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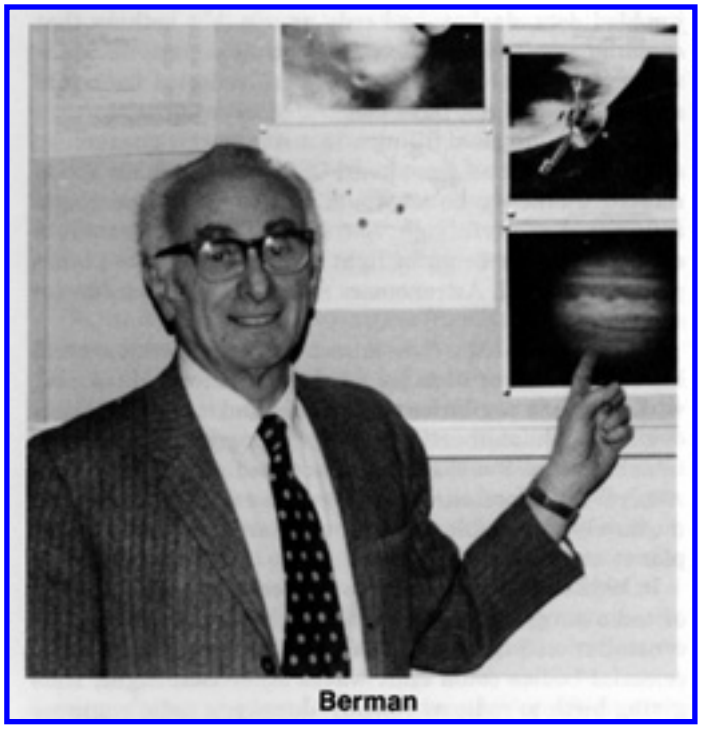
What It Was Like Before Ozma

By: Louis Berman


Berman

The search for extraterrestrials has quite a history prior to the advent of *Project Ozma* in 1960. Long ago, the idea of communicating with inhabitants of other worlds was regarded as fantasy, forever unattainable. But as telescopes grew in size and knowledge of the heavens increased, and as our technology improved, the time at last seemed opportune to consider seriously the problem of extraterrestrial communication. A century or more ago, in the absence of adequate techniques, attempts to communicate with extraterrestrial beings were confined to modest goals within the solar system and Mars was selected as the most appropriate candidate.

Let us first ask: How did humans acquire their speech-making ability and the knack of making artifacts that have made long-distance communication possible? When early man began to walk upright, it is believed that the vertical position of his head on top of his neck gradually caused the air passages in the throat to change so that he could form words rather than sounds. This would not have been possible in a four-legged creature whose head hangs in a horizontal position.

When humans learned to manipulate their hands for tool-making and other purposes, the part of the brain that controls hands grew stronger and larger. Now it happens that this part of the brain lies next to the part that controls speech. As man's manipulative dexterity grew he developed a larynx and vocal organs that aided in the production of speech. An explanation of why apes can't talk is that they haven't used their hands in the variety of ways humans do, and this could be one of the reasons their brain capacity does not match ours.

With the ability to communicate, man in time learned how to pass information on to others separated at some distance from him. There are a number of older ways by which messages can be relayed from one place to another:

Smoke signals

Beating of drums
Sounds from bugles and firearms
Yodeling
Wigwagging
Carrier pigeons
Semaphores
Heliograph by day
Light and fires by night
Flash lamps using Morse code

Signalling by semaphore in 1842, two years before Samuel Morse invented the telegraph.

Some of these are still in use.

In the nineteenth century interest in extraterrestrial communication took a quantum jump. In their book* (*"Intelligence in the Universe", Prentice-Hall, 1966) MacGowan and Ordway recall some of the schemes proposed for alerting other worlds to the existence of life on the earth. Three examples are as follows:

Around 1820 Karl Gauss, the celebrated German mathematical astronomer, proposed planting parallel wide strips of pine forest in Siberia to enclose a huge right-angled triangle with wheat growing inside as contrast to the green of the trees in summer while in winter snow inside would stand out from the trees.

