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COORDINATOR'S CORNER
By: Phil Barnhart

I find it a bit difficult to write about the plight of **Big Ear** at this time. We often hear about a level playing field. We have the situation now where not only is the playing field not level, but negotiations are (*and are not*) going on at the same time the rules of the game are being altered and invented from day to day.

We are in the dark regarding virtually everything but the fact that the University (*Ohio State*) is no longer interested in supporting in any way the radio telescope near Delaware. Rumor has it that the landlord of record for the past ten years is negotiating the sale to a new buyer (*developer?, invester?, speculator?, astronomer?*) and that the sale should be complete within 60 or 90 days.

Offers of support within the university for painting the telescope are refused and alternative suggestions for carrying on the radio observatory functions at another site are discounted because no one knows the cost of establishing new infrastructure. Such costs are not hard to arrive at, but lack thereof amounts to a reason to reject suggested alternatives.

I wish to publicly acknowledge and express gratitude to all those who responded to our request for letters to *President Gee*. So far I am aware of no response to any of us who wrote or called him regarding the extension of the lease or the radio observatory in general. There is skepticism among

[Note from webpage editor. The last sentence in the last paragraph above (in the printed newsletter) was cut short by an overpasting of the following text (shown below in italics).]

correction in press --

Several of us have received form responses from OSU Vice President for Research. There is still no indication that a change of attitude is in the air. We keep ourselves prepared.

[End of overpasting.]

I need to report that the **Flag of Earth** which has flown continuously since the early '80's at the radio observatory is now down. A recent windstorm broke the flagpole supporting it. As soon as we obtain a new pole it will go back up.

Here's hoping for fresh news with a positive twist the next time we report to you. If you have any copies of letters you sent to Gee but not to us, we would appreciate seeing them. Our archive is bulging.

PEB

PHOENIX PROJECT REPORT

While several stars have come under scrutiny by Parkes' metal ear, **Phoenix** has not yet lapsed into that plodding routine so characteristic of long observing programs. Team members look forward to the happy day when "how's it going?" elicits only simple pleasantries as a reply. The mood here is subject to fairly wide swings, but anyone who's observant will note that the oscillations are superposed on a generally rising all the time. A dual-polarization 10 MHz machine is days away. Full 20 MHz, dual-polarization may be a few weeks in coming.

Of course, if you are so intemperate as to ask the engineers point blank "when will both MCSAs be working?" you're sure to get the project's standard reply: "RSN." That's "Real soon now." The engineers, when in a sarcastic mood, will note that RSN also applies to the time required for Los Angeles to move to Berkeley, at least when measured on a cosmological timescale. When ebullient, the engineers will tell you that RSN means tomorrow. The bottom line? Production line observing will begin when more of the system is operational. It may only be a few days until a system superior to that used at Arecibo is on the air. **Project Phoenix** has been christened, but is not yet on the high seas. The sails are still being rigged, and there's little incentive to leave the harbor until that's done.

The media, who I thought had lost interest, proved to have staying power. There were two TV channels taping here today, and I gave four radio interviews as well. At least some of the latter called up because they expected immediate results, and wished to scoop the competition. Well, Chris Columbus didn't get immediate results either.

This will be my last report from down under on **Project Phoenix**. I leave tomorrow

for Sydney, and will be flying back to California on the weekend. Despite the heat, dust storms, 8,000 calorie lunches, mosquitoes, poisonous snakes, deadly spiders, and *&)*!@!$ flies, I'll miss Parkes. It's a monastic existence: each of us has his own small room. We meet in a dorm style dining room for our meals, and commute a kilometer to the telescope to put in our 16 hours for the cause. During the last few weeks we have gotten to know one another far better than we could have in a year back in California. Conflict is rare, and comaraderie is rampant. This is a very fine group of people, with big hearts and startling talents. I have every confidence in their efforts, and am sorry no longer to be in their presence.

HUBBLE IDENTIFIES HUGE CLOUDS OF INTERGALACTIC GAS

Thu. Jan 19, 1995

Organization: College of Liberal Arts and Sciences, ASU
CONTACT: Ray Villard, (410) 338-4514. Space Telescope Science Institute.
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University of Arizona, News Services.
PRESS RELEASE NO.: STScI-PR95-05.

