
# NAAPO (North American AstroPhysical Observatory)

## "NAAPO News"
## Volume 3 Number 7
## (January 26, 1988)

NAAPO Coordinator -- Philip E. Barnhart, Department of Physics/Astronomy, Otterbein College

### 11/23 MOVE TO OCCUR 30 JANUARY

The time has come! Further programming on campus (Dreese Labs) is no longer deemed necessary. Further programming will be done while the 11/23 is in the focus room, either on-line or pausing because of an unanticipated glitch.

The volunteer crew with assistance from volunteer experts will move the operation to Big Ear the morning of January 30. Weather forecasts indicate almost ideal conditions with no rain predicted before Monday. By then all systems should be assembled in the focus room and data rattling about on the discs and charts.

Details of this experimental refutation of Murphy's Law will appear in the next issue.

### BIG EAR REPORT HONORED BY ESL

The report on the use of Big Ear as a compact range by Young, Kraus, Caldecott, Poirier and Barnum received the ESL Award for Best Report of 1987. Framed citations were presented to the five authors at the Electro-Sciences Laboratory award luncheon December 23.

Congratulations, John!

## ASP OFFERS SETI A/V MATERIALS

The Astronomical Society of the Pacific is offering two SETI related items for use in portraying the fascinating, public grabbing ideas of trying to find evidence of Extra-Terrestrial Intelligent civilizations. These would be useful for colleges and planetaria in public programs or special sessions for school events.

First is a Video produced by NASA. Narrated by Jill Tarter, the program features Phil Morrison, Frank Drake, Carl Sagan, Bernard Oliver, Paul Horowitz, and other Scientists. It comes with a reading list of science and science fiction looks for further reading. (Order: VT100 "The Quest for Contact", VHS format only, $28). It is in color.

The other is a slide set (20 slides) assembled by Frank Drake. Images relate to various facets of SETI going back to Project Ozma in 1961. It too comes with a caption book and reading list. (Order: AS304 "The Search for Extraterrestrial Intelligence [SETI]", $18).

ASP will be glad to send you a complete list of astronomically related A/V materials available from their stock. Write:

Astronomical Society of the Pacific
1290 24th Avenue
San Francisco, CA 94122

## COORDINATOR'S CORNER

The season continues to be busy. Classes took up again first week in January after a long break in December during which I did not get done those things I was sure would be finished. I cleaned up a lot of back-logged work, but I did not catch up on my correspondence, office cleaning nor proposal writing that I felt were top priority.

Big things have been happening and these will be reported elsewhere in this issue. Right now I am struggling to find the best way to bring administrative assistants into the volunteer office of NAAPO Coordinator so that some of the work that needs to be done on a day-to-day basis can be shared, thereby giving me time back to get on with on-going tasks that need to be pushed. I still try to recruit from the campus population, but it is difficult to find a level of commitment that makes volunteering easy to offer. So, I spend a few extra hours keeping the necessary wolves from the door, while letting the smaller critters nibble away at less pressing lettuce patches.

I find it interesting that so many continue to volunteer a few hours a week to keep this operation moving. John Kraus has described the operation for the past year quite aptly as " . . dead in the water." What has not been obvious is that repairs have been going on in the engine room and

within the next few weeks we will again have a head of steam and a wake should again appear. I have confidence that it will be a wake on the waters of astronomical observation and not in the funereal halls of desperation. We ARE ready to again look at the sky and begin cataloguing data from Big Ear. It will be a shake-down cruise after a long stay in dry-dock, but at least we we will be developing sea legs for a long cruise ahead.

I quote Marc Abel when, from sunny California this past week, he changed the 11/23 system salutation to "BON VOYAGE".

