NRAO NEWSLETTER

1 October 1994 No. 61

GREEN BANK

GBT NEWS

The alidade is now virtually complete up to the elevation bearing level. The structure is almost ready for installation of the elevation shaft, wheel, and box structure. As shown in the photograph, a temporary scaffolding tower is in place which will support the elevation shaft and wheel during erection. Sections of the wheel support members have been arriving from the fabricator and are being welded on the ground into 36-inch square, 105-foot long spokes which attach the elevation wheel to the elevation shaft. Surface panel fabrication has begun at the contractor's facility.

Results of advanced analysis of the GBT pointing performance imply that there will be very small structural excitation due to azimuth and elevation motion: less than 1" during tracking. The production of 20 laser rangefinder units that will be used in the active surface and pointing systems is well under way. Work has begun on an experiment to use the 140 Foot Telescope to test the ability of the rangefinders to track a moving target several hundred feet above the ground and generate its coordinates with a precision of 100 microns.

The GBT C-band receiver is undergoing its final testing, and the 680-920 MHz receiver is nearing completion. Receivers covering 8-10 GHz and 18-26.5 GHz have been temporarily installed in the Cassegrain house of the 140 Foot Telescope and the 12-15.4 GHz receiver will follow in a few months. Results of the first tests of the GBT receivers on the 140 Foot are described elsewhere in this Newsletter.

F. J. LOCKMAN

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[Contact Joanne Nance (804) 296-0323, if you wish to receive mailings of the Newsletter]

GBT K-BAND RECEIVER PERFORMANCE

We have recently tested on the 140 Foot Telescope the 18-22 GHz HFET receiver that has replaced the maser receiver and which will eventually be used on the GBT. The receiver performed extremely well. Although the weather during the tests was far from ideal, I predict that the zenith system temperatures under good winter weather conditions will be about 55 K at 22.2 GHz and 40 K at 20 GHz. These system temperatures are about as good as what the maser receiver used to provide and will be much better when the receiver is used on the GBT due to the lower contribution to the system temperature on the GBT from spillover and scattering.

The receiver requires no tuning (other than a change of LO) between frequencies. The instantaneous frequency coverage, now limited by the 140 Foot IF system to about 450 MHz, will be the entire range of sky frequencies on the GBT. The second part of the GBT K-band receiver system covering 22 to 26 GHz is also mounted on the 140 Foot but has not yet been tested. Because of mechanical limitations on the 140 Foot, a change between the 18-22 GHz and 22-26 GHz bands now requires a few hours, but on the GBT both bands will be available simultaneously.

R. J. MADDALENA

PULSAR OBSERVING WITH THE GBT SPECTROMETER

Ray Escoffier has come up with a plan to add a long-term accumulator (LTA) to the GBT spectrometer that would allow it to be used for pulsar observations. Spectra could be sampled at a time resolution as short as one micro-second, then accumulated in an array at the appropriate phase in a pulsar period. The full bandwidth of the correlator would be available in this mode.

Anyone who is interested in using the GBT for pulsar or other rapid sampling observations should read the description of the proposed LTA in the September 20, 1994, agenda of the Scientific Working Group. It can be accessed through the GBT Home Page on the World Wide Web (WWW) (http://info.gb.nrao.edu/GBT/swg/GBTswg.html).

Your comments at this phase of the project are particularly welcome.

F. J. LOCKMAN

GBT MEMO DISTRIBUTION

New GBT memos are now being added to the GBT Home Page on the World Wide Web as they are written. The WWW entry now contains a complete index of memos, and many of the older ones have been added to the database. In order to reduce the costs incurred in the reproduction and mailing of GBT memos, we would like to send paper copies out only to those who cannot reliably obtain them through the WWW. Anyone who will be affected will be notified by mail and given a chance to request to remain on the paper copy mailing list. We appreciate your cooperation in reducing the number of unnecessary mailings and the consequent expenses.

F. J. LOCKMAN

SPECTRAL PROCESSOR DATA FORMAT CHANGE AND NEW DOCUMENTATION

We are now writing spectral processor pulsar data in FITS Binary Table format. The old data format, now being written in files SP0_xxxx and SP1_xxxx, will continue to be written to disk until late December. If all goes well with the new format, the old data format will be discontinued between pulsar campaigns sometime around the year-end holidays.

To help with the transition to the new format, Bob Payne has written a FITS Binary Table FORTRAN interface which he can describe to you in more detail on request. David Nice is working on getting Bob's routines into a call similar to the one used with the old data.

Note that during the period when both old and new formats are being written to the spectral processor disk, the disk will fill up twice as fast as usual. If you are comfortable with the new format before the December deadline, we can turn off the old format for your experiment to conserve disk space.

The spectral processor users manual has been updated on the World Wide Web (http://info.gb.nrao.edu/sp.doc/specProc.html) to reflect the changes made with the change of control computers. We will generate a printed version sometime soon.

J. R. FISHER

NEW 140 FOOT CASSEGRAIN RECEIVERS

This summer two cryogenic receiver front-ends, which have been built for the GBT project, were mounted in the 140 Foot vertex cabin and are available for use. The first (K-band) provides a choice between 18-22.3 GHz operation and 22-26.5 GHz operation. A scheduled feed change is required to switch between the two portions of K-band. The second (X-band) front-end covers the 8-10 GHz band. These two front-ends are mounted in the feed slots formally called "A-Rx" and "B-Rx," respectively. Changing operation between K- and X-bands can be accomplished from the control room by rotating the subreflector and configuring the local oscillators.

Both front-ends provide single-beam, dual-circular polarization operation with up to 400 MHz of instantaneous IF bandwidth. No tuning (other than LO tuning) is required to cover the front-end RF bandwidth. The new receivers will be used for all 140 Foot 1.3 cm and 3.6 cm VLBI observations as well as spectral line and continuum observations in these frequency ranges.

We are now working toward mounting a third GBT front-end later this fall. It will offer two operating bands: 12-15.5 GHz dual-circular polarization and 25-35 GHz single linear polarization. It will be placed in the feed slot currently occupied by the beam splitter.

These changes will give us a chance to test the GBT receivers in the field, and will reduce maintenance costs because all elements of the maser-upconverter receiver system will be removed. Also, the sensitivity of the 140 Foot at most frequencies should be improved. However, since we do not plan to make any further changes to the Cassegrain system after the third GBT front-end is mounted on the telescope, some frequencies that were formerly available on the 140 Foot will no longer be supported. In particular, there will be no receivers to cover the 5-8 GHz, 10-12 GHz, and 15.5-18 GHz bands.