In 1840 Joseph von Littrow, Director of the Vienna Observatory, suggested digging a circular ditch 30 kilometers in diameter in the Sahara desert. After filling the ditch with water, kerosene would be poured on top and lit to signal our presence to other worlds. Other large ditches in the form of squares or triangles could be ignited as a sign of intelligence on earth.

In 1869 Charles Cros of France conceived the idea of constructing a huge mirror to focus sunlight and burn out simple numbers on the desert sands of Mars. Another

plan proposed was to establish a network of mirrors in selected European cities arranged to beam the configuration of the Big Dipper to Martians.

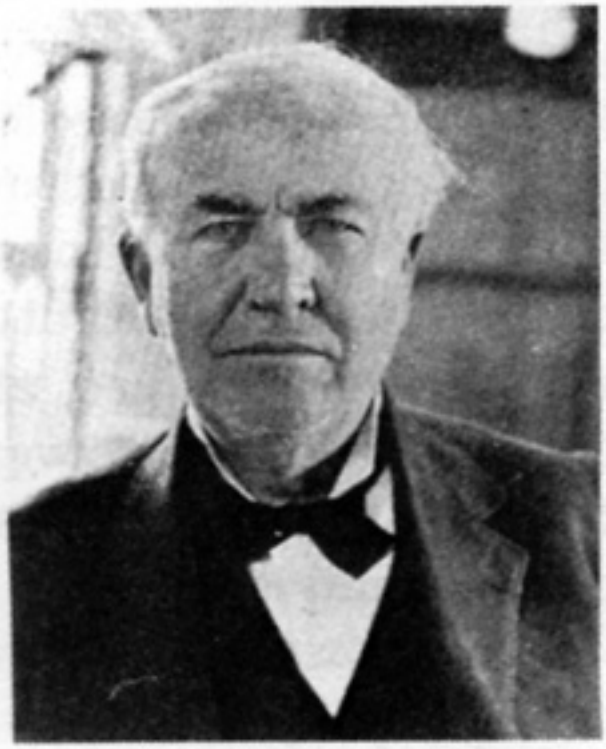
While the Europeans were hatching geometrical and mechanical schemes to alert other worlds of our presence, other developments were taking place that were to have a profound effect on the progress of long-distance communication. First came the invention of wire telegraphy by Samuel F. B. Morse who transmitted a message in 1844 from Washington to Baltimore before an assembled U.S. Congress. Next came the revelation by Heinrich Hertz in 1888 that electric waves could be propagated in space without wires, as predicted by Maxwell's theory of electromagnetic radiation fifteen years earlier, and in 1901, Guglielmo Marconi succeeded in transmitting a signal by wireless telegraphy across the Atlantic from Cornwall, England, to Newfoundland.

It was natural to inquire whether the sun might be capable of emitting electromagnetic energy in the form of radio waves. Arthur E. Kennelly, whose name is associated with the Kennelly-Heaviside ionospheric layer, wrote a letter in 1890 to Director Holden of the Lick Observatory suggesting that waves longer than light waves might be coming from the sun but nothing was done. However, both Thomas Edison and Sir Oliver Lodge carried out experiments to detect radio waves from the sun without success.

Maxwell

Hertz

Marconi



Edison

Lodge

Tesla

Jansky

Reber

One experimenter whose bold imagination carried him farther than the rest was

Nikola Tesla, the eccentric electrical pioneer. He set up equipment in his laboratory near Pikes Peak, Colorado in 1899 to "talk to the planets" as he expressed it. His apparatus consisted of a large primary coil 23 meters in diameter and a 1 meter copper ball mounted on top of a 60 meter mast. He sent powerful alternating surges of electricity into the copper ball and into the ground, believing that the magnetic field of the Earth would increase the power of the signal. Although incandescent lights were set glowing 40 kilometers away, he was unable to detect any extraterrestrial response. Somewhat later, he claimed to have picked up interplanetary signals directed by intelligent control.