Astronomers using **NASA's Hubble Space Telescope** have discovered evidence that clouds of hydrogen found between galaxies at distances of billions of light-years from Earth are at least ten times larger than previously thought — at least one million light-years in diameter — and may have a remarkable sheet-like structure.

Theorists will have to rethink explanations of how such large clouds exist, according to astronomers.

The new Hubble results shed light on the properties of these mysterious clouds, the true nature of which remains elusive more than 25 years after their discovery. Understanding this intergalactic material might give important clues to the nature of dark matter and processes occurring in the early universe, including galaxy formation.

The observations were conducted by **Nadine Dinshaw**, a graduate student at the *University of Arizona Steward Observatory*, **Craig Foltz** of the *University of Arizona/Smithsonian Institution Multiple Mirror Telescope Observatory*, **Christopher Impey** of the *University of Arizona Steward Observatory*, **Ray Weymann** of the *Observatories of the Carnegie Institutions of Washington*, and **Simon Morris** of the *Dominion Astronomical Observatory*, Victoria, British

Columbia.

The intergalactic gas clouds are so diffuse they cannot be observed directly. The only signatures of their existence are the imprints they leave on the light from more distant background objects. Astronomers have used these signatures to detect the presence of the clouds and to measure some of their physical properties, but have been unable to discover information on cloud sizes and shapes.

This information is crucial to any attempt to distinguish between the several theoretical explanations for the sites and mechanisms which produce the clouds," says Craig Foltz of the University of Arizona, Tucson, a member of the Hubble team who made the discovery.

Previous explanations have been that the clouds are the halos of primordial clumps of dark matter, that they are the very outer halos of normal galaxies, or that they are produced by shock waves resulting from explosive galaxy formation.

These Hubble results do not explain the details of how the clouds are produced, but they directly imply that the clouds are so large that none of the popular scenarios provides an entirely adequate explanation," Foltz says.

The team used Hubble's **Faint Object Spectrograph** at ultraviolet wavelengths to observe a pair of quasars — extremely luminous and distant objects — separated by an angle on the sky about one-twentieth the diameter of the full Moon. The clouds are detected by the dark absorption lines that they produce in the spectra of the light from the quasars. The quasars act like two flashlights seen from a distance of five billion to 10 billion light-years, shining through an intergalactic "forest" where the "trees" are the clouds.

A problem with such studies in the past has been in finding two quasars that are appropriately paired in the sky, roughly equidistant from the Earth and about equal in brightness. The team used the HST to study a pair of quasars bright at ultraviolet wavelengths but unsuitable for ground-based observations, since ultraviolet observations are impossible to make from Earth.

In the HST observations, several matching absorption lines were seen in the spectra of both quasars, implying that the clouds are at least large enough to cover the lines

of sight to both quasars, or at least a million light-years in diameter, roughly ten times larger than previously thought. (*By comparison, the luminous disk of our Milky Way Galaxy is about 100,000 light-years in diameter.*) Detailed analysis of the observations allowed the team to estimate that the actual size of the clouds may be as much as twice as large, or two million light-years in diameter, and that they may take the form of huge filaments, sheets or flattened disks of material.

These results were absolutely unexpected," Dinshaw says of the discovery. "We were just hoping to get upper limits on the size of these clouds. We never expected to see so many matches in the absorption lines (*in the spectra of each of the quasars in the pair*). We never expected the sizes of these clouds would be so large."

The team plans to confirm their discovery with more Hubble observations of this pair of quasars as well as other close pairs of quasars. They also have undertaken an extensive ground-based observing program to attempt to better understand both the properties of the clouds and their relationship to normal galaxies.

Their results appear in the November 19 issue of the science journal **Nature**.

The Space Telescope Science Institute is operated by the Association of Universities for Research in Astronomy, Inc. (AURA) for NASA, under contract with the Goddard Space Flight Center, Greenbelt, MD. The Hubble Space Telescope is a project of international cooperation between NASA and the European Space Agency (ESA).