**NEWS NOTES - - -**

**Supernova 1987A to Z**
*by Virginia Trimble, University of Maryland and University of California, Irvine*

We are finally beginning to understand in some detail why a star like Sanduleak -69º made a supernova like 1987A. This, for me, was the real highlight of the Fourth George Mason Fall Workshop in Astrophysics (Fairfax, VA, October 12-14, 1987). Obviously there were other points of interest. For instance, the 19 neutrons that interacted with water Cerenkov detectors in Japan and the USA a few hours before optical rise provide near-direct proof both of the total energy involved in a Type II supernova (3 +/- 1 x $10^{53}$ ergs) and of its origin in the collapse of a massive stellar core to neutron star densities.

In addition, hard X-rays (15-250 keV) appeared in the output of the (German-Soviet) HEXE experiment aboard the MIR satellite starting in August. Modellers all agreed that these represent gamma rays from the decay of $Co^{56}$ to $Fe^{56}$, Compton scattered in the supernova envelope, and that they provide a promise of detectable unscattered gamma-rays by spring. The softer (4-20 keV) X-rays recorded by the Japanese Ginga satellite are apparently a separate component, perhaps radiated by a shock wave where SN ejecta encounter circumstellar material. Such X-rays are expected, but turn-on simultaneously with the Comptonized flux and without accompanying radio emission is somewhat puzzling.

As for the progenitor it was a B3 Ia star, having a bolometric luminosity of 4 (-1,+2) x $10^{38}$ ergs/sec, effective temperature 15-16,000 K, radius 3 +/- 1 x $10^{12}$ cm, initial main sequence mass 19 +/- 3 solar masses, and a main sequence lifetime of $10^{7}$ year. By the time the star exploded, its core of helium and heavier elements had grown to 6 +/- solar masses, while at least a few solar masses of hydrogen-rich envelope had been lost in winds, after some mixing had enriched the outer layers in helium and nitrogen. And, as implied by the mass loss and mixing, the star had already spent up to $10^{6}$ yr as a red supergiant, looping back to the blue about $10^{4}$ yr before carbon ignition initiated the series of reactions leading to explosion in another thousand years.

Evolutionary tracks which do this have been calculated (in some cases before February 1987) by American, Japanese, German, Swiss and probably other theorists. Whether a massive star is red or

blue when carbon ignites turns out to be quite a sensitive function of metal and helium abundances, mass loss, Schwarzschild vs. Ledoux convection, and even more technical details.

Once the core has collapsed, the compactness and steep density gradient of a blue supergiant envelope affect observable quantities in a number of ways. The shock gets out very quickly (hence the rapid rise in brightness on February 23) but uses up a good deal of energy pushing the envelope out of its deep gravitational potential well (hence the relative faintness of the first light maximum near $M_v = -14$). The very top thin layers are both heated and kicked mightily (hence the initial very blue color and very wide spectral lines), but we quickly see down to denser, slow-moving, adiabatically-cooled layers (hence the rapid declines in temperature and line velocities). Matching the smooth, broad second light maximum (within half a magnitude of $M_v = -15.5$ for some two months) and the accompanying line velocities constrains the models a good deal more. The main energy source is recombination in the hydrogen-rich envelope, which must, therefore, be massive enough to carry the required ionization energy, but not so massive as to damp down the velocities. The broadness of the peak implies that helium or oxygen and similar elements (or both) in excess of solar abundances must also have been contributing their ionization energies. And the switch-over to an exponential tail with e-folding time (c. 110 days) characteristic of $Co^{56}$ decay tells us that about 0.075 solar mass of $Ni^{56}$ was blown out and partially mixed with the other ejecta.

In addition to the light curve and velocity constraints, we have other, more direct, evidence for mass loss from the progenitor. Data collected by the International Ultraviolet Explorer show that the supernova was initially a very bright uv source. It dimmed quickly (allowing us to see that two nearby hot main sequence stars are still there), but a new set of uv emission lines appeared in June. These apparently come from a circumstellar shell, shed while the star was a red supergiant, and ionized by the initial uv flash. The strength of the nitrogen and helium lines tells us that mixing preceded mass loss, and the turn-on time of the lines imply that the shell was as far from the star as it would have gotten in $10^4$ yr between the star looping back blueward and exploding.

