



NAAPO (North American AstroPhysical Observatory)

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PRIVATE FUNDING TO RESCUE SEARCH FOR LIFE IN SPACE

ed. note: The following press release is from the SETI Institute, scheduled for release 1/12/94.

PRIVATE FUNDING TO RESCUE SEARCH FOR LIFE IN SPACE

MOUNTAIN VIEW, CA. - Despite a stunning setback when Congress cut off funding in October, the world's most comprehensive project to Search for ExtraTerrestrial Intelligence (*SETI*) will go on.

Scientists at the **SETI Institute** have begun raising private funds for "**Project Phoenix**", an effort designed to capitalize on the technology and momentum of the now canceled **NASA** program, and to continue a major part of the search. The new project will use mammoth radio antennas and sophisticated digital receivers to try to discover signals from civilizations on planets around other stars. Such signals, if found, would prove the existence of societies elsewhere in the Galaxy and could contain information about their cultural and scientific achievements.

Project Phoenix will be a large-scale search program incorporating most aspects of **NASA's** former search of the vicinities of 1,000 nearby sun-like stars that began October 12, 1992. The **NASA** project was terminated by Congress last October 1 — less than one year into its approved 10 year life. This action, a token concession to deficit reduction pressures, was taken despite the objections of many knowledgeable congressmen who defended the project as good, worthwhile science.

"Recent developments in our private fund-raising efforts have been very encouraging. In just three months, we have already obtained commitments for \$4.4 million. This is more than halfway to our initial goal of \$7.3 million needed to carry us through mid-1995," said **Bernard M. Oliver**, retired Vice-President of Research and Development for Hewlett Packard, and Senior Technical Expert for the *SETI Institute*.

"We are gratified, but not surprised, that among the major donors are knowledgeable, visionary corporate leaders," Oliver said. These donors include **David Packard** and **William R. Hewlett** of the Hewlett-Packard Corporation; **Gordon Moore**, co-founder and Chairman of the Board for the Intel Corporation; and **Paul Allen**, co-founder of Microsoft Corporation and founder, Chairman, and

Chief Executive Officer for the Bellevue, Washington based Asymetrix Corporation and owner of the Portland Trailblazers basketball team. According to Oliver, who is also a significant financial contributor to *Project Phoenix*, "*The importance of continuing SETI is so widely recognized that the Institute is confident that the near-term funding goal will be met.*"

These funds will enable the *SETI Institute* first to modify and improve the digital receivers, developed by **NASA**, and then to deploy this equipment at the **Parkes** radio astronomy observatory in New South Wales, Australia, for Southern Hemisphere observations during the first half of 1995. At the conclusion of the Australian observations, the *Phoenix* receiving equipment will be moved to Northern Hemisphere observatories, beginning with the 1,000-foot diameter radio telescope at **Arecibo**, Puerto Rico. The total observational phase is planned to last into the next century. Arecibo, a primary instrument for *Project Phoenix* and the world's largest radio observatory, is in the midst of a planned upgrade making it unavailable until mid-1995.

"*There is a narrow time window for us to go to Australia,*" said **SETI Institute Executive Director Thomas Pierson**. "*We already have a solid block of approved observing time on the 210 foot Parkes antenna in the first six months of 1995. We must use it now, because for more than five years thereafter that facility is fully subscribed for tracking NASA, Japanese, and Russian spacecraft in addition to its normal radio astronomy programs.*" He notes that many of *Project Phoenix's* target stars — including our nearest neighbor, Alpha Centauri — are best observed only from the Southern Hemisphere, and that Parkes is the only large antenna available for appreciable amounts of time in that half of the world. Institute scientists will be working closely with their colleagues in New South Wales.

Pierson's sense of urgency is justified by the increasing radio frequency interference (*RFI*) from terrestrial and satellite transmitters that continue to obscure more and more of the microwave frequency bands where interstellar transmitters are believed most likely to operate. "*The RFI problem is only going to get worse*", said Pierson. "We are compelled to press on to Australia or lose an opportunity that has no viable alternative."

The Institute plans to continue to approach individuals who share its outlook on **SETI** and who have the means to provide substantial financial help. Once the initial

goal of \$7.3 million is met, the next need will be to raise at least \$3 million per year to sustain the decade-long observation phase. In addition to the major donors, people from many walks of life who believe in the **SETI** enterprise, have made spontaneous contributions.

