. 21, 1945
3:15 to 3:30 p.m. EST under the auspices of Science Service
over the Columbia Broadcasting System

(OPENING SELECTION FROM PROF. MARTUCCI.)

ANNR: This is Watson Davis, speaking from Washington.

(To be supplied)

That is the top science news of the week, in my opinion.

ANNR: For more news of the world of science, listen now as Columbia presents "Adventures in Science" with Watson Davis, director of Science Service and editor of the Science News Letter. In a few minutes you will hear about radio waves from the sun. Now, Mr. Davis, more highlights of science.

DAVIS: (To be supplied)

ANNR: Now, Mr. Davis, what is our Adventure in Science today?

DAVIS: Our Adventure in Science quest today is one of the country's most ardent radio listeners -- a scientist who spends his time listening to radio broadcasts originating in outer space. He is Dr. Dayton Ulrey of the National Bureau of Standards here in Washington. Dr. Ulrey, just what are these scientific and other radio broadcasts?

ULREY: Well, Mr. Davis, we can't know exactly what they are in terms of their ultimate source. We do know, however, that outer space, including the sun, is constantly radiating vast amounts of energy of one sort and another. Light and heat are the radiations that affect us most, and probably always will. But light and heat aren't the only forms of energy arriving from outer space. As a matter of fact the energy radiated in the radio frequency bands is becoming a rather important problem in the communications field.

DAVIS: Before we go into the facts and circumstances, Dr. Ulrey, perhaps you'd better tell us how the energy of the sun reaches us with sufficient intensity

[illegible]: That can be told with one word, Mr. Davis -- UNFAVORABLY. There doesn't seem to be any Beethoven or Vaughn Monroe out there in space. Radio energy from the stars, which comes mainly from the direction of the Milky Way, sounds like a steady hiss in a receiver. Solar noise has this steady hiss too, but added to it are swishes and puffs which often add up to a sound I can only describe as a grinding noise. Of course, we rarely do any actual listening these days, and all the information is recorded by electronic devices.

DAVIS: Is there an immediate practical aspect to your research on cosmic and solar noise?

[illegible]: There is, indeed, Mr. Davis, and it's becoming more practical every day as the scramble for "radio living space" forces us to higher and higher frequencies. Cosmic noise from the Milky Way is undoubtedly one of the major factors limiting the distance that FM and television can transmit.

DAVIS: In exactly what way, Mr. [illegible], does cosmic radio noise interfere on the FM frequencies?

[illegible]: As you know, Mr. Davis, the unusual feature of FM is that it suppresses static. It succeeds absolutely in suppressing cosmic static up to a certain distance away from the transmitting station. At some point, however, the strength between the competing FM and cosmic radio energy begins to change in favor of the cosmic noise, until it is at last able to drown out the broadcasting station.

[redacted]

[redacted]

DAVIS: What effect does the cosmic static have on the television frequencies, Mr. Reber?

REBER: On television frequencies, cosmic static causes picture jumpiness and streaking and snow to appear. These effects, by the way, are just as important in other high frequency equipment such as certain types of radar and aircraft safety instruments.

DAVIS: Before I ask you about the sun's broadcasting activities, Mr. Reber, I think there's a loose thread we ought to pick up. What is the effect of these radio energy showers on the lower broadcasting band such as the one this program is being received on?

REBER: As far as we know, none whatsoever. That's because the frequencies used in the standard broadcast band cannot escape from the earth through the ionosphere -- a sort of radio roof, about 75 miles in the air, which covers the earth and prevents radio waves from escaping into space. Likewise, lower frequencies from the Milky Way cannot reach through this ionosphere to the surface of the earth. This is all to the good, too, because the home radio broadcast band has trouble enough with the static generated within our own atmosphere. Beyond about [illegible] frequencies above 15

megacycles, and begins to slope off above 100 megacycles. However, it's at this point that solar static starts to come in.

DAVIS: And that, of course, puts the sun's radio noise in the upper frequencies of television and certainly in the color television band.

REBER: Yes, and the effects on television broadcasts caused by solar noise is much the same as that caused by cosmic noise. We are using similar equipment to track down both of them. except that it is most pronounced during periods of solar activity.

DAVIS: Before we go into your present project, Mr. Reber, it might help to catch up on the historical background. How long has this problem been bothering radio engineers?

REBER: Only recently have we recognized the concrete aspects of the problem, Mr. Davis. But like other fields of science, the probable existence of such radio energy radiations was pointed out on the basis of theory some time ago. Fifty years ago scientists recognized that radio, heat, visible light, ultraviolet light, and X-radiation were all manifestations of the same electro-magnetic phenomena and that the chief difference between them was probably not one of kind but of frequency.

DAVIS: Fifty years ago takes us back to the birth of radio. Opportunities to test the theory must have been completely out of reach.

REBER: Yes, Mr. Davis, and they remained out of reach until the year 1932. In that year, K. J. Jansky of the Bell Telephone Laboratories was studying the direction of arrival of thunderstorm static by means of a rotating directional antenna tuned to 20.5 megacycles. When no other disturbances were present, Jansky observed that his equipment continued to register a small residual static. This was traced down and ultimately found to come from the direction of the Milky Way. The celestial origin of these radio waves was demonstrated by the fact that no matter what the position of the earth, they continued to arrive from the direction of the Milky Way.

DAVIS: You say Jansky's work was published in 1932. When did you become interested in the field, Mr. Reber?