As the ejecta continue to expand and thin out, we can expect to see further details of composition and stratification. Thus it seems likely that our most important lessons from SN 1987A will concern evolution, structure, and nucleosynthesis of massive stars.

Reprinted from the AAS Newsletter
-- December 1987

## NAAPO WORKING SESSION: 15 Jan.

Those present: Janis, Bolinger, Dixon, Barnhart-L, Mook, Helwig-R, Helwig-D, Huck, Backus, Mitchell, Barnhart-P

Announcements

1. Barnhart-P reported on his funding seminar trip to Washington, D. C. immediately following the last working session. New Money from NSF is very scarce, but there is hope from some other sources, particularly for undergraduate research opportunities.

2. A shipment of PDP 11/xx training manuals and microfiche source codes arrived just before the meeting. All items were turned over to the Dreese mob to make best use they can of it.

3. An offer from NAAPO-friend, Russ Steele of sunny California to bird-dog some of the surplus sources was received and acknowledged with gratitude. We will keep this in mind as we seek input for specific items.

4. Otterbein has received some miscellaneous components from SCI, a Worthington control system manufacturer. When inventory is complete some sharing of the items will occur.

5. Palomar Sky Survey prints and overlays have been moved from Perkins Observatory to the 5th floor of Smith Labs (Department of Astronomy).

6. Lois Mikesell has moved from the farm and is now living with her mother at 39 Scottwood Ct., Delaware.

New Business

Plans were drawn for the January 30 move of the 11/23 to the focus room. It was noted that AT&T does not move computers in the WINTER! We do. Cliff Collins of the OSU IRCC, who is their move expert, has volunteered to assist in the big move for NAAPO.

Barnhart-P will rent the truck and will have it at the loading dock at 8 am 30 January. Shut-down of the 11/23 will occur Wednesday 27 Jan. Unhooking and disconnecting of cables will be supervised by Cliff Thursday or Friday.

Weather monitoring will be maintained and final GO/NO GO information will appear on the electronic mail on Friday.

Meeting adjourned: 11:40 am. Next Meeting 30 Jan for MOVE!!!

Next Working Session -- 6 February 10 am at Big Ear.

## MACLEAN'S ARTICLE REPRINT

The November 30 issue of Maclean's (the Canadian weekly news magazine) - carried an article painting a clear and accurate picture of what Bob Dixon is doing with SETI at Big Ear. Herewith is the NAAPOnews version of Julia Bennett's article.

**DATELINE: COLUMBUS, OHIO**

# An ear to the heavens

November afternoon sunshine warmed the countryside along the Olentangy River, a few kilometres north of Ohio's quiet state capital of Columbus. It was a setting more suitable to the strolling middle-aged golfers nearby than to a search for alien life-forms. But down a gravel side road, two giant walls of steel mesh, 150 m apart and towering over the trees around them, were poised to do just that. For the past 15 years Big Ear, Ohio State University's three-acre radio telescope, has almost continuously been scanning the galaxies night and day under the careful supervision of astronomer Robert Dixon - listening for radio signals that would prove the earth's inhabitants are not alone. "There is life beyond earth," said Dixon. "All the evidence indicates it."

Like hundreds of other scientists and interested amateurs who have devoted years to the Search for Extra-Terrestrial Intelligence (SETI), Dixon has struggled to help the movement gain acceptance as legitimate scientific research. Since the first search by radio telescope took place in Green Bank, W. Va. in 1960, roughly four dozen short-term projects have come and gone, two of them in Canada. Apart from Big Ear, an independent observatory near Harvard, Mass., is searching the skies and smaller projects are under way in such places as Madrid and Hay River, N. W.T.

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**'We may not receive a signal for a thousand years,' Dixon said. But 'that does not mean we should be discouraged'**

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SETI advocates have fought against tight budgets, technical challenges and a scientific community skeptical because of their lack of results. But a new proposal by the U.S. National Aeronautics and Space Administration (NASA) for a $100-million 10-year search to begin in 1992 is set to go before Congress in January. And next month Dixon and his colleagues will be ready to activate a complex new computer processing system for Big Ear, which will increase its search capabilities dramatically.