Noted science fiction writer **Arthur C. Clarke** has made a significant donation through the **British Interplanetary Society** to increase public awareness in the U. K. of the *SETI Institute's* objectives. Efforts are also underway in Japan to provide support for *Project Phoenix*. Astrophysicist **Jill C. Tartar**, former Project Scientist for the defunct **NASA SETI** effort and now manager of *Project Phoenix*, says "*An international funding base for SETI is appropriate. Any signal will have been sent to planet Earth and not just to the USA. All of humanity should share in the philanthropic support of this bold attempt to end our cosmic isolation.*"

SETI Institute Public Programs Scientist Seth Shostak stated, "*The Institute is also considering long term plans that might include the construction of one or more 300 foot class dedicated radio telescopes.*" Plans are also being made to expand the current development of educational programs for elementary and middle school children. *The Institute's* current education efforts have won enthusiastic acceptance in schools nationwide. Shostak noted that these activities are supplemental to the *Phoenix* core observing program and will be separately supported.

"*The private support reaffirms the importance of SETI,*" says **Frank Drake, SETI Institute President**. "*I look forward to a day, perhaps not far off, when we hear the first evidence proving we are not alone in the universe.*"

Information about Project Phoenix can be obtained from the **SETI Institute, 2035 Landings Drive, Mountain View, California 93043. Tel. 1-415-961-6633. Facsimile 1-415-961-7099.**

COORDINATOR'S CORNER

After a two month hiatus we are now getting an issue of **SIGNALS** to press. I take full blame for the delay because it was to the bottom of my 'important to do' file that the printing and mailing got pushed. It has not been a shortage of news-worthy copy that held us up. We have had a very eventful two months at the **RO**. Hopefully we will get longer reports of these affairs in future issues. I would just like to alert our friends of some of the events that are keeping us on our toes.

NASA SETI CUT

RO Aftermath — Shocking as it was to the **NASA SETI** people the Congressional zeroing of support for **SETI** research has had great impact on our operation. We have lost in the range of \$150,000 over the next two years. We did manage to salvage enough to assure delivery of the 4 Megachannel *SERENDIP* receiver being built by Dan Wertheimer's group. It should be up and running next summer. We find ourselves again heavily dependant upon our volunteers and friends to support the **SETI** program at **Big Ear**. Now that the *SETI Institute* is cut off from **NASA** funding, they have made a plea for private funding. (See the press release elsewhere in this issue.) It becomes ever more important to maintain a diverse set of strategies and instruments at a variety of locations around the world. The *Phoenix Project* will be active in the southern hemisphere (at Parkes, Australia) along with the Argentine program, while we and Paul Horowitz will carry on the northern hemisphere search for the U. S.

Conference on Transient/Intermittent Phenomena

Early in January we got word that a special conference scheduled last year by the *SETI Institute* was, in fact, not cancelled as we assumed would result from the deepsinking of the **NASA SETI** funding. We scurried to arrange (with less than a week's notice) to send to Palo Alto, Bob Dixon — a key contributor to the program — and Steve Brown — to confer with Kent Cullers, Dan Wertheimer and others about *SERENDIP III* and potential graduate research assistant support. Since the **NASA** Grant budget is virtually zeroed out and could not support the trip, it fell to **NAAPO** to again step into the breach and provide what has turned out to be a very important trip. Occurring on the first day of the devastatingly cold upper midwest storm and the Los Angeles earthquake week their travel was far from routine. Cancelled flights and delays put them separately into San Jose a couple of hours apart, but in the 36 hours of meeting, conferring and mingling much was

accomplished and programs in our list of things to do have been moved higher on the priority list. A thorough review of the circumstances surrounding the 'WOW' signal and the many Search Strategy "hits" accumulated over the years may receive some funding so that we can more clearly describe and defend what we have been saying over the years. Much interest was expressed at the conference in such a look at past data. As a start Steve Janis and Russ Childers have found that the archived data for the SETI program has been read from punched cards and is sitting in computer memory awaiting reconciliation with the card decks. Needless to say this task will be accelerated to the top of the priority list.