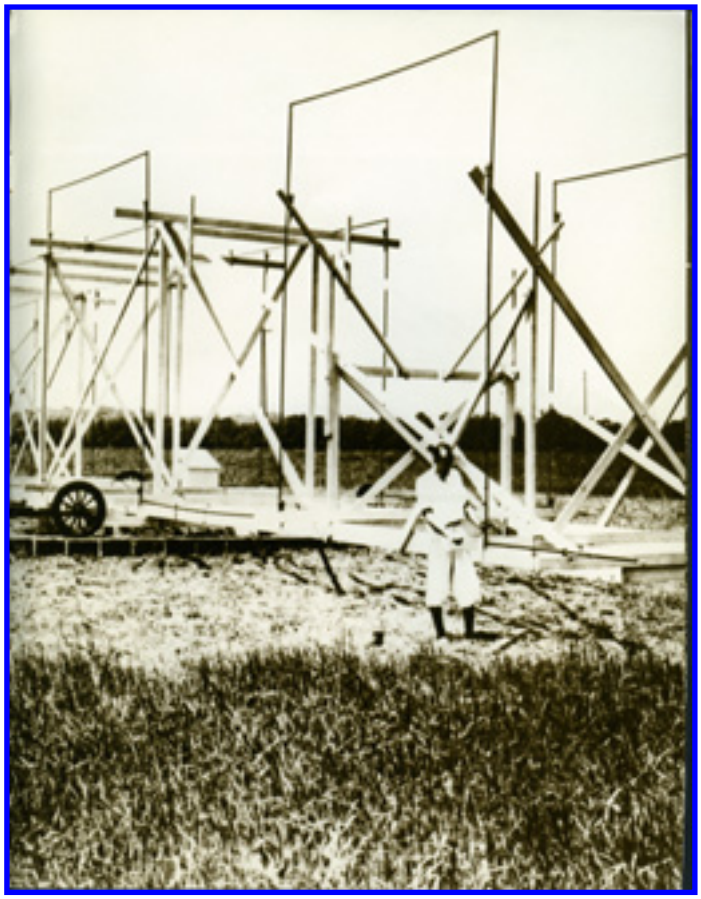
In 1921 Marconi reported that he had detected pulsed long-wavelength extraterrestrial signals while aboard his experimental communications yacht, Elettra (named after his wife).

Davis Todd, Professor of Astronomy at Amherst College, proposed operating a radio set from a dirigible 3000 meters above the ground for communicating with Martians in the belief they were capable of tuning in on our broadcast stations. In August 1924 when Mars was closest to the earth at 60 million kilometers Todd arranged to have the U.S. Government turn off its high-powered transmitters for five minutes before each hour between August 21 and August 23. During these silent periods he used a receiver tuned to a wavelength between 5 and 6 kilometers to record on tape any signals coming through. All he and listeners throughout the country could pick up was a potpourri of jumbled dots, dashes, and code groups, but nothing that could be ascribed to an extraterrestrial source. We know today that such very long waves are reflected back into space and could not have penetrated to the ground.

Todd also proposed filling a 15 meter bowl with mercury at the bottom of an abandoned Chilean mine shaft. When rotated the heavy liquid would form a natural parabolic reflector. A powerful light source placed at its focus would send an intense beam of light to Mars when the planet passed overhead. Astronomers ridiculed it as a hare-brain scheme.