This unfortunate reduction in the capabilities of the 140 Foot is a byproduct of the switch from the maser-upconverter receivers to the GBT HFET receivers, which was done to free up resources to be concentrated on development of the GBT electronics. It may be possible to construct a special purpose receiver to bridge a gap between the Cassegrain receivers if warranted by proposal pressure, but none are contemplated at this time. There has been very little demand for work at these frequencies in recent years, so the inconvenience should be slight.

F. J. LOCKMAN AND R. J. NORROD

12 METER

SUMMER SHUTDOWN SUMMARY

The 1994 summer shutdown period was busy and productive. The staff undertook major projects in the electronics, computing, and site maintenance areas. The major electronics project was the repackaging of the 2 mm and 3 mm receivers into one cryostat. The principal objective of this project was to free one of the "long" receiver bays for the 8-beam receiver. Now, the 8-beam and 2-3 mm receiver can be on the telescope at the same time. Various other cryogenic and compressor upgrades were made during the summer. Other electronics projects included the design and fabrication of a new sampler board for the hybrid spectrometer. We expect this upgrade to reduce some of the baseline flaws seen occasionally in hybrid spectrometer data. Tests will begin shortly.

The major software project this summer was to work toward on-the-fly data acquisition with the hybrid spectrometer. This project is continuing, with completion expected by the end of this year. This project involves acquiring 2048-channel data from the hybrid spectrometer, performing the FFT's, and outputting the results 10 times a second. The computing staff is using a high-speed digital signal processor (DSP) to do this task. This is a challenging project, but initial results are good. Other computing projects included a new operator interface to the control system, repackaging and enhancing the optical pointing system, and developing a new "what's up" display for showing the position of planets and observing sources on an X Window display.

The major site project was the replacement of the fabric on the dome door. The old door fabric was worn and was ripping apart at the seams, and had already exceeded its expected lifetime by several years. The fabric on the door folds as the door is opened and is, thus, subjected to more wear than the fabric on the remainder of the dome. The local NRAO staff worked together with the contractor, Sullivan and Brampton, to complete this job quickly and smoothly. In addition to the dome project, the control room was renovated to allow observers more, and better-arranged, work areas.

P. R. JEWELL AND J. S. KINGSLEY

SPECTRAL LINE ON-THE-FLY OBSERVING

Several improvements have been made to the spectral line on-the-fly (OTF) observing technique. An OTF map consists of data acquired every 0.1 seconds and tagged with the actual encoder positions as the telescope slews rapidly and continuously over the source. Since we do not assume that the telescope tracks perfectly at high slew rates, OTF data can be considered as pseudo-randomly sampled, and are in this way similar to the uv-data acquired through synthesis imaging techniques. Because of this similarity a decision was made last year to use as far as possible existing NRAO image processing packages to analyze OTF data. Data export will normally be in the form of FITS image cubes rather than the UniPOPS sdd data format.

Primarily due to the efforts of Eric Greisen, the reduction pipeline through AIPS which was developed last spring has been streamlined and should now be quite palatable to 12 Meter observers; it is available at the telescope now. As a longer term initiative, AIPS++ tasks for OTF analysis are also under development, and will benefit from the experience gained with this earlier implementation. The first OTF observing run was recently completed by Al Wootten and Gary Fuller. A preliminary, sample map showing the J=1-0 $C^{18}O$ emission toward a portion of the Ophiuchus molecular cloud is displayed below; the map is one quarter-degree in extent, and represents about one hour of data taken in very poor weather conditions. This map already compares extremely favorably with the best data available until now in the literature (Wilking & Lada 1983, ApJ 274,698).

Currently, the time it takes to produce an image from the data is longer than the acquistion time. The primary limitation on the data analysis speed is cpu time. As the 12 Meter will soon upgrade its analysis computer from a Sun IPX to a SPARCStation 20 multi-processor, it will become possible to process the OTF data in less than the time it takes to acquire it. An upgrade in cpu speed will also be necessary for the increased data flow that will result once OTF observing with the hybrid spectrometer is implemented in the near future.

For a description of the current OTF data processing pipeline , please contact Jeff Mangum (jmangum@as.arizona.edu).

J. G. MANGUM, H. A. WOOTTEN, G. A. FULLER, D. T. EMERSON, AND P. R. JEWELL

Figure Caption

Integrated Intensity $C^{18}O$ J=1-0 Rho Ophiuchus A to C Cores. Figure 1 shows the integrated intensity of the J=1-0 line of $C^{18}O$ toward a position midway between the ‘A’ (upper right) and ‘C’ (bottom just left of center) cores; the ‘B1’ core appears at far left just below center. Peak intensity (9.3 K) lies near the submillimeter source SM1, where the peak integrated intensity is 10.8 K km/s. The 5-sigma noise level in the spectra is typically 0.4 to 0.5 K. Total observing time for this map was slightly over one hour; the spectrometer consisted of two banks of 128 100 kHz filters sampling signals of orthogonal polarization. Data were reduced using the AIPS and Drawspec software packages.

IAU Symposium 170 Announcement

CO: TWENTY-FIVE YEARS OF MILLIMETER-WAVE SPECTROSCOPY

(A symposium to celebrate the 25th anniversary of the detection of carbon monoxide.)

29 May - 2 June 1995 · Tucson, Arizona, USA

Co-Sponsored by:
The National Radio Astronomy Observatory and The Submillimeter Telescope Observatory

Symposium Objective:

Interstellar carbon monoxide (CO) and several other basic molecules were first detected twenty-five years ago with the 36 Foot Telescope of the National Radio Astronomy Observatory. These discoveries have profoundly influenced our understanding of several diverse yet interrelated fields, including the phases of the interstellar medium, the initial and final phases of stellar evolution, the chemistry of dense and diffuse interstellar matter and the solar system, the structure of the Milky Way, and the content and structure of other galaxies. These research areas are among the most fundamental in astrophysics, and the spectroscopic information provided by CO and other molecules serves as the primary tool of investigation. New developments in instrumentation will further increase the power and utility of molecular line spectroscopy. The twenty-fifth anniversary of the detection of CO is a timely opportunity to bring researchers in all these areas together to review progress and discuss future directions. The emphasis of the meeting will be on CO and other molecules as tracers and diagnostics: what we have learned from CO and what remains to be learned.