Such developments clearly hearten Dixon, who founded the Big Ear SETI project. Said Dixon: "As the saying goes, absence of evidence is not necessarily evidence of absence. We may not

receive a signal in my lifetime-perhaps not for a thousand years. That does not mean we should be discouraged." Dixon's dream is shared by many amateur astronomers. One of them is Robert Stephens, a former electronics technician from Edmonton who for two years has lived at a former Distant Early Warning (DEW) line station in Hay River. There, he has earned the acclaim of experts worldwide with Canada's only SETI program, run on a shoestring budget with a telescope fashioned from two secondhand military dish antennas.

Such search projects as Dixon's and Stephens's are based on the ability of the radio telescope to receive a potentially infinite number of radio waves from space. A computer program instructs the telescope to weed out natural interstellar noise. Some astronomers say that any distinctive remaining signals - if they apparently do not come from such manmade objects as satellites - might be emissions from another life-force. Because of the limited extent of their technical equipment, researchers have been able to listen to only a small part of the microwave spectrum. Still, they have encountered brief but tantalizing signals, and Dixon predicted that the new Big Ear computer unit will be able to isolate and analyse such signals with greater success. "Up to now, we have seen things," he said, "but they are never there when we go back."

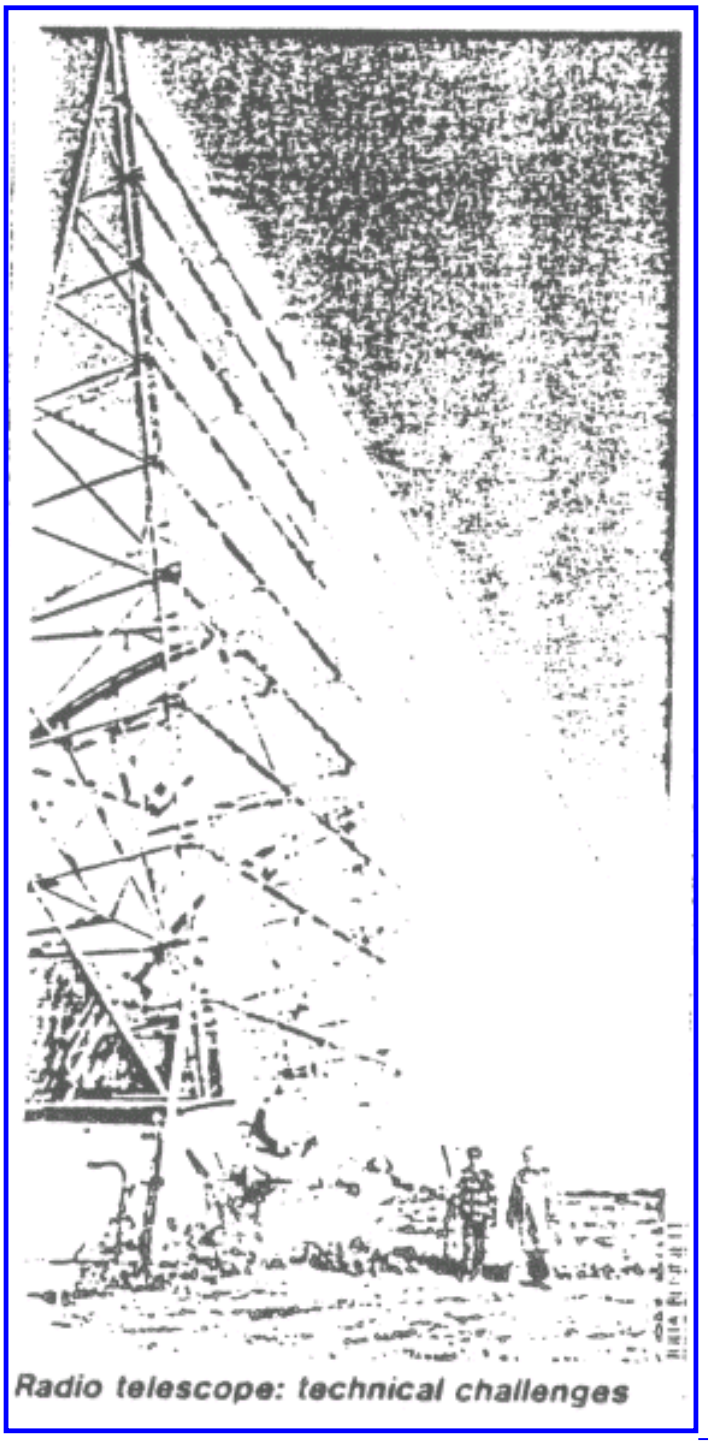
The proposed NASA search excites enthusiasts because the agency's extensive equipment, unlike that of Big Ear and other independent telescopes, would be able to scan the entire microwave spectrum in great detail. And despite cutbacks in NASA's space program spending, Congress may look favorably on SETI programs such as Big Ear because of their relatively low cost. Indeed, Dixon himself is employed as deputy director of The Ohio State computer centre and earns no money from the search activities. And aside from a few thousand dollars in yearly donations, Big Ear's only support is an annual NASA grant of $20,000. "Bob is really an unsung hero," said Paul Feldman, an astronomer at Ottawa's National Research Council. Feldman himself conducted a two-year search from 1974-1976 at Algonquin Park's federal observatory in Ontario - a facility now closed due to funding cutbacks. "Ohio State is just a drop in the bucket" he added, "but it's one of the only games in town."