Sky Survey Continues

Russ Childers has nearly single-handedly completed just over 10% of the sky included in the *Ohio Survey*. He is generating maps to compare with the *Ohio Survey* and has worked out an algorithm to convert the two horn, S-shaped source signature into a representation of a single horn output. He finds the continuum sources agree quite closely to the *Ohio Survey* sources and the intensities seem comparable. Observed features of the radio sky are becoming evident as Russ tunes his procedures. Saving the raw data on magnetic media allows considerable off line processing. Some of his plots are scheduled to appear in this issue. Russ teased us a bit at the Tuesday night session with an apparent continuum transient event with one of the *Ohio Survey* objects. It seemed to be a factor of 5 brightening with a cut-off time of less than about two minutes. It is now head-scratching time.

Heater Repair

As the buildings at the RO site become older various repairs become necessary. Of the 25 wall mounted heaters in the main office/lab building 7 have become inoperative. This makes the conference room chilly and on very cold night threatens water pipe freezing. Don James has been working out the needs for bringing the heaters back on line and it looks now like he will have replaced the 7 heaters and 4 thermostats to get us back to the cozy, warm conditions of yesteryear. This sets **NAAPO** back another \$300. At this rate the coffers will bottom out about May.

Intermittent/Transient Events

Before leaving for Cal Tech to study the beaches, Marc Abel ran through the SETI data to tabulate the search strategy 'hits' recorded since 1975 or so. We are now going to update and replicate the search by independent observers. Steve Janis and Russ Childers are setting up a routine to examine all the archived data since 1973 to

the present, looking for not only the Search Strategies 1 through 9, but any potential short term anomalies or outbursts. Attempts will then be made to analyse the distribution of strikes and try to identify those events that seem to be of particular interest.

Take note: We are on the verge of another financial crisis. We will gladly accept volunteer help, equipment, aid of any kind, money, money, etc., etc., etc.

PLUTO MISSION PROGRESS REPORT

ed. note: The following article was originally posted to the internet newsgroups 1/15/94 by Ron Baalke @ JPL as the entire paper presented at the 44th Congress of the International Astronautical Federation, held at Graz, Austria, on 10/16-22/93. I have included the abstract and the summary here as I feel it is of sufficient interest to Signals readers. If you are interested in obtaining a copy of the entire paper, send me a request along with a SASE (at least 9x12, about \$1.00 postage) and I'll send you a copy.

LOWER MASS AND FLIGHT TIME THROUGH ADVANCED TECHNOLOGY INSERTION

ABSTRACT: A development team at **JPL** and other facilities is designing a mission to send two very small spacecraft to Pluto and Charon to complete the initial reconnaissance of our Solar System. The two probes, each carrying four science instruments, will obtain data on both hemispheres of Pluto and Charon in the form of visual images, infrared and ultraviolet data, and radio science. This paper briefly describes the mission design and spacecraft instrumentation and sub-systems, and reports on the current progress to implement advanced technology in reducing spacecraft mass and power requirements. Cost, schedule and performance, in that priority, are the primary design drivers. The goal of the mission is to deliver two 120 kg class spacecraft costing less than \$400M for both, on direct trajectories to the Pluto-Charon system taking approximately 7-10 years to arrive well before the collapse of Pluto's atmosphere and the impending polar shadow that will reduce the global science coverage. Contract and in-house work has been in progress to provide breadboard proof-of-concept hardware and software contributing toward the lower mass goal. Results are reported for candidate scientific payload instruments, a composite structure, advanced antenna, significantly smaller electronics packaging, high efficiency thermal-to-electric converters for the

radioisotope power sources and other candidate areas for mass, power and size reduction within strict cost limits.

SUMMARY AND CONCLUSIONS: A scientifically exciting initial reconnaissance of Pluto and Charon is possible with a strict cost cap. Technologies pioneered for small Earth orbiters, and in some cases advanced further through **NASA** support for the Pluto mission, enable spacecraft mass and operations cost reductions far below what was thought possible as little as two years ago. Present efforts are focused on demonstrating the viability of new subsystem and instrument components, and an innovative development, test an operations approach, through procurement and testing of proof-of-concept hardware and software. Mission resource constraints are being tightened even further, so recent work represents a head start toward reaching aggressive goals of life cycle cost and technology improvement within a first-class scientific mission to unexplored Pluto and Charon.