General Topics to be Discussed:

- Giant and diffuse molecular clouds
- Star formation: observational data and constraints on theory
- General chemistry of the ISM and star formation
- Evolved stars: mass loss and chemistry
- CO in the submm, UV, and IR
- The Milky Way Galaxy
- Galaxies
- Planets at mm wavelengths
- Future directions

Scientific Organizing Committee:

John Bally (University of Colorado; chair)
Jaap Baars (MPIfR and SMTO)
Leo Blitz (University of Maryland)
Dennis Downes (IRAM)
Edith Falgarone (Ecole Normale Supérieure)
Harvey Liszt (NRAO)
Tetsuo Hasegawa (University of Tokyo)
Nick Scoville (California Institute of Technology)
Ewine van Dishoeck (Sterrewacht Leiden)
Glenn White (Queen Mary College)

Additional details are available. See the NRAO World Wide Web information pages for occasional updates (go to http://info.aoc.nrao.edu/ and click on the Tucson site).

For further information and registration details please contact:

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EIGHT-BEAM RECEIVER — CALL FOR PROPOSALS

We will accept proposals for the upgraded 8-beam, 1.3 mm receiver at the January 1 proposal deadline. We expect the receiver to be tested on the telescope beginning in late January and available for use by visiting observers by late March. The weather is usually acceptable for 1.3 mm observing through early May.

The 8-beam receiver utilizes SIS mixers and is tuned double-sideband. The tuning range has not yet been accurately measured, but will be at least 215 to 245 GHz, and probably wider. System temperatures on the sky will likely be about 700 K per beam under the best conditions, and single-sideband T_R^* should be relatively fast. The spectral line backend for the 8-beam receiver is the hybrid spectrometer. In 8-IF mode, the hybrid spectrometer has 192 spectral points per IF over bandwidths of 37.5, 75, 150, or 300 MHz. A 600 MHz bandwidth mode is available for 4-beam spectral observations, and an 8-channel digital backend is available for continuum work.

P. R. JEWELL AND D. T. EMERSON

VLBA/VLBI

VLBA STATUS

An encouraging confirmation of the general health of the VLBA came from monitoring of X-ray transient GRO J1655-40. Seven epochs spread by typically 5-6 days were observed. For this set of expedited observations, the average time between observation and release of the tapes was about 12 days. Data quality was good, except for some problems with playback quality necessitating recorrelation of one epoch.

A comparison of the results from a 1993 MkIII experiment, independently correlated and analyzed with the Haystack correlator and software and with the VLBA correlator and software, has been completed with very encouraging results. The observed delays, phases, and rates were in excellent agreement. The very slight differences are consistent with somewhat different algorithms and data handling in the two systems. A more complete and accurate comparison of the two correlators is now in progress using a 24-hour, dual frequency, geodetic-style VLBA experiment. The agreement of the correlated amplitudes between the two correlators has not been analyzed in detail as yet.

At the end of September, the rate of releasing tapes was approaching one project per day. The backlog of VLBA-only observations is gone. The throughput of the VLBA correlator, and indeed the whole VLBA, has been limited by the self-imposed rule that we scrutinize every project carefully for defects introduced by flaws in the observing system and correlator. This rule was adopted at the beginning of production in the early part of 1994 and was a natural reaction to the large number of problems that were being found. Currently, the correlator is operating sufficiently reliably that most projects suffer principally from problems at record time. While these problems must ultimately be fixed, they either cannot or should not be remedied by adjusting the correlation. Consequently, we have decided to move to a two-track approach to checking the results of correlation: most projects will be checked for good playback and the presence of fringes on a strong calibrator. A quasi-random and limited sample of projects will be examined in depth as we now do. From our experience with the data quality achieved in most projects, we expect that this approach should catch nearly all of the problems that compromise the scientific goals of a project. Since after passing the scrutinization the data tapes will be released immediately, we are committed to re-observing those projects that fail and are not caught in scrutinization. The goal of this new scheme of scrutinization is to sustain a release rate of one VLBA project per day. This translates into an observing duty cycle of 50 percent, and in terms of correlator throughput is about 25 percent of that ultimately possible.

Global projects take more time in preparation since clocks and tape head offsets must be determined. The backlog of unprocessed Global observations is 55 projects. Currently we release about one project per two weeks. Our goal is to double this rate of release by the beginning of December.

The considerable improvement in correlator throughput has come from a freeze of the correlator real-time software. A rationale for the freeze is to allow the software team to concentrate upon the re-design and re-write of some key components of the software. This revision of the software is expected to take at least four months. We can describe reasonably clearly just what type of projects can be processed successfully on the correlator using the current software. We publish a document on the World Wide Web in the NRAO VLBA Home Page (http://info.aoc.nrao.edu/doc/vlba/html/VLBA.html) that describes the do's and don'ts of scheduling a project. Observers must adhere to these guidelines if the project is to be processed on the correlator. The VLBA Friend for a project will provide advice on scheduling if required.

The drop in recording and/or playback quality described in the last Newsletter was found to be due to a design problem with an equalizer in the playback drives. Once this was discovered, a simple fix was possible and the playback quality improved dramatically. We still suffer from poor playback more often than is ultimately acceptable but the current level of quality does not significantly limit throughput.

Finally, statistics on correlator processing are now available via the NRAO VLBA Home Page on the WWW.

T. J. CORNWELL

VLBI NETWORK CALL FOR PROPOSALS

Proposals for VLBI network observing are handled by the NRAO. In particular, the network sessions for 1995 are expected to be as follows:

Session	Dates	Bands	Proposal Deadline
1	08 Feb to 01 Mar	0.7, 3.6/13, 90	1 Oct 1994
2	03 May to 24 May	6, 18/21, (50)	1 Oct 1994
3	04 Oct to 01 Nov	1.3, 6, 18/21	1 Jun 1995

The Caltech Mark II processor has ended routine correlation for the astronomical community as of the end of 1993. It is still available for astronomer operation in some circumstances. In addition, the Block O correlator in Bologna may occasionally be available. In this somewhat confusing situation, Mark II proposers are requested to make arrangements for correlation before submitting proposals, and to mention their arrangements in the proposal. In any event, no proposals for Mark II observations will be scheduled without assurances from the manager of a Mark II correlator that the observations can be processed. NRAO support for Mark II observations will end at the end of December 1994.

It is recommended that proposers use a standard cover sheet for their VLBI proposals. Fill-in-the-blanks TeX files are available by anonymous ftp from ftp.cv.nrao.edu, directory proposal. Printed forms, for filling in by typewriter, are available on request from Joanne Nance (804-296-0323, jnance@nrao.edu).