REBER: During the year the work appeared, Mr. Davis. I was then attending the Illinois Institute of Technology. After graduation, and a year of post-graduate study at the University of Chicago, I began working as a radio engineer with Stewart Warner in Chicago, so my study time was mainly at night.

DAVIS: Was it just general scientific curiosity that made you continue studying while holding down a full-time job?

REBER: Something like that, I guess, Mr. Davis. In many ways scientific curiosity isn't so different from any other kind. The heavy work began in 1936 when it seemed obvious, from considerations of physical optics and theoretical physics, that if the sources of noise in the stars could be more accurately determined, then it would be possible to draw a noise chart of the sky much like the charts of constellations found in any astronomy textbook. By 1936 I had my equipment assembled and after a series of disappointing tries, began to get results on 160 megacycles.

DAVIS: Where were you conducting your experiments at that time, Mr. Reber?

REBER: Because of a rather tolerant family, Mr. Davis, I was able to usurp the side yard of our home in Wheaton, Illinois. People there got so used to seeing my equipment that I could always spot strangers in town by the fact that they'd stop to take a look.

DAVIS: Just what was your equipment like?

REBER: It looked like a giant mushroom. The largest item was a big saucer, 30 feet in diameter, that captured the signals from outer space. Cosmic broadcasts collected by the saucer were absorbed by a drum at the focus which acted like the photographic plate in a light telescope. Radio energy from the drum was transmitted down to a meter which registered the intensity of incoming radiations.

DAVIS: If you worked all day, you must have had to do your research at night.

REBER: It was done at night but not only because of the job. The gear was sensitive enough to pick up almost any type of energy radiation. In the daytime, the only thing coming in was the sound of the ignition systems of automobiles passing nearbys. For a number of months I worked in the quiet hours of the night, taking down the data registered on the meter by hand. But a job in the daytime, and the necessity for extreme accuracy eventually stopped this and I installed automatic recording equipment.

DAVIS: Equipment such as you describe must have been very expensive. Where did you get financial aid for the project?

REBER: I used my own money. It was a somewhat inflated version of the spending habits of the average radio amateur. The enthusiastic ham, you know, is always doing just one more thing to his rig and every $10 spent is going to be the last -- almost. Two things happened eventually. The project became too big to handle alone of course. But also with the rush to higher frequencies, the results began to have real practical importance.

DAVIS: I suppose that was the meeting point between you and the National Bureau of Standards.

REBER: Yes, Mr. Davis. Through scientists at the Yerkes Observatory I got in contact with the men at the Bureau of Standards. They were, by the way, already conducting cosmic noise observation projects of a slightly different nature.

DAVIS: I understand your group is a part of Ross Bateman's Experimental Ionospheric Research Section. What is the Section's next step?

REBER: My own equipment has been moved from Wheaton to Sterling, Virginia, and is almost completely installed with substantial improvements made over the old set-up. One of our biggest finds was a set of German Giant Wurzburgs which the Army Signal Corps had brought back from Germany.

DAVIS: Those were the German devices that gave early warning of the approach of

our aircraft, weren't they? Just how big are they and how are they being used, Mr. Reber?

REBER: Their most obvious feature, the saucer or mirror, is 25 feet in diameter. A small antenna in the center of each saucer actually receives static which is then carried by cable to the electronic equipment in an adjoining building. The saucers will be controlled so that they automatically follow the sun's path throughout the day.

DAVIS: Then you're going to be using the Wurzburgs to receive broadcasts from the sun and your own Wheaton equipment for the cosmic noise broadcasts from the Milky Way.

REBER: That's right, Mr. Davis.

Davis: What is the next step in your research series, Mr. Reber?

REBER: First of all, we're going to try to really pin-point the sources of the two types of static. But perhaps even more important, we're going to find out the frequencies they are strongest on -- whether or not there is a long-term cycle connected with them -- and the details of their seasonal variations. You can see, Mr. Davis, that a rather long period of time is involved in this sort of thing.

DAVIS: Yes, indeed, Mr. Reber. But I'd like to know if there is an even further gleam in your eye.

REBER: Not in mine, particularly, but in the eye of everyone interested in studying our universe. It's no more than a gleam now, but here is an idea that has been advanced. It is known that the elements, like hydrogen, will, under certain conditions, emit several forms of energy. If some of the energy is in the radio frequency spectrum, we may be able to construct receiving equipment sensitive enough to pick it up. If that day ever comes, it is not impossible that we will be able to make an analysis of outer space. But let me emphasize again -- such ideas are very much in the future, although

sometimes, in science, the future turns out to be next year.

DAVIS: Thank you, Mr. Reber, for telling us about listening in on the radio signals from the sun. We hope to hear good results from these future experiments. To keep you up to date on the latest developments in science, Science Service issues the weekly magazine, Science News Letter. I'll be glad to send you a sample copy. It's free. Just write for it.

ANNCR: For your sample copy of the Science News Letter, drop a postcard to Watson Davis, Science Service, Washington 6, D.C. Be sure to ask for a sample Science News Letter. (I'll repeat the address: Watson Davis, Science Service, Washington 6, D.C.) Now what is next week's adventure, Mr. Davis?

DAVIS: Next week Adventures in Science will be devoted to a national meeting of Science Clubs of America with speakers before the national Science Talent Institute on the program. Every boy or girl who is interested in science is specially invited to attend this meeting by listening in.

ANNCR: You have been listening to Adventures in Science with Watson Davis, Director of Science Service.....a CBS presentation.....heard every Saturday, same time, same station.

(System
1:29:30 This is CBS, the Columbia Broadcasting System.
p.m. EST)

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