BIOASTRONOMY NEWS

BIOASTRONOMY: THE SEARCH FOR EXTRATERRESTRIAL LIFE

IAU COMMISSION 51

Volume 6 Number 4 Published by The Planetary Society Fall 1994

Project META Reports 56 "Alerts"

Dual Search Detects Signals That May Have Extraterrestrial Origins

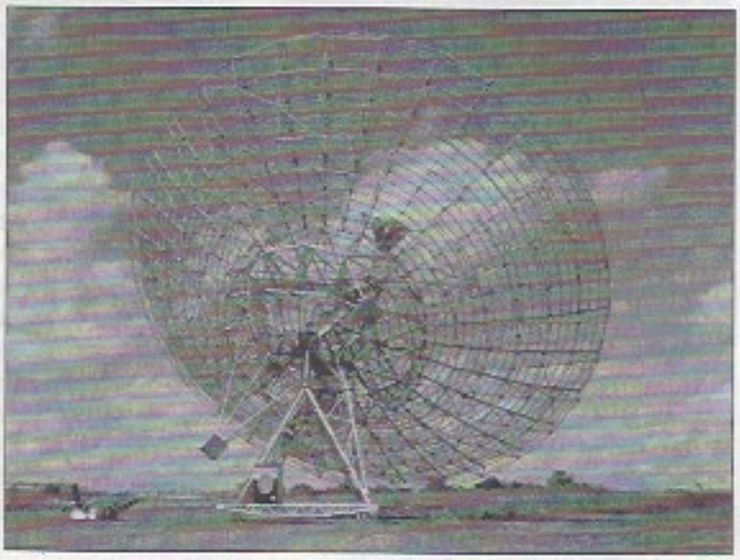
By Guillermo A. Lemarchand

In the northern and southern hemispheres, the search for extraterrestrial intelligence known as META (the Megachannel Extraterrestrial Assay) has detected 56 signals that may be alerts from extraterrestrial civilizations. But this search has not successfully confirmed that these signals have an intelligent extraterrestrial origin.

After six years of operation, META I—operated by Paul Horowitz at Harvard University—has examined more than 6×10^{13} different spectral channels, among which they found 37 candidate events. (Horowitz and Carl Sagan reported these findings in "Five Years of Project META: An All-Sky Narrowband Radio Search for Extraterrestrial Signals," *Astrophysical Journal,* vol. 415, Sept. 1993, pp. 218-235, and "Project META: What Have We Found?," *The Planetary Report,* vol. 13, no. 5, Sept/Oct 1993, pp. 4-9.)

Meanwhile, in the southern hemisphere, META II—directed by Raúl Colomb at the Argentine Institute of Radio Astronomy near Buenos Aires—found 19 candidate events after examining more than 1.6×10^{13} different spectral channels.

All these "alerts" have extremely narrow bandwidths that do not seem to share the Earth's rotation. But, unfortunately, searchers haven't detected any of these signals on reob-



This 30-meter-wide telescope near Buenos Aires, Argentina scans the southern hemisphere for signals that may come from extraterrestrial sources. To date, this part of the META search has recorded 19 potential alerts.

See "META Alerts" Page 2

The Cooperative Approach to SETI

Latest Searches Continue To Join Forces with Other Telescope Efforts

By Robert Quist

The search for extraterrestrial intelligence known as SERENDIP is about to take another step forward. Operating out of the University of California at Berkeley, SERENDIP (an acronym for the Search for Extraterrestrial Radio Emissions from Nearby Developed Intelligent Populations) is preparing to launch its fourth and largest search.

Since April 15, 1992, SERENDIP III has been running at the Arecibo Radio Telescope in Puerto Rico, the largest radio telescope in the world. The program has analyzed more than 70 trillion channels of data, has looked at more than 30 percent of the sky and has encompassed more volume than all previous SETI searches in the world combined.

By many independent standards, the SERENDIP Project is the most comprehensive SETI effort in existence. Examining 4.2 million channels every 1.7 seconds, SERENDIP III has logged information on 200 million channels where the system detected spectral peaks with power significantly above the background noise. The program has come up with about 400 "candidate" signals—alerts that are unusual enough to merit further investigation.

But the SERENDIP organizers—led by principal investigator Stuart Bowyer and program manager Dan Werthimer—are not stopping there. In the middle of next year, they will begin SERENDIP IV, which will be able to

See "SERENDIP IV" Page 3

META Alerts

Continued from Page 1

servation—a key to determining if a signal comes from an extraterrestrial source.