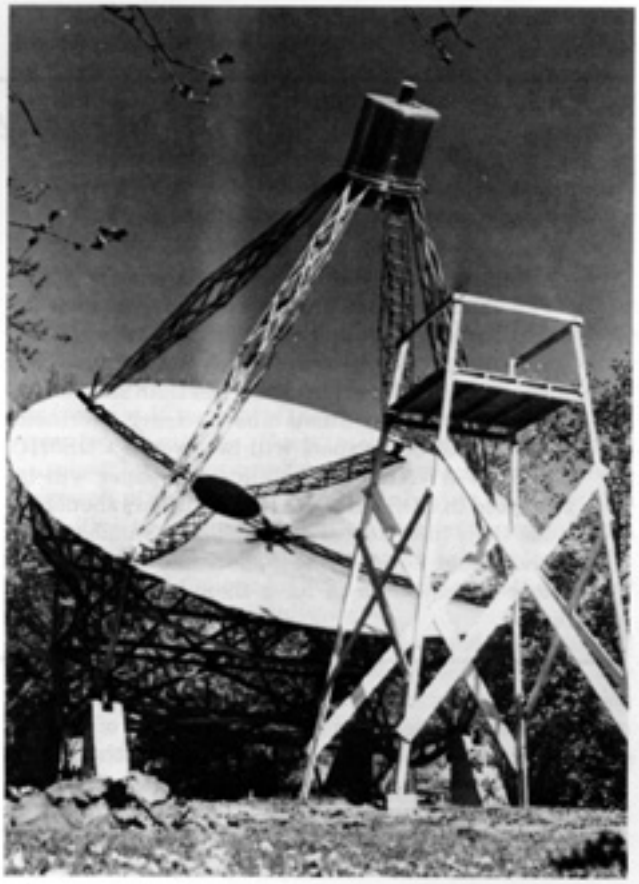
If hypothetical Martians launched probes in orbit around Earth at the same distance as our weather satellites, and with the same resolution, they would find it hard to obtain evidence of human artifacts from photographs, at least in the short run. But if the probes carried short wave radio receivers, the presence of life on the earth

would be immediately detectable because our earth is a very noisy planet at radio wavelengths.



In 1932 came the serendipitous discovery by Karl Jansky of radio waves from the center of the Milky Way in the constellation Sagittarius. Here was the first evidence that celestial bodies could emit waves other than light, thus giving birth to radio astronomy. Jansky, a radio engineer at the Bell Telephone Laboratories in New Jersey, had been assigned the task of identifying the static noises plaguing trans-Atlantic radio telephone communications. He constructed a 30 meter antenna system tuned to 14.5 meters. It was mounted on a rotatable wooden frame which rolled on four wheels running on a circular track (see photo to the right; from inside back cover). He employed a very sensitive receiver coupled to a continuous recorder. In addition to registering the crackling noises arising from local and distant thunderstorms, he later succeeded in singling out a weak static noise that was hardly distinguishable from the receiver's internal noise. In headphones he could hear a faint hissing whenever the antenna pointed toward the direction of Sagittarius in the sky.

In 1933 Jansky published his results in the *Proceedings of the Institute of Radio Engineers* but they received little attention. Another paper published in *Popular Astronomy* attracted scant attention by astronomers who were too preoccupied with optical astronomy and who knew little or nothing about radio techniques. When Jansky died at the age of 44 in 1950, his obituary in the magazine Science consisted of a very short paragraph without any mention of the potentialities of his discovery.



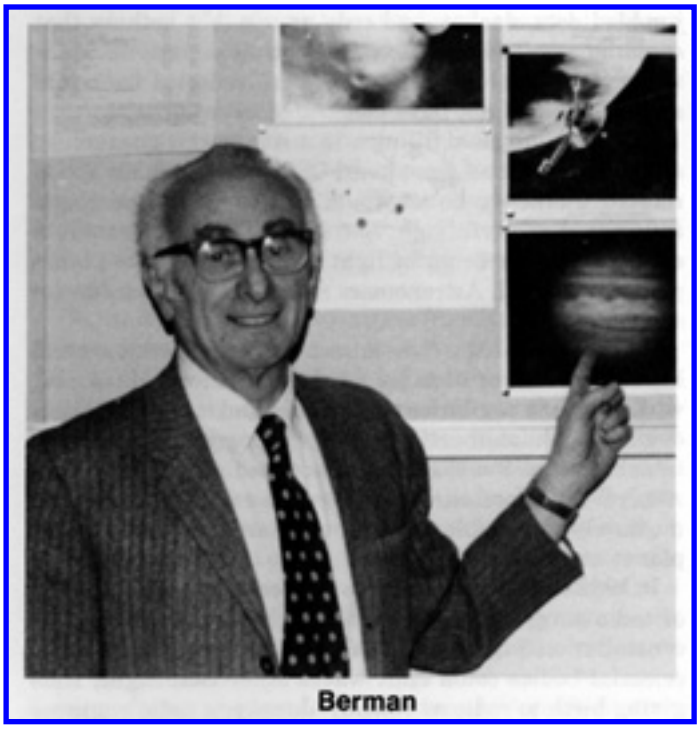
Grote Reber's dish antenna at Wheaton, Illinois, in 1938, the prototype of the modern radio telescope.