Saturday Meeting Report for January 21, 1995

The meeting room at the Observatory was pleasantly warm, on a wintry January day. This is an appropriate time to thank Don James, once again, for his many contributions to maintenance of the facility, and particularly for his repair of the electric heaters and thermostats in the administration building.

In order of their seating at the table, Dr. Barnhart, Ang Campanella, Marilyn McConnell-Goelz, Cindy Brooman, Phil Schumacher, Mark Sundstrom, Jerry Ehman, Russ Childers, Bill Brown, Dr. Dixon and Steve Brown comprised the gathering.

As I arrived, a '**fate of Big Ear**' discussion was underway. Letters to *President*

Gordon Gee were discussed, and a fine example was passed around. Dr. Dixon has been working on a counter proposal, beyond the information presented in the January, 1995, issue of "*Signals*", and he will be working with others to develop it further.

Ang Campanella suggested the possibility of conducting a colloquium or symposium on the *Ohio State* campus, and this idea was given extended consideration.

Dr. Barnhart proposed that the next Saturday meeting might be devoted to a human examination of data gathered during the past year of Russ Childers' sky survey. Russ informed us that he has written analysis programs to review the computer records, and he last ran them in March of 1994. There was discussion of the possibility of converting the programs to run on platforms other than the Macintosh. Russ challenged attendees to duplicate his analysis methods in other languages than C.

Russ estimated that the total volume of data to be gathered during the current 3 year survey will amount to about 20 megabytes.

Cindy Brooman has found a way to scan "*Cosmic Search*" into her computer at home. She has completed almost all of the first issue.

Phil Schumacher brought his system, including **Homenet for Windows** software and a **World Wide Web** package.

Following the meeting, Phil and Cindy impressed onlookers with their systems. Phil demonstrated *Homenet for Windows*, and went on to astonish some of as with his ability to bring in text and pictures from anywhere in the country (*or world*), at a very acceptable data rate over the **Observatory** telephone line.

Cindy demonstrated the database she has constructed of the "*Cosmic Search*" first issue, a very high quality image of the photograph of Dr. Dixon from the *Cleveland Plain Dealer Sunday Magazine* special on **Big Ear**, and a collection of sound and visual images from her pet parrot.

During his World Wide Web tour, Phil visited *Dr. Klein's* **Radio Observatory**

Home Page, and Cindy explained that her work is directed toward offering "*Cosmic Search*" and other materials there.

Alien Life Search Goes Aussie
Fri Jan 27 19:00:43 EST 1995

SYDNEY, Australia (AP) — The huge radio astronomy observatory sits in the outback 220 miles west of Sydney — and perhaps 150 million light years away from extraterrestrial civilization.

For five months starting Thursday, scientists funded by top computer industry whizzes will use the **Parkes** telescope to scan billions of radio waves across the galaxy in search of extraterrestrial life on 200 stars.

The scan is part of a larger project, dubbed **Project Phoenix**, in which observatories around the world are focusing on 1,000 stars for at least the rest of the decade.

It will be the biggest and most systematic sweep of its kind across the southern skies. It continues the quest for proof of alien life that was begun by **NASA**, which had its funding cut by the deficit-conscious Congress in 1993.

Some U.S. lawmakers have dismissed the search for other beings in the universe as pointless. But **SETI**, the private California-based institute that has picked up where **NASA** left off, regards it as vital. [Note from webpage editor. ERROR! The institute referred to is called "The SETI Institute", not "SETI". Note that "SETI" refers to the "Search for ExtraTerrestrial Intelligence" (which is a project, i.e., a search, done by a group or organization or even an individual) but "SETI" is not the name of any single organization.]

It is the most important question the human species has asked itself ... are we alone or are we not? Either way it's mighty important," said scientist *Jill Tarter*, one of a group of former **NASA** astrophysicists now with **SETI**, which stands for search for extraterrestrial intelligence.

The search is backed by **Hewlett-Packard Co.** co-founders *David Packard* and *William Hewlett*, **Intel Corp.** co-founder *Gordon Moore*, *Paul Allen*, co-founder of **Microsoft Corp.**, and science fiction author *Arthur C. Clarke*.

Most of the stars that will be watched are similar in age and size to our sun and so could have Earth-like planets capable of sustaining life, said project spokesman Seth Shostak.