Big Ear has itself at times been threatened. In 1983 the neighboring Delaware Country Club bought the site, intending to expand its private golf course to 18 holes. But local opposition to the plan saved the telescope, which, with its underground control chamber and cement foundation, would have been too expensive to rebuild elsewhere. One high-school science class raised funds selling T-shirts with an alien hand, similar to that of the extraterrestrial movie character E.T., dejectedly holding a telephone receiver. The club agreed to rent the Big Ear site to the university on a renewable eight-year lease.

As the autumn dusk began to throw the moon and stars into faint relief above the horizon, Dixon walked toward a lonely flagpole on the telescope site. As he took down the Flag of Earth - its blue, yellow, black and white design flown at only a few dozen institutions around the world - he said the fact that no civilization has yet left a calling card is no reason to lose hope. "Of course, if we do find a signal," Dixon added, "the scientific big guns will move in with a steamroller, and

our efforts will be forgotten." Then he smiled. "But that would be all right. We would have done what we intended to do."

- JULIA BENNETT in Columbus



Radio telescope: technical challenges

[Note. Click on this photo to obtain a larger version.]

## 1 JANUARY WORKING SESSION

Those attending: Huck, Fisher, Dixon, Backus, Hain, Bolinger, Barnhart-P

Announcements:
1. Dixon reports opportunities to work on two books and an IAF statement on formulating a response to ETI contact.

2. Dixon responded to the north central SARA questionnaire. He allows they are a good distance from us, but we have a willingness to help in any way we can.

3. There will be a Planetary Society Conference in Toronto on 7 - 9 Oct. 1988. He has submitted a preliminary title for a paper on our revamped program of SETI. There should be several NAAPO representatives at the conference.

4. August 13 - 16 will bring an IAU conference on "Light and Radio Pollution". We will try to get together a report on our RF1 monitoing program.

5. There may be a publisher (reprint) for Dixon's "Masterlist of Non-Stellar Objects." There may be some additions or revisions necessary. This could provide a large number of student-hours of involvement for NAAPO.

6. The IAU will meet in Baltimore in August. We should generate a paper.

7. Barnhart announced he is formalizing plans for a sabbatical term Fall of 1988. This will involve visitation to some of the consortium institutions. Keep posted.

8. A letter from Guillermo Lemarchand to the effect that he will be in the U. S. in January requests that he have the opportunity to visit Big Ear and discuss the operation with all concerned. He is to contact Barnhart-P from New York. All parties are ready.