It remained for the radio engineer, Grote Reber, to carry on where Jansky had left off. In 1937 Reber constructed the first large parabolic radio dish, 10 meters in diameter, in his back yard at Wheaton, Illinois. This radio telescope operated at a wavelength of about 2 meters and could distinguish more detail than Jansky's antenna. After several years of observing Reber was able to put together a map of the radio sky (see below right) which revealed the presence of several discrete radio sources as well as the diffuse radio emission coming from the direction of the center of the Milky Way, previously discovered by Jansky. His results, published in 1940 in the *Proceedings of the Institute of Radio Engineers* and in the *Astrophysical Journal*, attracted the attention of a few astronomers but World War II intervened and many astronomers became involved in the war effort.

However, some serendipitous radio astronomy observations occurred during the war. Late in February 1942 the 5 meter wavelength British early-warning radar system overlooking the English channel suddenly became inoperative because of a very strong noise-type signal. Enemy jamming was suspected but further investigation by British radio physicist J. S. Hey identified the sun, then undergoing a flare outburst, as the source of the noise. Later a radar installation used to detect incoming V-2s picked up radio noises from various celestial sources. This information was kept confidential until after the war.

First map of the radio sky as produced by Grote Reber showing strong sources of radiation in Cassiopeia, in Cygnus and in Sagittarius, the center of the galaxy, the region from which Karl Jansky had detected radio emission.

When the war ended in 1945, radio engineers, physicists and astronomers rapidly expanded the field of radio astronomy with the construction of ever larger radio telescopes. At the National Radio Astronomy Observatory in Green Bank, West Virginia, scientist Frank Drake, with the support of Director Otto Struve, began to entertain the idea that the time was ripe to look for intelligent signals from outer space although many scientists were not so disposed and some were scathingly critical. The idea gained respectability with the historic publication in the September 19, 1959, issue of *Nature* of an article by Giuseppe Cocconi and Philip Morrison who recommended that a search for intelligent signals from beyond the solar system should be instituted with existing large radio telescopes in the microwave region around 21 centimeters wavelength. At that time the largest radio telescope was the 76 meter dish at Jodrell Bank, England, but its director, Sir Bernard Lovell, expressed no enthusiasm in using it to search for extrasolar intelligence. He later changed his mind about the Cocconi-Morrison suggestion, but the telescope was never used in that capacity. This is where **COSMIC SEARCH** comes in and takes over the story in its first issue of January 1979.


Berman

Louis Berman is adjunct professor of astronomy at the University of San Francisco. He has taught courses in mathematics, physics and astronomy at the City College of San Francisco and the history of rocketry at the State University of San Francisco. Born in 1903 in London, England, he received his bachelor's and master's degrees at the University of Minnesota (1925, 1927) and his doctorate as a Lick Observatory Fellow from the University of California at Berkeley (1929).

The second edition of Dr. Berman's textbook, "Exploring the Cosmos", with co-author John C. Evans, has been used as the background text for a 39-part TV series on introductory astronomy entitled: "Project: Universe", produced for the Public Broadcasting Service by the California Consortium of Community Colleges. Like many other SETI people, Berman is also a licensed radio amateur.

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