Project META was the world's first million channel search for ultra-narrowband signals that could be generated by other galactic civilizations. META scans 8,388,608 channels with a spectral resolution of 0.05 Hz and 400 KHz of instantaneous bandwidth (plus another 1,048,576 redundant channels to check up on the main branch). The system corrects the observing frequency for motions with respect to three astronomical inertial frames. META also adjusts the frequency to compensate for Earth's rotation, which provides a characteristic changing Doppler signature for narrowband signals of extraterrestrial origin.

Horowitz created the system. Director Steven Spielberg's $100,000 contribution to The Planetary Society funded the construction and launching of META I (autumn of 1985), while the contribution of the Society's members made possible the construction—by two Argentine engineers under Horowitz's supervision—of META II (in operation since October 1990).

META I made a continuous meridian transit search of the northern sky (δ = –30 degrees to +60 degrees) with an 8.4-million-channel spectrum analyzer connected to the Harvard/Smithsonian 26-meter radio telescope at Agassiz Station in Oak Ridge, Massachusetts. META II also made a continuous meridian transit search, but from the southern sky (δ = –90 degrees to –10 degrees), with a similar spectrometer connected to one of the two 30-meter antennas of the Argentine Institute of Radio Astronomy.

META I has covered the sky five times. It has looked at the celebrated 21-centimeter wavelength (the frequency that is theoretically the most likely communication line for an extraterrestrial civilization). META I has also exploited the idea of SETI pioneer Sebastian von Hoerner, looking at the "second harmonic" of the 21-centimeter wavelength—at 10.5 centimeters.

META II has covered the southern sky almost three times, scanning only at the 21-centimeter wavelength. Every 20 seconds, the META system gets an 8.4-million-channel spectrum profile, and keeps only what it judges to be the most interesting. The system saves these strong, interesting signals and saves them and whatever immediately follows onto a hard disk.

Real Extraterrestrial Alerts or Flukes?

How can we determine if these interesting alerts are real extraterrestrial signals? James Cordes and Joseph Lazio from Cornell University are now working on a technique that can help us decide.

Are We Ready for Interstellar Flight?

Facing the Challenges of Exploring Stars

By Greg Matloff

The subject of interstellar travel has begun to move from the domain of science fiction authors to the realm of applied and theoretical physicists. Sending robotic probes to the stars has been the focus of recent studies in the United States and Great Britain, and astrodynamicist Edward Belbruno has been intensively studying the subject for some time. The Planetary Society therefore recently decided to sponsor a conference devoted to this emerging subject.

"We may not be ready yet to advocate a flight project," said Planetary Society Executive Director Louis Friedman, "but the subject bears looking at in a conference setting every five years of so, just to see what's new and what technologies may be encouraged."

The conference—organized and cosponsored by the British Interplanetary Society, NASA, Jet Propulsion Laboratory, Planetary Society, United Nations Outer Space Affairs Division and 13 other organizations—may mark the emergence of robotic interstellar travel as a serious engineering discipline.

Traveling to the Stars?

Conference chair Belbruno and keynote speaker Robert L. Forward (of Forward Unlimited) both noted that practical interstellar flight may not be too far in the future. We already have serious technical studies of many nuclear and solar interstellar propulsion systems at our disposal. And the emerging discipline of nanotechnology makes designs of small (and hence "practical") star probes more realistic.

Of interest to SETI followers, the conference included a special session on detecting planets around other stars. Astronomical progress has led to space- and ground-based observatories that may be on the verge of detecting Jupiter-sized worlds orbiting nearby stars. Scientists are devising techniques for discovering Earth-sized planets and perhaps even ways of determining if such planets are habitable. These techniques may be less than a decade from realization.