Any proposal requesting antennas from two or more institutions in the European VLBI network constitutes a Global proposal. Global proposals MUST reach BOTH networks' schedulers on or before the proposal deadline date; allow sufficient amount of time for mailing. In general, fax submissions of Global proposals will not be accepted. Proposals requesting use of the Socorro correlator must be sent to NRAO even if they do not request the use of NRAO antennas; proposals requesting use of the Bonn correlator must be sent to the EVN even if they do not request the use of any EVN antennas. For Global proposals, or those to the EVN alone, send proposals to:

R. Schwartz
Max-Planck-Institut für Radioastronomie
Auf dem Hugel 69
53121 Bonn
Germany

For proposals to the VLBA, or Global proposals, send proposals to:

Director
National Radio Astronomy Observatory
520 Edgemont Road
Charlottesville, VA 22903-2475
USA

B. G. CLARK

VLA

UNUSUAL MOVEMENT IN VLA PAD W28

Antenna position measurements at the VLA are usually routine, with normal changes of the order of a centimeter or less. Occasionally, much larger changes are seen. During the last B configuration (from May to September of this year), pad W28 (occupied by Antenna 10) was found to have risen by about 10 centimeters since February 1993, the last time the pad was occupied. Due to operational "snafus," this extraordinary change was not accurately measured, and the changes entered into the Modcomps, until August 3. All data taken between May 10 and August 3 involving Antenna 10 will have large phase winds, and should be corrected. The procedure for this correction is straightforward and is fully described in Chapter 4 of the AIPS Cookbook. Astronomical sources strong enough to be self-calibrated will not require this correction, although it certainly is useful to do it.

Remarkably enough, pad W28 has "jumped" once before. Between March 1989 and May 1990, the pad moved in a nearly identical direction ("up") and by a similar amount. Between May 1990 and February 1993, the pad slowly settled back to its original (pre-1990) position. No other nearby pads showed any similar motion during these time periods. The pad is now empty and will remain so until the next scheduled B configuration—currently scheduled for late 1995. Needless to say, VLA staff will be very curious to see if this pad continues its peculiar motion.

R. A. PERLEY

VLA CONFIGURATION SCHEDULE

Configuration	Starting Date	Ending Date	Proposal Deadline
C	14 Oct 1994	03 Jan 1995	1 Jun 1994
DnC	13 Jan 1995	13 Feb 1995	3 Oct 1994
D	17 Feb 1995	29 May 1995	3 Oct 1994
A	09 Jun 1995	28 Aug 1995	1 Feb 1995
BnA	08 Sep 1995	25 Sep 1995	1 Jun 1995
B	29 Sep 1995	02 Jan 1996	1 Jun 1995
CnB	12 Jan 1996	29 Jan 1996	2 Oct 1995

The VLA currently is scheduling two large surveys. One will be done at night in the DnC and D configurations (01^h-13^h and 06^h-18^h, respectively for the 1995 D configuration), and one in the north galactic cap (07^h-17^h) in the B configuration. Observing time in those configurations and LSTs will be much reduced over past practice. On the other hand, observations disjoint with the surveys in those configurations will have more time available for scheduling than has previously been the case.

Several suggestions have been made for changing the above cycle to better accommodate the large surveys. A memo by Juan Uson discussing desiderata and options is available from Rita Salazar, Socorro. The options are: a) to keep the present cycle, or b) to reverse the order of the configurations, i.e., D->C->B->A->D. Either option can be traversed in either a 16-month or a 20-month cycle and maintain the property that a given configuration precesses through the seasons. Any change from the present 16-month cycle would bring a transitional period of two or three years which could be adjusted to accommodate the surveys with less pain to prospective observers. NRAO welcomes your opinion regarding this change. This was discussed at the Users Committee meeting in Socorro in June, and their tentative recommendation was to keep the cycle as it is and to continue discussion of this question.

The maximum antenna separations for the four VLA configurations are: A 36 km, B 11 km, C 3 km, D 1 km. The BnA, CnB, and DnC configurations are the hybrid configurations with the long north arm, which produce a round beam for southern sources (south of about -15 degrees declination).

	Q1	Q2	Q3	Q4
1994	D,A	A,B	B	C
1995	D	D,A	A,B	B
1996	C	D	D,A	A,B
1997	B	C	D	D,A
1998	A,B	B	C	D

Observers should note that some types of observations are significantly more difficult in daytime than at nighttime. These include observations at 327 MHz (solar and other interference; disturbed ionosphere, especially at dawn), line observations at 18 and 21 cm (solar interference), polarization measurements at L-band (uncertainty in ionospheric rotation measure), and observations at 2 cm and shorter wavelengths in B and A configurations (tropospheric phase variations, especially in summer). They should defer such observations for a configuration cycle to avoid such problems. The D configuration daytime will be about 00^h RA and the A configuration daytime will be about 07^h RA.

Time will be allocated for the VLBA on intervals approximately corresponding to the VLA configurations from those proposals in hand at the corresponding VLA proposal deadline.

B. G. CLARK

VLA OBSERVE

OBSERVE now supports default blocks. This feature reduces the number of lines in your OBSERVE file by not printing out redundant /LO, /FI, /DS, or /PM cards. Using the World Wide Web, select the OBSERVE item on the VLA Home Page (http://info.aoc.nrao.edu/doc/vla/html/VLA.html) and look at the file default blocks for more information. The most current version of OBSERVE is 3.2.5, dated 1994.10.01.

W. K. YOUNG

VLA 7 MILLIMETER SYSTEM STATUS

The 7 mm (Q-band) system upgrade is finished and operational. For details on the system and its performance, see Technical Memo #189 available from T. McBride (Socorro) or contact dwood@nrao.edu for the latest status report.

For the next D-array the 7 mm receivers will be located at the following stations: east arm: 1,4,7; west arm: 2,5,8; north arm: 3,6,8,9. This "spiral" pattern produces a more uniformly sampled u-v plane than the previous configuration of the Q-band antennas which used the inner stations of each arm. The spiral also avoids some time lost due to shadowing. With this configuration operating at 43.3 GHz, a 12-hour synthesis of a source at 45 degrees declination produces a synthesized beam of 2.2 x 1.5 arcseconds with no sidelobes above ten percent. A ten minute snapshot produces a synthesized beam of 2.0 x 1.4 arcseconds with several sidelobes above 50 percent and many above ten percent. A 12-hour synthesis of a source at -20 degrees declination should have a synthesized beam of 2.2 x 2.2 arcseconds and some sidelobes at the ten percent level. The AIPS task UVSIM can make these predictions for your particular observation.