NAAPO Saturday Meeting February 5, 1994

PRESENT: John and Ken Ayotte, Barnhart, Brown, Campanella, Childers, Dixon, James, Janis, Bill Schultz, Schumacher.

HANSON CARD PROJECT GROUP: Post processing/reconciliation of cards seems to have stalled with construction in Dreese 805 forcing the shut down of the VAX 8550. Other demands on Steve Brown's time have also contributed to the slow down. It is expected that the construction will soon be far enough along so as to allow the use of the VAX again. Steve Janis reports that Jenny Kelbley has volunteered to help read cards using the reader in Baker Systems on the campus of **OSU**. She has been trained in using the reader and has already read in several boxes.

ARGUS/KLT GROUP: Bob Dixon continues to review references regarding **Argus** and **KLT** signal processing, including those recommended by Phil Schumacher. Steve Brown has submitted a grant proposal to **NASA** for support in research into the **Argus** array telescope concept. If approved, the grant would provide support for Steve's research for 3 years, with at least part of his time spent at **NASA Ames**.

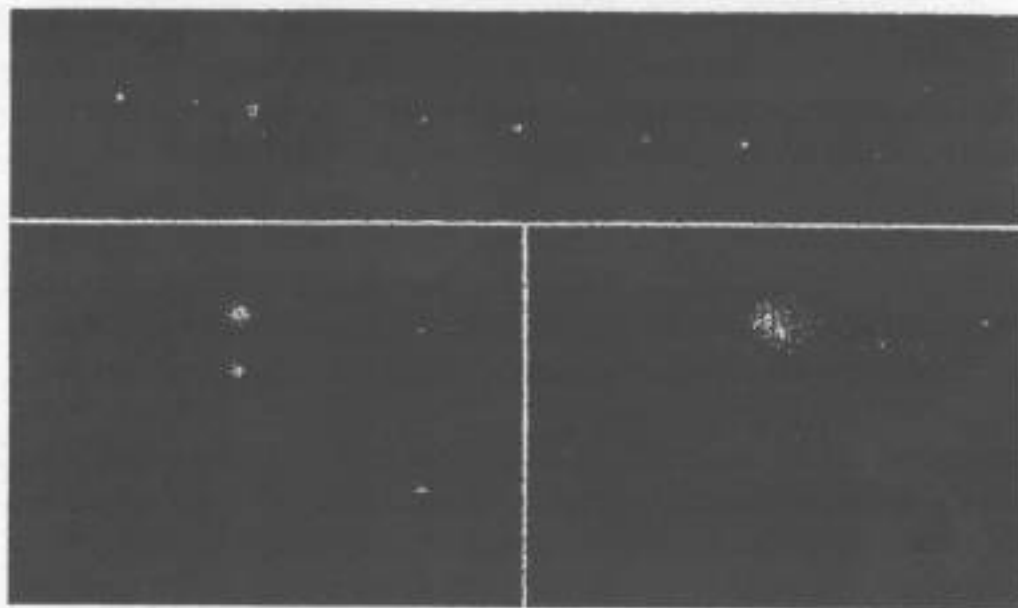
SETI SURVEY GROUP: Russ Childers reports the detection of what he calls the

"**Whoa!**" signal (*not to be confused with the "Wow!" signal*), a strong continuum source (as opposed to a narrowband **LOBES** strike) which seems to have increased its strength after entering the beam of the telescope. Speculation as to the signal's increase in power lead to a discussion of possible "lensing effects" due to the interstellar medium, solar wind, or massive bodies passing in front of a source (*gravitational lensing due to MACHOS*). This discussion was fed by Bob Dixon's account of his and Steve Brown's recent trip to the *SETI Institute* in Mountainview, California for a colloquium on the topic of intermittent effects generating transient **SETI** strikes. This colloquium convened other experts in **SETI** such as *Jill Tarter, Frank Drake, and Carl Sagan*, as well as experts on the interstellar medium. It was suggested that archived **Big Ear** data should be reviewed for such transient events, and *Bob Dixon* will pursue the possibility of securing a grant to conduct such a comprehensive review as well as to incorporate these types of events into our current search strategy. Additionally, Bob Dixon will be pursuing Carl Sagan's interest in seeing the **Ohio SETI** data from the period of 1977-1984, including the "**Wow!**" signal, revisited, re-analyzed, compared to past results and published.