Among the conference's other subjects were the following:

- Propulsion techniques (chaotic dynamics, photon and proton sails, particle beams, nuclear radioisotope sails, fission, fusion, antimatter and exotic possibilities)
- Non-propulsive engineering fields that may enable a star probe
- Spacecraft engineering, especially miniaturization technologies for ultra-small launches

A talk by Swedish engineer Curt Milekowsky regarding high projected costs of relativistic star flight may have been sobering to many conference participants. Nevertheless, we can accomplish a great deal with slower probes that can reach 500 to 1,000 astronomical units from the Sun within a human lifetime. As discussed by Jeffrey Van Cleve of Cornell University, such a craft could look back at our solar system to help us determine the validity of our interpretations of current observations of possible extrasolar planetary systems. This is just one of the potential benefits of sending robotic probes to the stars in the future.■

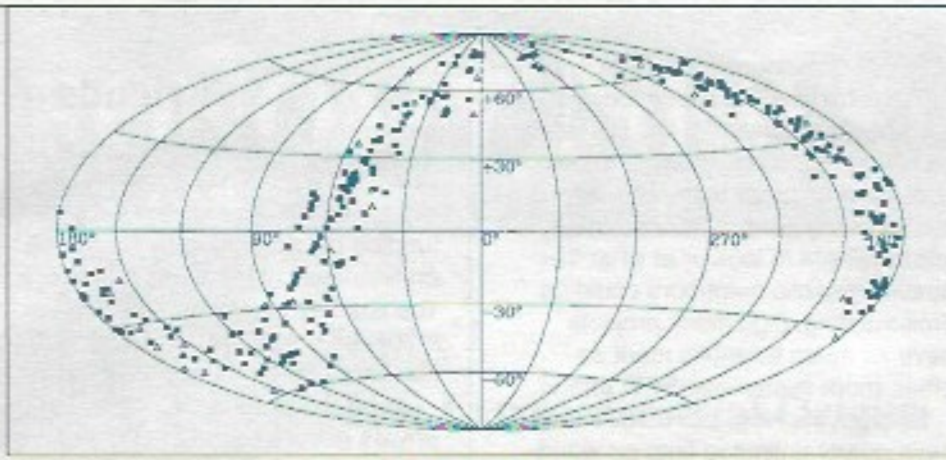
Greg Matloff is a professor of astronomy at New York University and coauthored The Starflight Handbook *with E. Mallove.*

Based on our knowledge of physics, we know that radio signals traveling through the galactic plasma vary a great deal in amplitude. This large amplitude variability is called *scintillation*. Cordes and Lazio are developing reobservation schemes that take these variations into consideration. Such theoretical considerations will eventually help us design better observing strategies.

We have also been working on a different approach. Two days a week, from META I and META II, we have been observing simultaneously the same region of the sky (between –30 and –10 degrees in declination). We scan this area at the same frequency, with the same spectral resolution and at the same reference frame. Under these observing characteristics, the noise statistics alone would generate only one "coincidence" signal per year. If we get a strong narrowband signal from both observatories at the same time and at the same frequency, then we will have more compelling evidence of extraterrestrial origin.

Thus, the quest for the discovery of intelligent life beyond Earth continues. We are also exploring new strategies and developing more sophisticated devices, such as Project BETA (Billion-channel Extraterrestrial Assay)—Horowitz's new scheme to find those elusive signals. With projects such as this, META and others, we are close to the start of a new generation of SETI strategies and hardware.■

Guillermo A. Lemarchand is the editor of Bioastronomy News *and a researcher at the Argentine Institute of Radio Astronomy.*



SERENDIP III has observed about 30 percent of the sky from the Arecibo Radio Telescope. As this diagram shows, more than 400 candidate signals are spread out fairly evenly across the S-shaped band of sky visible from the 305-meter telescope in Puerto Rico.

SERENDIP IV

Continued from Page 1

look at more channels than the current search by a factor of 40.

Like SERENDIP I, II and III, the new system will piggyback onto other astronomical projects; that is, it will share telescope time with other observation efforts. Using this cooperative technique, the Berkeley researchers will be able to analyze 160 million channels every 1.7 seconds.

Using the Arecibo Radio Telescope, this search will concentrate observations near the 21-centimeter hydrogen line, which has frequencies relatively free of cosmic background radiation—perhaps making this part of the radio spectrum a likely place for an intentional beacon. Moreover, international law prohibits radio transmission in part of this band, so human interference is slight.

Previous SERENDIP Programs

Now in existence for 14 years, the SERENDIP project has gone through a series of improvements. The first effort—SERENDIP I—ran from 1980 to 1982 with a 100-channel, 1,000 Hz-per-channel spectrum analyzer piggybacked onto radio telescopes at the Hat Creek Observatory in northern California and the Goldstone Observatory in that state's Mojave Desert.

SERENDIP II ran from 1986 to 1988 and was thousands of times more powerful. It was able to observe 65,000 channels every second on the 300-foot National Radio Astronomy Observatory radio telescope in West Virginia, and, to a lesser extent, at four other telescopes around the world.