The closest is about 4.5 million light years from Earth. The most distant 150 million light years away.

The project's aim is to identify artificial signals amid the deluge of natural radio waves constantly pulsing through the cosmos. Such a find could be a sign of extraterrestrial civilization, the scientists say.

It's like Columbus getting his sailing ships together and heading out for America," said Kel Wellington, of Australia's **Commonwealth Scientific and Industrial Research Organization**, which operates the Parkes observatory.

Attempts to listen in on alien signals have gone on for decades. This exercise will be much more than twiddling a radio dial.

Intricate computerized equipment, developed by **NASA** for its now defunct research effort, has been attached to the 210-foot Parkes dish.

It will monitor and analyze 28 million radio channels simultaneously in a spectrum which covers radio, television and microwave signals.

If an (*alien*) signal is found, it won't be heard by a human ear. We'll see it first on a computer screen," said Shostak.

Such messages might have taken generations to cross vast distances of space — and it's unlikely any earthling would understand it.

Earth itself has been sending artificial signals since radio was invented a century ago — perhaps not enough time for distant extraterrestrials to know of our existence, Shostak said.

Plenty of possible alien signals have been reported by radio astronomers in the past but none been verified. Elaborate cross-checking will be done by a smaller radio telescope at Coonabarabran, 185 miles northeast of Parkes.

The scientists are convinced extraterrestrial intelligence, probably far more advanced than our own, is somewhere out there. And they promise they will announce any confirmed discovery quickly.

Until then, they regard it as a matter of when, not if. "We could have success at any step, but we are prepared for the long journey. It might take a decade. It might take a century," said project physicist John Dreher.

We can't just sit here and wait for them to arrive in their shiny spacecraft. That's not going to happen."

NASA operated radio receiving equipment for nearly 10 months in 1992 at the *Arecibo* radio astronomy observatory in Puerto Rico. The **SETI** donors pitched in $4.4 million to upgrade the equipment for use at Parkes.

Congress originally committed $100 million to a 10-year radio search for signals from distant planets. Astronomers spent $60 million developing equipment and starting the search before the **NASA** project was eliminated.

Meeting Report for Saturday, February 4, 1995
By: Tom Hanson

The meeting was underway when I arrived at 10:30. Someone had plowed the hillside road next to **Perkins Observatory**, so that all visitors except for one were able to negotiate the incline. The sun shown brightly on the expanse of snow south of the Administration Building. The meeting room was comfortable and warm, with most seats around the conference table filled.

Seated around the table were Drs. Barnhart and Dixon, Phil Schumacher, Jerry Ehman, Russ Childers, Mark Sundstrom, Joe Mitchell, Don James, Steve Brown and Ang Campanella.

At 10:30, Dr. Dixon was concluding his remarks. A binder full of copies of letters from **Radio Observatory** supporters was circulating. It is heartening to read these testimonials from across the country, and even overseas. The **Jones Middle School** students have *once again* responded to the need for their participation, with a packet of well written letters.

Phil Schumacher discussed his modelling of pulsar behavior. The ongoing discussion of possible detection of pulsars came about as a result of an initiative by Herb Johnson, who lives on the East Coast, but who actively participates in **Radobs** discussions via *Internet*. Herb had proposed that it might be possible to find evidence of pulsars in previously collected data, as well as in data collected during Russ Childers' current survey.

Drs. Dixon and Barnhart, Ang Campanella and Phil Schumacher carried on a lengthy discussion of the pulsar question. Eventually Russ Childers joined the discussion, by requesting a review of the history of pulsar detection methods. Russ circulated correspondence he had received from Herb Johnson.

Jerry Ehman joined in with comments about corrections applied to previously collected data.

There seems to be a consensus that the 10-second integration time which has been in place for many years, and which is still in place, would prevent detection of pulsars. The discussion included examination of a table of known pulsars which Phil had brought to the meeting.

Steve Brown reported that a phase detector, damaged during shipment from an **Observatory** supporter, appears to be repairable. This device is equipped with its own power supplies. The existing equipment is supported by serveral independent power supplies.