SITE GROUP: Don James has obtained replacement units for the defunct heaters in the site office building and has transported them to the building. Furniture was moved so that Don can install the new units at his leisure. Russ Childers reports that the flat reflector air compressor froze up with the recent frigid weather. The existing heater in the compressor shed was apparently not effective against the extreme temperatures. After a brief meeting, the site group once again ventured outside to the garage area. The mercury vapor lamp above the control hut was removed with the intention of getting a replacement lamp. Further grounds clean-up ensued such as the weather would allow. "Fluids" stored in the garage, which Don James had previously inspected, were reorganized with old or useless ones being marked for disposal. Steve Janis will work with OSU officials for proper disposal of toxic substances. If anyone can use 5 quarts of jet engine oil, circa mid-1960's, please let us know.

The meeting adjourned at approximately 12:30pm.

**PUBLIC INFORMATION OFFICE
JET PROPULSION LABORATORY
CALIFORNIA INSTITUTE OF TECHNOLOGY**



**NATIONAL AERONAUTICS AND SPACE
ADMINISTRATION, PASADENA, CALIF. 91109.**

PHOTO CAPTION:

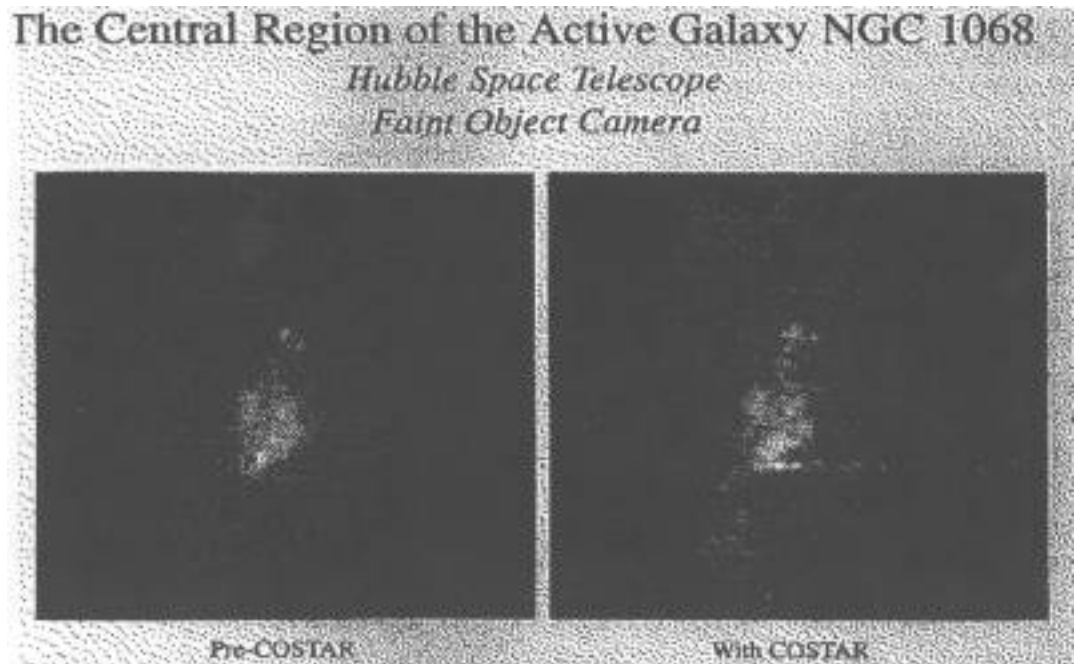
February 1994
**Comet P/
Shoemaker-Levy 9**
(1993e) made a close approach to Jupiter in the summer of 1992 and was broken into multiple pieces as a result of tidal forces from that giant planet. These remaining pieces will plunge into Jupiter's atmosphere at high speed (60 km/sec) during a 5.6-day period centered on July 19, 1994,