9. On January 20 Dixon is to deliver his standard spiel to the Delaware County Amateur Radio Club. He is exercising his vocal chords.

Status Reports
Dreese Labs -- Dixon has gone onto full time programming of the 11/23. He figures that by mid-January he should have the system ready to move. We now will have need for a big supply of 8-inch floppy discs for archiving the output of the 11/23.

Hardware emphasis is now shifting to the 11/44. The hardware status of the 11/23 is generally ready for installation in the focus room. The 11/44 will be used for off-line processing and testing of programs for the 11/23.

Some concern has been expressed for assuring the minimum disruption of 11/23 operation in case of power failure. We should seriously consider installation of an uninterrupted power source (UPS) for the 11/23.

Otterbein -- Barnhart reports Fisher is working with his scout group on an in-house alarm system for the observing site. He seems to have a source of components and a lot of eager Eagle Scouts to assemble them.

Site -- Huck is donating a logbook. Jim is developing a log card. The extra toll calls seem to have been tracked down. Dixon will again explore phone line options, both at the observatory and his home to make programming the 11/23 remotely an inexpensive operation. Not much hope.

New Business:
Consideration will be given to development of Southern Hemisphere Sky Survey Overlays. This will need to be a long tern funded project. It will require committed employees -- students may qualify -- for a two or three year period.

## RADIO QUIET, HIGH z QUASARS CONTINUE TO SHOW UP IN SURVEYS

The Dec. 3 1987 issue of Nature carries an article by Warren, Hewitt, Irwin and Osmer describing the discovery of radio quiet quasars with redshifts (z = wavelength shift/rest wavelength) exceeding 4.0. The optical survey, carried out in the southern hemisphere, is of a region in the vicinity of the south galactic pole. The two objects described in this paper are within the area surveyed by Ehman, Dixon, Ramakrishna and Kraus (A. J., 79 no. 2, 144-317, 1974).

The nearest Ohio sources to the high redshift objects are at least a degree away. Pertinent data are included in the accompanying table.

Table 1

| Object | R.A.(1950) | Dec.(1950) | z | f.u. |
|---|---|---|---|---|
| Q 0051-279 | 00:51:49.8 | -27 58 24 | 4.43 | - - |
| Q 0101-304 | 01:01:14.1 | -30 25 04 | 4.07 | - - |
| OB-280 | 00:48:13 | -30 12 | | 0.29 |
| OB-295 | 00:56:17 | -29 12 | | 0.55 |
| OC-317 | 01:10:18 | -30 10 | | 1.12 |

NOTE: z = 4.43 corresponds to a recession velocity 93.4% the velocity of light. Such a red shift places the Lyman alpha hydrogen line (rest wavelength = 0.1216 micron) at 0.5286 micron. To

measure this "uv" line requires a YELLOW sensitive detector. The hydrogen Balmer alpha line has a rest wavelength of 0.6563 micron. For the Lyman alpha line to be shifted to correspond to the Balmer alpha wavelength would require a z = 5.397!

A comment made in the Nature article indicates the belief that about two thirds of all quasars are radio quiet. This is interesting for a class of objects originally brought to the attention of the world because of their radio emission.

**"MURPHY WAS AN OPTIMIST! ! !"**

**Edsel Ford**

## Low Cost Digital Filters

***by***

***William H. Mook***

SETI would not be possible without the ability to distinguish between narrow band and wide band signals. Thus signal filtering is an important part of any SETI instrument.

It is now possible to build digital filters of significant capacity at reasonable costs using existing dedicated math processors. These processors can filter signals in real time by using the fast fourier transform (FFT) to convert input data into frequency data.

In 1985, Harvard put one of the world's largest digital filters on-line at its radio telescope. The filter performs a full eight million point FFT every 10 seconds. An FFT requires

N*log(N)/log(2)

floating point operations (flop) for every N data points converted.