Q-band sensitivity estimates remain at ~1 mJy/beam for a one-hour observation under good conditions with two IFs of 50 MHz. Under poor conditions, the rms may be 2-3 times worse. Observations at low declination will have approximately twice the rms as sources near the zenith. Atmospheric phase stability is much worse during the day and especially in the summer. The winter D-array should be much better on this account. This summer, I have found that observations from mid morning to just after sunset in the summer have little or no phase coherence.

Observers planning high frequency observations (up to the receiver limit of 50 GHz) should expect approximately five times worse signal to noise performance than the nominal Q-band frequency of 43.3 GHz. Most of this is due to increased system temperature due to the atmosphere and an approximately 50 percent loss of antenna efficiency.

Although it is possible to use the non-Q-band antennas in a subarray at some other frequency while observing at 7 mm, observers should be aware that the two arrays are not entirely independent. The details of subarray observing are described in D. Wood's 7 mm status report. All Q-band observations should be made with "reference pointing" applied. We encourage Q-band observers to come to the VLA for their observations and data reduction.

D. O. S. WOOD

COMPUTING AT NRAO-NM

During the summer several Suns made the transition to Solaris 2. This enabled us to gain further expertise with running AIPS under Solaris 2. Our experiences are very positive. Due to the large number of workstations at the AOC, we do not expect to have all machines running under Solaris before late fall. If members of NRAO's user community have concerns or questions about your own migration to Solaris 2, please contact Ruth Milner, manager of New Mexico computing systems, at 505-835-7282 or through e-mail at rmilner@nrao.edu.

We are currently busy investigating the possibility of installing faster disks on our IBM 580s. It appears that disk I/O rather than CPU is the limiting factor when running AIPS tasks on large amounts of data on these machines. We have just concluded testing a 14 GByte RAID-3 system. This system boasts a dramatic improvement in disk I/O compared to traditional disks. Our first preliminary results, though, indicate that on average the speed gain on a series of VLBA related tasks is a mere fourteen percent compared to using a traditional disk system in which I/O is optimally distributed over different individual disks.

The robustness of realtime data filling using the AIPS task FILLM was increased; at the same time the whole process was made more transparent to the user. In short, realtime filling allows the user to load data into AIPS on a VLA or AOC workstation while the observation is ongoing. A memo explaining the process is currently in preparation; a preliminary version is available from Gustaaf van Moorsel, gvanmoor@nrao.edu.

G. A. VAN MOORSEL

VLA UPGRADE SCIENCE WORKSHOP

Preparations are underway for a major upgrade of the VLA. Recognizing the importance of external users of the VLA for defining the scientific program of the upgrade and in so doing the upgrade itself, the NRAO will host a VLA Upgrade Science Workshop in Socorro, tentatively scheduled for the weekend of 13-15 January 1995. The workshop will be modeled after the highly successful MMA science workshops, wherein a comprehensive scientific case was formulated for the instrument by several science working groups. It is hoped that roughly 40 individuals will participate in the Workshop. Interested parties should contact tbastian@nrao.edu.

T. S. BASTIAN, R. A. SRAMEK, AND R. J. PERLEY

VLA POWER DISTRIBUTION CABLE

The project to replace the buried high voltage power distribution cable at the VLA was completed in August 1994. This project has been a major part of the VLA infrastructure repair. The cable replacement began in 1988 when the VLA was experiencing an increasing rate of failures due to aging of the original cable. Between 1988 and 1994, 630,000 feet of cable were installed along the VLA arms in 38 miles of trench. The project was funded by NSF and NASA (in support of the Voyager Mission). The materials cost was $1.0M and the work was done by the people of the VLA Engineering Services Division. The installation of the new power cable is a major step in maintaining the VLA's reliability as it progresses through its second decade of operation.

R. A. SRAMEK

THE NRAO 5TH SYNTHESIS IMAGING SUMMER SCHOOL, 1995

The NRAO has held in Socorro, typically every three years since 1982, a Summer School on the principles and techniques of synthesis imaging. This series of lectures has proven to be very popular amongst scientists and graduate students, with typically more than 150 attendees. Due to the VLBA dedication, and the symposium that accompanied that event in mid-1993, it was decided to postpone the regular tri-annual summer school one year, to 1995.

The fifth summer school in synthesis imaging will be held in Socorro, June 5 through 10, 1995. Lectures covering aperture synthesis theory and techniques will cover the first four and one-half days. Demonstrations of data collection, calibration, and imaging from both VLA and VLBA data will be given on Friday afternoon and Saturday, June 9 and 10. Dormitory space at NMIMT will be available at nominal cost from Sunday, June 4, through Saturday, June 10 with checkout on Sunday, June 11. Due to budget limitations, the NRAO will not be able to provide financial support for attendees. There will be a nominal registration fee, sufficient to cover only the cost of this meeting.

Planning for this summer school is now just beginning. We expect to make a general announcement, complete with a preliminary list of lectures and lecturers, in November.

M. T. ROMERO AND R. A. PERLEY

SUBMISSION OF VLA/VLBA PROPOSALS: SOME CHANGES

Several changes have been made to the cover sheets for VLA proposals. These are substantial, and we request that proposals submitted for subsequent deadlines use this new form. A hard copy is available from Joanne Nance (jnance@nrao.edu; 804-296-0323).

Some of the questions in the original cover sheets have been eliminated as they are no longer relevant given the changes in our computers and the software used. Some questions on the desired sensitivity have been added. In addition, we have dropped the possibility of requesting a "staff collaborator" at the time of submission of the proposal. We emphasize that such a request is still welcome, but prospective users who would like a staff collaborator should request it from the VLA site director well in advance of submission of the proposal.

As the back cover is no longer in landscape mode, the previous two TeX templates (vlacover1.tex and vlacover2.tex) have been merged into one (covervla.tex) which is available as before via anonymous ftp from ftp.cv.nrao.edu. Both TeX template and postscript file (covervla.ps) are available with the "get" command after changing directory with the command "cd proposal" (see the file "instructions" in that directory). The VLBI cover sheets files also have been updated (covervlbi.tex or covervlbi.ps). The logos "nraologo.ps" and "evnlogo.ps" should also be copied.