Steve has received more documentation for the **Serendip** software. He and Dr. Klein have carefully reviewed this new offering, and they have identified four remaining 'sticking points'. Dr. Klein told Dr. Dixon that he had a long conversation with **Serendip** developers during this past week.

Steve went on to describe his attempt to identify sources of birdies detected by **Serendip**. Steve's method was to power down equipment in the focus room, with a dummy load connected to the antenna input, to see if birdies remained. It appears that the Icom receiver is a source, and Steve believes this device can be shielded. A more difficult problem would be correcting birdies caused by the mixer which feeds radio frequencies to **Serendip**. This equipment predates Steve.

A range of frequencies from 1418.75 to 1421.25 megahertz has been investigated to date. Bill Brown is currently studying data collected with the antenna connected to the system.

Steve concluded his report by announcing that keys are now available for the new locks installed on doors to Dreese 805 and Dreese 817. Steve will manage distribution of these keys.

Russ Childers brought six diskettes to he meeting, in response to requests for copies of data taken during the current sky survey. Mark Sundstrom had his MacIntosh Powerbook on hand, and he made copies of the data for several people. Ang Campanella requested one diskette of data, in order to test the Basic version of Russ Childers' analysis programs, which Ang is planning to write. 400 separate files are included in the six diskette set.

Russ has mailed copies of his analysis programs to Ang Campanella, Mark Sundstrom and Cindy Brooman.

Russ announced the the telescope is positioned at 20 degrees, zero minutes of declination. The survey has entered a band of sky in which planets and planetary probes will occasionally enter the beam. He inquired about a means of knowing the coordinates of objects, and the frequencies associated with them.

Russ restored the WWV radio antenna, which had fallen due to deterioration of nylon tielines.

The *World Wide Web Radobs home page* was discussed, and it was emphasized that the member list will be replaced with an edited version.

Don James was in California, helping flood victims.

Jerry Ehman is working on a request from Herb Johnson, regarding 1983 **SETI** data.

Phil Schumacher inquired about the status of the HEMT amplifiers, and Steve Brown said he'd been too busy to work on them recently, but that he hoped to be able to spend some time on them soon.

After the meeting, Tom Hanson and Joe Mitchell visited Dreese Hall, to discuss a potential volunteer opportunity, to head up the *Phase II* portion of the **Card Project**. Successful completion of Phase II will result in a CD rom disk, containing fully organized, verified and annotated data.

Tuesday 2/7/95 Evening Meeting
By: Tom Hanson

Drs. Barnhart and Klein were present for the meeting of February 7th, along with Steve Brown, Russ Childers, Cindy Brooman and Bill Brown, the graduate student who is helping to try to understand the Serendip system.

When I arrived at about 5:30 PM, a discussion of *Lease renewal issues* and status was underway. Suffice it to say that the level of uncertainty remains high, and there is nothing new to report.

Serendip was the next topic. Dr. Klein has authorized final payment for the system. Steve Brown, Bill Brown and Dr. Klein have been carrying out extensive evaluations of the system. Goals of this effort include calibration and understanding of the system. Dr. Klein showed a printout showing a distribution of fine points on bond paper. I gathered that the desired display would have been uniform across the field, indicating uniform response of the entire system, but in this trial there were bands of lesser density on either side of the center field. Two strong birdies were clearly shown as heavy vertical lines, and one faint possible birdie was visible as well. One birdie had been forced through injection of a signal, and the other has been identified as coming from the mixer ahead of Serendip, although the exact mechanism is not known at present. The faint birdie will require further analysis. The system includes an AGC function, designed to adjust signal levels to prevent arithmetic overflow. At the moment, there is no mechanism for tracking the variations caused by this function. The Serendip developers suggested adding an A/D converter to measure the level set by the AGC, so this variable could be fed back into downstream processing. Dr. Klein has a list of 7 more items he and his team will try over the next couple of weeks. Russ Childers mentioned the Dicke switch, and Dr. Klein related an experiment in which it was anticipated that influence of the switch would have a pronounced effect on the Serendip system. The surprising result was that no change was observed, so this too will be the object of further study.