possibly producing spectacular results depending on the sizes of the impacting nuclei. The **Hubble Space Telescope's Wide Field and Planetary Camera** first observed the comet on July 1, 1993, and the data indicated that the 11 largest nuclei probably have diameters in the range of 2 to 4 kilometers. The new images, taken with the Hubble telescope's new Wide Field and Planetary Camera-II instrument on January 24-27, 1994, have given us an even clearer view of this fascinating object, which should allow a refinement of the size estimates. In addition, the new images show strong evidence for continuing fragmentation of some of the remaining nuclei, which will be monitored by the Hubble telescope over the next several months. The upper part of the screen shows a mosaic containing two new Wide-Field Camera (WFC) images and one Planetary Camera (PC) image (*resampled to the same resolution as the WFC images*) of the comet. Twenty nuclei are visible here, while one more is slightly outside of the field-of-view (*to the right*). Each nucleus has its own coma and tail. The fourth nucleus from the left (*the first bright one*) is apparently starting to separate into at least two pieces. Notice that some of the

nuclei are now significantly displaced from the "train," which is defined by the imaginary line connecting most of the bright nuclei. Also notice that most of the dust (*fine particles*) in the system lies below the train as a result of solar radiation pressure pushing the dust in this direction. The width and height of this image project to distances of 605,000 kilometers (*376,000 miles*) and 126,500 kilometers (*78,600 miles*), respectively, at the comet. The lower left and right parts of the screen show the region near the brightest nucleus at higher resolution in images taken with the Planetary Camera (PC). To the left is the new image from the corrected PC, while the image to the right shows old data from the aberrated PC. Although careful analysis of the old data indicated that this region contained four nuclei, the new data show this much more clearly. Also, the relative separations and orientations of these nuclei have changed dramatically during the time period between the old and new images. These changes should provide further insight into the mechanism producing the fragmentation.

HST REVEALS THE CENTRAL REGION OF AN ACTIVE GALAXY

NASA's refurbished **Hubble Space Telescope** has provided this outstanding image of the nuclear region of the galaxy **NGC 1068**. NGC 1068 is located at a distance of approximately 60 million light years and is the prototype