Forty-seven proposals were successfully received by e-mail for the June 1, 1994, deadline. Most of these were successfully printed on the first try; the rest were printed successfully on the second try. The problems mostly were due to the assumption of DIN A-4 paper in our printer which resulted in pages that were chopped at the top. Please, remember our printers use standard USA paper (8.5" x 11.0"). We believe that e-mail submission of proposals will work reliably and would like to encourage that proposals be sent this way. Proposals are printed promptly during working hours and acknowledged shortly after that. Please send all e-mail proposals to propsoc@zia.aoc.nrao.edu.

J. M. USON

IN GENERAL

THE MILLIMETER ARRAY

We were pleased to hear at the spring meeting of the NSF Astronomy Subcommittee of the Division of Mathematics and Physical Sciences Advisory Committee that it is the intention of MPS to pursue the formal development phase of the MMA upon completion of the U.S. funding of Gemini construction (1996). There are, of course, conditions that the MMA project must satisfy and requisite approvals that MPS must receive within the Foundation in order to proceed even with the MMA development phase. Nevertheless, it is very satisfying to see the progress that NSF Astronomy has achieved in working for the community goals for ground-based astronomy for the 1990s as set forth in the Bahcall Report.

The development phase of the MMA project, lasting 2-3 years, is meant to provide an opportunity for us to answer fundamental design questions, particularly those questions that have an impact on the construction or operating cost of the array. As much as possible, the MMA hardware will be prototyped. Because so much of the MMA development phase activity involves experimentation or prototype, the needs of the MMA project mesh with similar instrumentation research tasks that are ongoing activities at the two U.S. university-based millimeter arrays, OVRO and BIMA. The NRAO, OVRO, and BIMA have agreed to establish the Millimeter Array Development Consortium (MDC) as a collaborative mechanism to oversee the development of the MMA. The MDC will be managed by an Executive Committee of four members—two representatives from the NRAO and one each from OVRO and BIMA—appointed by the participating institutions and reporting to the NRAO director. The Executive Committee will define major MMA-related development issues and tasks, identify personnel from member institutions to work on those tasks, and construct the task budget for funds made available to the NRAO for the development of the MMA. We believe that the MDC is a concept that could serve as a new model for future large science projects where there is a desire to maintain viable university-based instrumentation development efforts in the era of major national facilities.

A major question for the MMA is the site. Extensive atmospheric transparency and stability measurements made with the NRAO 225 GHz tipping radiometer have provided us with a reasonably complete characterization of two potential sites in the continental U.S., a site near Springerville, AZ at 9200 feet elevation and a site in the NM Magdalena mountains at 10,200 feet. Recently we have sought to compare the continental sites with sites at even higher elevation on Mauna Kea, HI. A comparison of the 225 GHz atmospheric transparency between a potential MMA site adjacent to the VLBA site at 12,500 feet elevation with the transparency at the CSO a thousand feet higher (MMA Memo 118) shows the higher site to advantage. The atmospheric phase stability is a separate question that will be studied with a 12 GHz interferometer on a 300 meter baseline that will be operational near the VLBA site in October 1994. From the tipper and the interferometer, we will be in a position to assess the utility of the Mauna Kea sites for the MMA.

In cooperation with the group from the Nobeyama Radio Observatory in Japan that is investigating possible sites for the Large Millimeter and Submillimeter Array (LMSA), we have agreed to exchange the data we are accumulating on Mauna Kea with similar data they are acquiring on high sites in the southern hemisphere in northern Chile. In principle, Chile offers flat sites for a 3-kilometer array such as the MMA at the elevation of the summit of Mauna Kea and even several thousand feet higher. However, we know little about the utility of these sites for millimeter interferometry, that is, we don't know how the atmospheric transparency and stability scales with elevation nor do we know how these parameters compare on any Chilean site with those from the U.S. sites. We look forward to receiving the reports from the NRO group. We also hope to make some limited exploratory 225 GHz transparency measurements ourselves with the NRAO tipper on Chilean sites at elevations as high as 16,000 feet.

We are continuing to hold discussions with potential foreign partners. International partnership is likely to be essential to an eventual approval by NSF of construction of the MMA.

The MMA Advisory Committee will hold its 1994 meeting at the AOC in Socorro November 18 and 19. At that meeting we will discuss the outlines of MMA development work to be done through the MDC, the site studies and related questions, and progress in specification of MMA hardware. Attending the meeting, in addition to the Advisory Committee members, will be representatives of the participating MDC institutions and members of the MMA Subcommittee of the NRAO Users Committee.

R. L. BROWN

JANSKY LECTURE

Dr. Vera C. Rubin of the Department of Terrestrial Magnetism, Carnegie Institution of Washington will give the 1994 Jansky Lecture in Socorro on November 5 and in Charlottesville on November 15. Her lecture is entitled "What's the Matter in the Universe?"

The Jansky Lectureship was established by the Trustees of Associated Universities, Inc., and was first awarded in 1966. It is named in honor of Karl G. Jansky, who in 1933 first detected cosmic radio waves from the Milky Way.

P. A. VANDEN BOUT

REPORT OF THE 1994 NRAO USERS COMMITTEE

The NRAO Users Committee met in Socorro June 12-14, 1994. The following summary was prepared from their final report.

The Committee noted the many dramatic developments in instrumentation and techniques at NRAO telescopes during the past year. The first Q-band images from the VLA were presented at the meeting, as were images from the VLBA. There were also impressive large-scale millimeter maps using the new on-the-fly mapping on the 12 Meter Telescope, and steady progress on the construction of the GBT. The Committee commended NRAO for continuing to develop and refine the instruments and techniques on all of its telescopes.

A number of Observatory-wide issues were discussed. The Committee was pleased to see that NRAO remains at the forefront of information technology with their utilization of the World Wide Web and recommended that NRAO continue to utilize this resource for dissemination of information and data. It was suggested that NRAO reiterate and clarify its policy on archival data and develop an accurate list of archival data. The Committee expressed concern about the increase in radio frequency interference, and encouraged NRAO to continue to monitor this problem. NRAO was once again urged to continue efforts to increase the number of women in its ranks and to generally diversify its population.

A major topic of discussion at the meeting was the impact of the VLA sky surveys. The Committee felt that the impact of the two sky surveys on the scheduling of non-survey proposals for the B and D configurations was much greater than expected, and suggested that the scheduling of future surveys should be more carefully considered in the context of this experience. The Committee had a number of suggestions for ways to alleviate the pressure imposed on the B and D configurations by the surveys, including a possible six weeks extension of the D-array to finish one survey, and a shift in LST range for the B-array survey.