Dr. Barnhart continued his round-the-table reports, by reminding me of the **Card Project**, *Phase II* idea which I suggested to him recently. Joe Mitchell has expressed interest in helping with the preparation of input for a final, verified, confirmed, usable collection of card data on a CD rom. Various ways of approaching this project phase were considered, and the consensus seems to be that if Joe would like to carry this forward, he can count on substantial support. Dr. Klein agreed to provide a 3.5" diskette version of one of the reconciled boxes, so that Joe can begin evaluating the task on his personal Mac.

Cindy Brooman provided a copy of an article on the subject of creating CD rom disks, which she had read because of the many problems encountered by Raul Ordonez when he undertook writing of the *Phase I* CD rom. Cindy also gave to Dr. Klein, a new enhanced logo for the **World Wide Web Radobs Home** page. This version has shadowing as well as other enhancements.

Russ Childers has been working to improve the performance of his pattern matching algorithm for **LOBES**. He has extended the 'tail' of data included in the sliding window which his software moves along the incoming stream. He explained that he will be taking better account of episodes of noise which may preceed a 'valid' set of humps, since such episodes of noise may cause a false detection of a humped pattern.

GALILEO UPDATE

By: Ron Baalke

11 Feb 1995

PUBLIC INFORMATION OFFICE
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In January, **Galileo** completed its playback of the *comet Shoemaker-Levy 9* observations, including the rest of the time-lapsed pictures of the fragment W impact, which appeared to last about 26 seconds. The science teams have also collected and begun to analyze data on fragment R's impact from the photopolarimeter radiometer, infrared and ultraviolet instruments.

Starting January 30 and continuing into March, the Galileo flight team is installing new flight software on the spacecraft in preparation for arrival at Jupiter. Like the operating system of a personal computer, the flight software translates commands from the ground and from a stored flight sequence into the actions of the spacecraft.

The new flight software will operate onboard the spacecraft through the rest of this year and into early 1996. Some critical maneuvers will take place during this time, including deployment of the atmospheric probe, Galileo's approach to Jupiter and its observations of Io and other satellites during approach, receiving and storing the probe's transmitted data and going into orbit around Jupiter on December 7, 1995. The flight software will provide backup storage for probe data and increased options for attitude control and communications, some of which will be used before the spacecraft arrives at Jupiter. Once in orbit the same software will operate the initial data playbacks and orbital operations until March 1996, when even more enhanced flight software will be installed to conduct orbital operations and data return.

The spacecraft continues to operate normally, spinning at about three revolutions per minute and transmitting data at 10 bits per second to the **NASA/JPL Deep Space Network**. Currently the spacecraft's signals take almost 47 minutes to reach Earth and commands take the same time to be uplinked. The spacecraft is 845 million kilometers (*525 million miles*) from Earth and 157 million kilometers (*97.6 million miles*) from Jupiter.

ULYSSES UPDATE
By: Ron Baalke
11 Feb 1995
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The **Ulysses** spacecraft is racing toward the sun's equator, traveling today at a heliocentric velocity of about 113,000 kilometers per hour (*70,000 miles per hour*) with respect to the sun — much faster than it had traveled during its pass over the sun's southern pole. The spacecraft is about 24 degrees south of the sun's equator

and expected to cross that mark on March 12. At that time, Ulysses will make its closest approach to the sun — about 1.3 astronomical units (*193 million kilometers or 120 million miles*) — the closest it will ever come to the sun since it was launched in October 1990.

All spacecraft operations and science experiments continue to go well aboard the spacecraft. Flight controllers report that the slight wobbling onboard the craft, caused by illumination of the axial boom, has been stabilized, probably because the angle of the spacecraft to the sun has shifted and the axial boom is now shaded from the sun's heat. Flight controllers, however, are continuing to make adjustments to Ulysses' thermal control system to keep temperatures stable as the spacecraft approaches the sun.

A radio science experiment is planned later this month to measure the electron content of the sun's outer atmosphere, called the corona, as Ulysses passes in back of the sun as seen from Earth. The S-band transmitter will be turned on February 22. This transmitter, in conjunction with the X-band transmitter, will beam signals through the corona to provide measurements of the electron content. The experiment will be carried out over three weeks, ending on March 15.