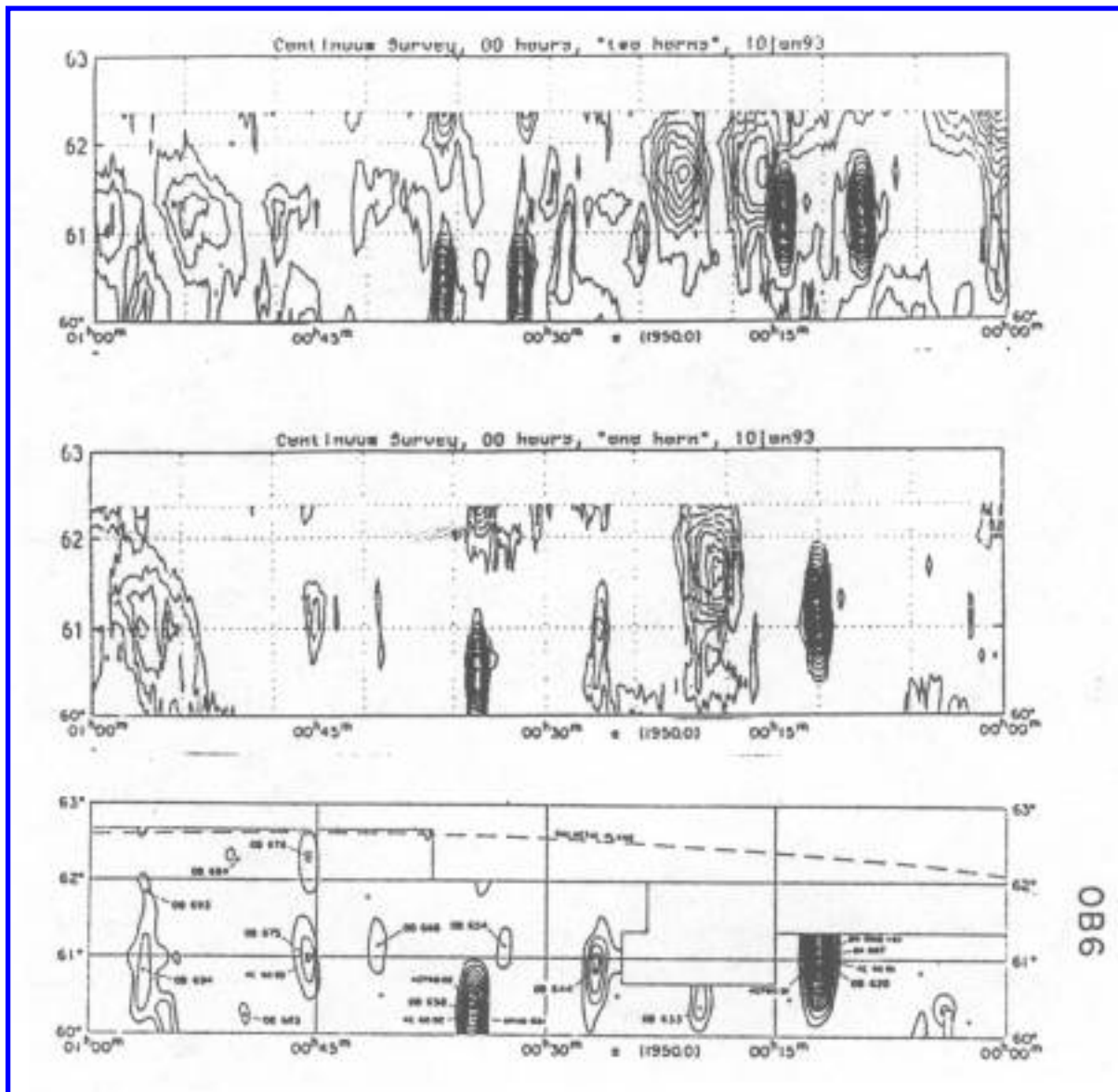


of a class of active galaxies, known as Seyfert Type 2. Typically, an active galaxy's core shines with the brightness of a billion solar luminosities and fluctuates over the period of a few days, implying that the energy is being released from a region only a few light days in extent. The most likely source for this enormous amount of energy is a "super massive" black-hole with a total mass of 100 million stars like the Sun (left). In the case of NGC 1068, previous *HST* observations have shown a number of hot gaseous clouds ionized or heated by the intense radiation from the nuclear source. This diverging beam of emission, or "cone," is caused by the shadowing effect of the

radiation of the active nucleus by opaque gas and dust clouds orbiting the suspected black-hole (right). The new **FOC-COSTAR** observations show with unprecedented clarity a much more extensive double cone of emission, believed to be shaped by radiation from the active nucleus. An incredible wealth of new and previously unsuspected filamentary detail also is revealed in this core region, embedded within the diffuse emission. The knots and streamers of emission will enable the geometry of this fascinating core region to be understood, and will offer new information on the nature of the clouds themselves. It will now be possible to make comparisons among images taken at various wavelengths of light to gain insight into the hidden source of all the energy — perhaps an obscured black hole. These data were taken by a team led by Duccio Macchetto of the **European Space Agency (ESA)** and **Space Telescope Science Institute (STScI)**, and including William Sparks and Alessandro Capetti of *STScI*, using the *Faint Object Camera* and *COSTAR* "combination." *COSTAR* was developed by **Ball Aerospace** of Boulder, Colorado, under contract to the **Goddard Space Flight Center**.

From Russ Childers:

[\[Click on image to obtain a larger version.\]](#)



These are data collected during the current sky survey. Data must be converted from the switched feed dual horn format to single feed format for comparison with the plots in the Ohio Survey — 1960 - 1973.

The top figure is a plot of the absolute value of the dual horn output. It is clear to see the double image for each source and the symmetric placement about the position of the source.

In the middle plot is the rectified, single horn display which may be compared with the plot of the same region of the sky published in the Ohio Survey (Astronomical Journal, Vol. 76, Nov. 1971, page 838) These sources agree with the positions of the Ohio Survey sources and the intensities seem comparable.

The point sources seen here show up on the Ohio Survey. The sources not removed from the middle plot are extended and did not match the point-source antenna pattern.

It should be noted the declination scaling is not the same for for the Childers plot and the Ohio Survey plot.

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