The Committee expressed enthusiasm for all facets of proposed VLA upgrades, including the proposed receiver and bandwidth correlator upgrade, the extension of Q-band capability to all VLA antennas, and the extension of the VLA to longer baselines. The Committee recommended that the scientific community be consulted on any scientific choices that need to be made for proposed upgrades in a timely fashion. There was widespread support for the present VLA configuration sequence, as opposed to the proposed reversal to DCBA. However, a minority of Committee members felt strongly that a reversal of the sequence would be beneficial; this issue may need further study. It was also recommended that NRAO complete their studies of the possible use of mixed configurations, in which shorter spacings are added to existing configurations. The Committee was impressed with the maps from the new Q-band subarray of the VLA, which promises to become an extremely important frequency band. It was urged that the VLA staff institute a modest program of weekly or monthly flux monitoring of a selected set of high frequency sources at Q-band, as well as a complete update of the existing calibration manual.

The VLBA was a major topic of discussion. The Committee was pleased with the progress on the VLBA and with the images that are being produced. It recognized that the VLBA staff have worked hard with the users to get data through the new system. However, it was noted that it will be some time before the VLBA becomes attractive to non-specialists. NRAO is encouraged to maintain good and up-to-date documentation on the VLBA and to make sure that changes to VLBA software are thoroughly tested. The Committee noted a general tendency toward over-optimism concerning VLBA capabilities, particularly the correlator. It was recommended that a single person serve as the contact point for the official status of the various correlator modes and reductions. The Committee was also concerned about the low throughput of data from the correlator and the consequent idle time on the array. It was recommended that NRAO encourage VLBA-only proposals as being much easier to correlate, and to consider the addition of a weekend operator for "vanilla-mode" experiments. VLBA proposal reviewing still seems to be problematic. The Committee suggested that NRAO consider teleconferencing for at least one VLA/VLBA review group to see if this might help.

Computing and software were a major concern of the Committee. In this regard the Committee felt that the special AIPS++ session on Saturday was very informative and useful. NRAO was encouraged to continue to keep the user community abreast of the progress on AIPS++. The Committee strongly recommended that AIPS be maintained not only until AIPS++ is up and running, but mature. There was dismay within the Committee for the fact that the interferometric portions of AIPS++ are being developed by other consortium members and not NRAO, as well as the lack of explicit senior scientific staff involvement in the project. Although distressed to discover that C++ code is not only difficult to read and write but also to optimize, the Committee was encouraged to learn that FORTRAN programs can be accommodated in AIPS++ and that routines from AIPS are being incorporated into AIPS++. The Committee urges the AIPS++ project to include native 3D capability for spectral line analysis. The Committee also suggested that during the next year NRAO consider planning an AIPS++ users workshop for AIPS++ system managers and AIPS++ light programmers.

Another important computing challenge was identified in the single dish area, particularly in the new technique of on-the-fly (OTF) mapping now available at the 12 Meter Telescope. At present the data cannot be reduced without heroic efforts. The Committee asked that NRAO put some manpower into single-dish mapping software, preferably at the 12 Meter Telescope.

The Committee was pleased with the progress on the GBT and with the use of the 140 Foot Telescope as a GBT testbed. Concern was expressed about the correlator chip development and possible adverse effects on the spectrometer schedule. The Committee also

disapproved of the replacement of the K-band maser receiver on the 140 Foot with a receiver with higher noise temperature, and urged that it be upgraded as soon as possible. The Committee approved of the institution of OTF mapping on the 12 Meter Telescope, and particularly liked the OTF maps of the moon and W51. The remote observing program for the 12 Meter is also very impressive. The Committee would like to see the 8-feed SIS receiver on the telescope soon.

The Central Development Laboratory was commended for its work, especially the new InP HFET amplifiers. NRAO was encouraged to continue to pursue relationships with other technological leaders, including UVa, so that radio astronomy can continue to benefit from the CDL's leadership.

The Committee once again strongly endorsed the MMA project and was pleased to hear that the project will receive design funding next year. The Committee was pleased that NRAO is continuing aggressive site testing efforts on Mauna Kea, particularly the installation of the test interferometer at the VLBA site. The Committee appreciates the importance of the phase stability problem and recommended continued consultation with other millimeter array sites on this problem, especially the recent experience of the OVRO array with conditions at 1 mm.

Steve Unwin (Caltech) will serve as the new Chair for 1995. The new members and chairs of the subcommittees are:

VLA/VLBA: Jim Cordes (Cornell), Karl Menten (CFA), Ralph Gaume (DTM), Colin Lonsdale (MIT/Haystack), Bob Mutel (Iowa), Mark Reid (CFA), Steve Unwin (Caltech), Jacqueline Van Gorkom (Columbia); chair: Jacqueline Van Gorkom.

MMA: Mary Barsony (UC Riverside), Andy Fruchter (STScI), Ralph Gaume (DTM), Karl Menten (CFA), Lee Mundy (Maryland), Steve Unwin (Caltech), Jacqueline Van Gorkom (Columbia); chair: Mary Barsony (UC Riverside).

GBT: Morley Bell (Herzberg Institute), Jim Cordes (Cornell), Roger Foster (NRL), Andy Fruchter (STScI), Karl Menten (CFA), Lee Mundy (Maryland); chair: Karl Menten (CFA).

AIPS++: Mary Barsony (UC Riverside), Roger Foster (NRL) Andy Fruchter (STScI), Ralph Gaume (DTM), Colin Lonsdale (MIT/Haystack), Bob Mutel (Iowa), Steve Unwin (Caltech); chair: Ralph Gaume (DTM).

JEAN TURNER, 1994 CHAIR

1995 JANSKY POSTDOCTORALS

Applications are now being accepted for 1995 Jansky Postdoctorals at the NRAO. Individuals holding Jansky Postdoctorals formulate and carry out their research program either independently or in collaboration with others within the wide framework of interests of the Observatory. Minority applicants, female applicants, and applicants with research interests in the development of astronomical instrumentation and in image processing are especially encouraged.

The full NRAO observing, computational, and support facilities are made available to Postdoctorals. The Postdoctoral appointment also includes a travel budget, scientific page charge support, as well as vacation allowance, health insurance, moving allowance, and other benefits.

Appointments, which are available at any of the NRAO sites, are made for a term of two years and may be renewed for a third year. Stipends for 1993 will be approximately $33,000. Successful applicants must have received their Ph.D. prior to beginning the appointment. Preference will be given to recent Ph.D. recipients (1994 or 1995).