TOPEX UPDATE
By: Ron Baalke
10 Feb 1995
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The satellite and sensors continue to operate as expected and ground system computers are performing well. The satellite tape recorders have been played back and the daily science and engineering data products are being produced.

TOPEX/Poseidon completes a global map of the ocean every 10 days. Scientists are continuing to study the equatorial Pacific and the ongoing *El Nino* phenomenon. Data from the radar altimeter onboard TOPEX/Poseidon, taken during three months from October through December 1994, reveal a new Kelvin wave moving toward

the western coast of South America.

VOYAGER UPDATE

By: Ron Baalke
11 Feb 1995

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Both spacecraft are healthy and are continuing to make observations of their interplanetary environment. They are using their ultraviolet spectrometers to map the heliosphere and study the incoming interstellar wind. The cosmic ray detectors are seeing the energy spectra of interstellar cosmic rays in the outer heliosphere. The magnetometer sensors are still measuring the strength and direction of the solar magnetic field. The plasma detectors looking back at the Sun record the solar wind parameters. The low energy charged particle experiment studies the energy spectra of particles coming from the Sun. The plasma wave instrument is studying the incoming signals from the direction ofthe heliosphere.

Voyager 1 is currently 8.8 billion kilometers (*5.5 billion miles*) from Earth and is traveling at a speed of 61,200 kilometers per hour (*39,000 miles per hour*). **Voyager 2** is 6.8 billion kilometers (*4.3 billion miles*) from Earth and is traveling at a speed of 57,600 kilometers per hour (*36,000 miles per hour*).

A BRIEF HISTORY OF SETI

ed. note: *The following article is from The SETl Institute, which has a home page on the WWW.*

A BRIEF HISTORY OF SETI

While interest in the question of extraterrestrial life is at least as old as historical civilizations, the modern **SETI** era can be defined as beginning in 1959. In that year, *Cornell* physicists **Giuseppi Cocconi** and **Philip Morrison** published an article in *Nature* in which they pointed out the potential for using microwave radio to communicate between the stars.

A young radio astronomer, **Frank Drake**, had independently reached the same conclusion, and in the spring of 1960 conducted the first microwave radio search for signals from other solar systems. For two months Drake aimed an 85-foot West Virginia antenna in the direction of two nearby Sun-like stars.

His single-channel receiver was tuned to the "magic" frequency of the 21 cm (*1,420 MHz*) line of neutral hydrogen, a spot on the radio dial also favored by Cocconi and Morrison because of its astronomical significance. While he didn't detect any signal of extraterrestrial origin, Drake's **Project Ozma** spurred the interest of others in the astronomical community, most immediately the Russians.

In the 1960's, the Soviet Union dominated **SETI**, and it frequently adopted bold strategies. Rather than searching the vicinities of nearby stars, the Soviets used nearly-omnidirectional antennas to observe large chunks of sky, counting on the existence of at least a few very advanced civilizations capable of radiating enormous amounts of transmitter power.

At the beginning of the 1970's, **NASA's Ames Research Center** in Mountain View, California began to consider the technology required for an effective search. A team of outside experts, under the direction of **Bernard Oliver**, on leave from the *Hewlett-Packard Corporation*, produced a comprehensive study for **NASA** known as **Project Cyclops**. The Cyclops report provided an analysis of **SETI** science and technology issues that is the foundation upon which much subsequent work is based.

As the perception grew that **SETI** had a reasonable prospect for success, the Americans once again began to observe. During the 1970's, many radio astronomers conducted searches, using existing antennas and receivers. Some of the efforts, employing improved technology, have continued to the present time. Foremost among these are the **Planetary Society's Project META**, the *University of California's* **SERENDIP** project, and a long-standing observing program at **Ohio State University**.