Harvard's filter performs over 184 million flops every 10 seconds. Total throughput then is around 20 Megaflops. Constructed in 1984 for around $50,000 the filter consisted of 128 processors connected in a large array within several equipment cabinets. It was the state of the art for its day.

Today a two chip math processor can be purchased for under $1,000 capable of 40 Megaflops. The table below shows some available 64 bit numeric processors.

It should be possible to build a digital filter on a single board with a greater capacity than Harvard's filter. This could be done at 1/50 the cost!

| *Manufacturer* | *Model* | *Speed* | *Price* |
|---|---|---|---|

| | | (megaflops) | |
|---|---|---|---|
| *Advanced Micro Devices, Inc.* | *Am29325* | *10* | *$395* |
| *Bipolar Integrated Technologies* | *2110/2120* | *60* | *$980* |
| *Texas Instruments* | *T18837* | *40* | *na* |
| | *TMS320C30* | *20* | *na* |
| *Weitek* | *WTL3332* | *40* | *$400* |
| | *WTL2264/2265* | *40* | *$760* |

**Reprinted from the AAS Newsletter**
**-- December 1987**

***College Astronomers Should Play Leadership Roles in the AAS***

Dear Editor:

The slate for the next AAS election prompts me to raise the questions: Where are the colleges?

It is now recognized that the colleges play a crucial role in the preparation of future scientists including astronomers. Some statistics given by J.S. Rigden in the *American Journal of Physics* (Vol. 54, 875) are quite interesting. "Over the period 1976-85 ... the fraction of freshmen who intend to major in science...has dropped significantly for the universities--from 26.4% to 15% in 1985--it has stayed essentially constant at the colleges--31.8% in 1976 to 29.2% in 1985. The fraction of science majors who earn doctorates is greater for the colleges than for either the Ivy League schools or the 20 top-rated universities."

Now, if the purpose of the AAS is to promote the advancement of astronomy, then the Society is ignoring one of its major constituencies, the undergraduate colleges, where many of our future astronomers receive their original training.

I note that members of the AAS Council, those nominated, and the committee doing the nominating are all affiliated with universities and research institutions. There is no representation from the small institutions! This is not to suggest that we do not have good, reputable people in the leadership positions of the AAS or that they do not make good decisions. But we are overlooking the ideas from an important group. So in the future, let's try to get some better representation from the colleges within the structure of the AAS.

Henry Albers
Vassar College

## Of Darkness and Light

### *Have ETI's already been detected?*

### *by*

### *William H. Mook*

In 1956 astronomers from the Harvard Center for Astrophysics and the Smithsonian Astrophysical Observatory completed a three dimensional map of the universe. The map shows the positions of bright galaxies to a distance of 300 million light years from Earth. To their astonishment all the galaxies appeared to lie on the surface of bubbles. "It was as if all the bright matter in the universe were arranged like suds filling the kitchen sink", said Margaret J. Geller, one of the astronomers.

The cause of the darker regions has not been settled. Some astronomers have speculated that early in the evolution of the universe *superstrings* formed. These objects later exploded sweeping up the matter around them creating the voids. But according to other astrophysicists that would imply a non-isotropic background radiation and that seems pretty uniform.

One possible explanation could be ETI's! Freeman Dyson, Frank Tipler, and other scientists have for years argued that if ETI's really existed they would dominate astrophysical phenomenon just as life on earth dominated certain atmospheric and geological phenomenon.

Advanced ETI's would surely build self replicating *Von-Neuman* robots. These robots would spread outward in all directions from their creator's world.

An expanding shell of influence centered on their home world would be formed. The robots would be capable of transiting from star to star with an average rate of expansion of between .001C and .1C depending on their rocket technology.

According to the Drake equation, ETI's shouid have gotten started 1 or 2 billion vears ago, after population II stars had time enough to cook a lot of the heavier material in the universe. If Von-Neuman robots got started by any of these ETI's, they would inhabit a sphere of about 1 million to 200 million light years across. This makes the voids about the right size and shape to ask, could ETI's and these voids be related?