Application may be made to:

Director
National Radio Astronomy Observatory
520 Edgemont Road
Charlottesville, VA 22903-2475

The application should include a curriculum vitae and a brief statement of the type of research activity to be undertaken at the NRAO. The applicant should have three letters of recommendation sent directly to the NRAO, Director.

The application deadline is December 15, 1994. All letters of reference must be received by December 31, 1994. The announcement of the Jansky Postdoctoral appointments will be made in compliance with the AAS resolution on uniform notification dates for postdoctoral appointments.

R. L. BROWN

1994 SUMMER STUDENTS

The 1994 Research Experiences for Undergraduates at NRAO has ended with the 19 students heading for their colleges from the four NRAO sites. As examples of the sorts of research students and their advisers undertake at the four NRAO sites, we give a short summary of the activities of several students.

Dale Frail, at the VLA, worked with Britt Scharringhausen (U. Iowa) this summer. She began with a project to search for new pulsar wind nebulae around high velocity and/or energetic, young pulsars. She learned AIPS to calibrate the 3.6 cm VLA data and image the regions around about 40 pulsars looking for signs of extended emission. Many point sources, which Britt showed were likely just pulsar emission, were detected at the expected locations of the pulsars but no extended emission—no pulsar winds. Britt went on to do detailed radio imaging of two known pulsar wind nebulae.

Sarah Winfrey, from the University of Michigan, assisted Cecilia Barnbaum (Charlottesville) in the early stages of a project on Late Type Stars with Gas Deficient Circumstellar Envelopes. As a first attempt to understand these gas deficient giants, Cecilia had observed them with an optical telescope to determine their spectral type. Since there are important evolutionary differences between late type giants and supergiants and their environments, these stars must be identified in the sample. Sarah spent much of her time learning to reduce optical spectra with the NOAO program IRAF. It is difficult and lengthy, but all-important training. Mid-visit, she accompanied Cecilia to Lick Observatory where she assisted in aquiring new data with a low resolution spectrograph and CCD detector. Her tenure at NRAO was finished just as she successfully reduced the latest data. At the upcoming AAS Meeting in Tucson, she and Cecilia will present some of the spectral classifications of these stars previously unobserved optically.

In Tucson, Pamela Gay, from Michigan State University, worked with Jeff Hagen and Phil Jewell to create a software mapping tool to enable 12 Meter observers to create images of the millimeter sky. The observer fills in parameters for the planned map, from which the tool calculates the pattern the map will cover on the sky and the time necessary to complete it to a given noise level. Satisfied that these parameters will produce the desired image, a file then transfers the parameters to the operating system for execution.

Christi Eixenberger, from the University of Idaho, worked with Ed Meinfelder in Green Bank. Her programming tasks covered a wide range of topics, including X Windows, TCP, C++, and Motif, with which she became familiar as the summer progressed. One way in which she employed her knowledge was to create a simple Motif Editor with which to examine and edit data from the GBT retroreflectors.

Information and application forms will soon be mailed soliciting applications for research assistantships next summer. The majority of the assistantships will be offered to undergraduate students who are currently enrolled in U.S. undergraduate institutions and who will not receive their degrees before or during the summer of 1995. A limited number of assistantships may be available for graduate students or students from non-U.S. institutions.

Owing to the large number of applicants, and the difficulty of distributing materials among sites across the continent, the deadline for receipt of application materials will be January 20, 1995; notice of decisions will be sent by March 1, 1995. Forms are available from Department Heads or by writing to:

Program Director, Summer Student Program
National Radio Astronomy Observatory
520 Edgemont Road
Charlottesville, VA 22903-2475

H. A. WOOTTEN

NRAO PREPRINTS ON THE WORLD WIDE WEB

We are pleased to announce the availability of NRAO preprints on the World Wide Web. We are presenting the following pages:

1) A listing of current preprints by NRAO staff and by visitors whose papers include original observations made with NRAO instruments; arranged by NRAO preprint number with links to the preprint abstracts and the full-text PostScript file.

2) An alphabetical listing by author/title of unpublished preprints received in the NRAO-CV library, authored by NRAO staff or by visitors whose papers include original observations made with NRAO instruments; preprints with abstracts and full text available have the appropriate links in this listing.

3) Annual alphabetical listings by author and title, including citation, of published papers by NRAO staff and visitors; when published, papers will be removed from lists 1) and/or 2) above and added to the published list for the appropriate year.

The URL for the NRAO preprint pages is: http://info.cv.nrao.edu/html/library/intro_preprints.html. There are also links to the preprint pages from the NRAO Home Page and from the NRAO Library Page.

We encourage everyone whose papers have an NRAO staff author or include original results from any NRAO telescope(s) to consider adding them to the WWW. For instructions on having your paper included, contact Ellen Bouton, library@nrao.edu, or read the instructions to authors on the WWW.

R. L. BROWN AND E. N. BOUTON

OBTAINING SLIDES OF IMAGES

There is now a reasonably simple procedure in place by which users may make slides of their images from the NRAO telescopes. We certainly encourage users to make use of the facility both for their own professional research purposes and also as an aid to their instructional activities. Single images will usually be printed directly to the 35 mm slide format; multi-panel images will be printed to 4x5 film in addition to the 35 mm format.

The procedure for making slides is described below. The slide will be made in a day or two and returned to the individual submitting the image file. Among the reasons the NRAO offers this service to staff and users is that it enables us, in principle, to enhance the NRAO library of astronomical images. With permission of the astronomer submitting the image to be made into a slide, we will make a master copy of the slide for the library and ask for a brief image description. The NRAO will make the image available for scientific and educational purposes, noting in material sent with the slide the name of the observer(s) responsible for producing the image. In return for permission to include the slide in the library, the NRAO will provide any of the observers involved with copies of the slide, or prints of it, at no charge for as long as the image remains in the library.

To make a slide of your image:

- On your workstation create a postscript file containing your image. The filename should be no more than eight characters with an extension of no more than three characters. All letters in the filename should be lower case (e.g., my-image.ps).
- ftp the file to the pub/slides directory in the anonymous login area of Solitaire;
- Send an e-mail to psmiley@nrao.edu giving the filename, number of slides and prints needed, your mailing address, and noting whether you would be willing to have the image included in the NRAO image library.

A typical ftp session would be the following:

ftp	solitaire.cv.nrao.edu
login	anonymous
password	your e-mail address
cd	pub/slides
put	my-image.ps
quit	

R. L. BROWN AND P. J. SMILEY