By the late-1970's, **SETI** programs had been established at **NASA's Ames Research Center** and at the **Jet Propulsion Laboratory** (*JPL*) in Pasadena, California. These groups arrived at a dual-mode strategy for a large-scale **SETI** project. Ames would examine 1,000 Sun-like stars in a Targeted Search, capable of

detecting weak or sporadic signals. **JPL** would systematically sweep all directions in a Sky Survey. In 1988, after a decade of study and preliminary design, **NASA Headquarters** formally adopted this strategy, and funded the program. Four years later, on the 500th anniversary of Columbus' arrival in the New World, the observations began. ***Within a year, Congress terminated funding.***

With **NASA** no longer involved, both researchers and interested members of the public saw a diminished chance to answer, within their lifetimes, the profound question addressed by **SETI**. Consequently the **SETI Institute** is endeavoring to continue this large-scale program with private funding.

Project Phoenix will concentrate efforts on that component of the **NASA SETI** project known as the Targeted Search. Its strategy is to carefully examine the regions around 1,000 nearby Sun-like stars. The world's largest antennas will be used, and these have already committed observing time for **SETI**. By pursuing the search now, Phoenix can take advantage of an historical window of opportunity. Within a decade, radio interference from terrestrial sources will grow significantly, compromising our ability to detect weak signals.

Project Phoenix is orders of magnitude more comprehensive than any experiment yet performed. Frequently, the successful attainment of an elusive goal requires nothing less than a systematic and thorough effort. That is the philosophy behind, and the promise of, **Project Phoenix**.

TUESDAY, 2/14 MEETING NOTES
By: Tom Hanson

The meeting of Valentine's Day, 1995, was divided between a hard working crew at the **Observatory**, and Drs. Barnhart and Dixon exchanging news and comments at Dreese Hall.

Dr. Dixon said there is to be a meeting of University people on Friday, which I gather will include some consideration of the future of the observatory.

Dr. Barnhart received word from the **Bexley Historical Society**, that they would like to tour **Big Ear** when the weather improves. He had addressed a gathering of the Society last fall, thanks to an introduction arranged by one of his students.

The view was expressed that recent changes in editing of Listserver messages have improved the quality of correspondence for everyone.

It is time to begin thinking of a **Radio Observatory Spring Frolic**, .. er .... picnic.

COMET CREATED NEW CHEMICALS ON JUPITER
15 Feb 95

LONDON (*Reuter*) - The **comet Shoemaker-Levy**, which collided with Jupiter in a series of explosions last July, set off a chain of chemical reactions that created new substances in the planet's atmosphere, astronomers said Thursday.

Emmanuel Lellouch of the *Observatoire de Paris Meudon* in France and colleagues in Spain and the United States studied radiation from Jupiter after the collisions and found several new chemical compounds in the atmosphere.

Here we report observations of the impact sites ... which reveal strong emission lines associated with carbon monoxide, carbonyl sulphide and carbon monosulphide," they wrote in the science journal **Nature**.

The abundance of carbon monoxide in the Jovian atmosphere is normally very low; carbonyl sulphide and carbon monosulphide, on the other hand, have not hitherto been detected."

Astronomers can tell what chemical compounds exist in a distant star or planet by analysing the radiation spectra coming from such heavenly bodies. Each element has its own distinct "signature" on such emissions.

The collision, one of the most-studied astronomical events, also changed the temperature of the gas giant's atmosphere, observations have shown.

U.S. TO BUY U.S.S.R. SPACE TUG

WASHINGTON (*AP*) - The United States has completed arrangements to buy from Russia a $190 million space tug that will become the first element of a space station to be put in orbit.

The agreement, announced on Wednesday, was reached in Houston over the weekend by representatives of **NASA** and the **Russian Space Agency**. It accepts terms negotiated by *Lockheed* and Russia's *Khrunichev* space center.

The unit, known as the **FGB**, will be launched in 1997 on a Russian Proton rocket. It will be the cornerstone to which other elements are joined until the station is completed and fully operational in 2002.

The FGB, a unit that has been flown more than a half dozen times by the Russians, can function as a transfer vehicle and a service module. It was considered a better option for the station than a U.S.-built unit used by the Air Force.

It will be used initially as a propulsion module and later to store fuel, and as a service area with living and experimentation space as well as backup guidance, navigation and control for the station.

Launch of the FGB, scheduled for November 1997, will begin Phase 2 of a joint-venture agreement with the Russians. Phase 1, currently under way, includes eight shuttle flights to the Russian Mir station, starting with the first of seven dockings and a crew transfer in June.

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