Why are the voids dark if this is the explanation for them? Why would ETI's want to shut off galaxies anyway? Well according to Dyson, any really advanced civilization would build a space station enclosing its star. In this way they could fully utilize all of its energy.

They may even turn off stars that aren't needed for later use. If an ETI could do this to one star, they could do it to any star. All they need are Von-Neuman robots and a high speed rocket.

There is another interesting feature in this scenario. If matter is indeed distributed throughout the

dark regions as it is in the brighter ones, there may be enough matter there to solve the missing mass problem.

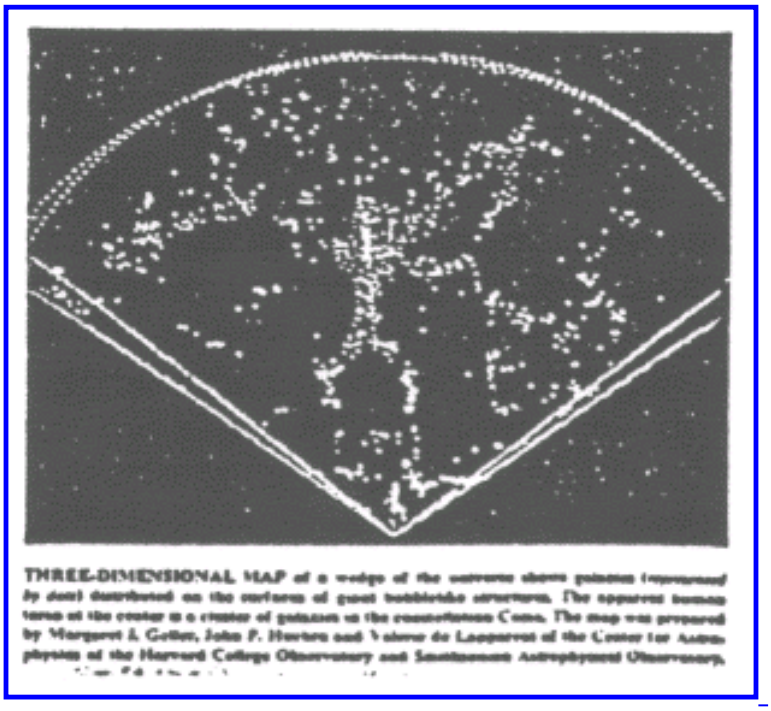
This is all interesting speculation. All the facts hang together enough to make the hypothesis seem plausible. Are there any experiments we could do to confirm or disprove the ETI's 'built' the voids? One experiment would be to examine the dark regions in the infrared. Any super ETI would radiate a lot of heat. Another experiment might involve checking the void centers for radio beacons.

Why would there be radio beacons near the void centers? To keep the Von-Neuman robots from evolving, and to orient them when deep in the universe.

Such beacons would provide information to a robot so that it could confirm its prerecorded instructions. The beacon would also orient the robots so they will know where to send data and materials, and where to send daughter robots. If radio sources are found at the void centers they may tell us how to build Von-Neuman robots of our own!

There may even be a weak anthropic principle operating. Life on Earth couldn't have started if Von-Neuman probes shut off the sun. So we find our galaxy in one of the bright uninhabited regions of the universe.

There may even be competition among ETIs. ETIs who wish to control and dominate the universe would represent the forces of darkness. Those who wish the universe to evolve naturally would represent the forces of light!



THREE-DIMENSIONAL MAP of a wedge of the universe shows galaxies (represented by dots) distributed on the surfaces of giant bubblelike structures. The apparent human torso at the center is a cluster of galaxies in the constellation Coma. The map was prepared by Margaret J. Geller, John P. Huchra and Valerie de Lapparent of the Center for Astrophysics at the Harvard College Observatory and Smithsonian Astrophysical Observatory.

[Note. Click on this photo to obtain a larger version. However, that larger image will not show the caption any better than the small version. I was not even able to read the caption on the newsetter itself due to the very small print that resulted from shrinking the image and the inherent loss in duplicating the newsletter. (Jerry Ehman, webpage editor)]

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