

NATIONAL RADIO ASTRONOMY OBSERVATORY
Charlottesville, Virginia

Quarterly Report

April 1, 1978 - June 30, 1978

PROPERTY OF THE U. S. GOVERNMENT
RADIO ASTRONOMY OBSERVATORY
CHARLOTTESVILLE, VA.

JUL 18 1978

RESEARCH PROGRAMS

<u>140-Foot Telescope</u>	<u>Hours</u>
Scheduled observing	1808.00
Scheduled maintenance and equipment changes	140.00
Scheduled tests and calibration	232.25
Time lost due to: equipment failure	67.50
power	11.50
weather	7.50
interference	0.00

The following line programs were conducted during this quarter.

<u>Observer</u>	<u>Program</u>
R. Freedman (York, Canada) A. Irwin (Toronto) L. Rickard B. Turner	Observations at 2932 MHz to search for SiH in clouds of moderate density.
B. Turner	Search at 24.641 GHz for the (2,0)→(1,0) transition of (H ₂ O) ₂ , and at 21.457 and 25.033 GHz for the J=6-5 and J=7-6 transition of (HCN) ₂ .
M. Guélin (Inst. for Space Studies) M. Morris (Inst. for Space Studies) P. Thaddeus (Inst. for Space Studies)	Observations to determine the relative abundance of HC ₅ N at 23.963 GHz and HC ₇ N at 25.944 and 24.816 GHz in molecular clouds.
J. Bologna (NRL) P. Schwartz (NRL) A. Cheung (California, Davis) D. Matsakis (Berkeley)	Measurements of the structure and temperature in molecular clouds by the study of NH ₃ at 23.7, 23.9, and 25.1 GHz.
L. Snyder (Illinois) D. Buhl (Goddard) L. Brown (Goddard) F. Lovas (NBS) R. Suenram (NBS) J. Hollis	Observations at 1.4-cm in a search for NH ₂ CH ₂ COOH (glycine).

<u>Observer</u>	<u>Program</u>
P. Gregory (U. British Columbia) W. McCutcheon (U. British Columbia)	Water-line measurements at 22 GHz of CO hot spots that have been detected around Sharpless HII regions, and a search at this frequency for water-line emission from early-type emission-line stars.
P. Bowers	Search at 22 GHz for H ₂ O emission from late-type stars.
J. Fix (NSF) R. Mutel (Iowa)	Observations of the polarization of 1612 MHz OH radiation from IRC 10420.
N. Fourikis (CSIRU)	Studies of CH ₃ NHD at 2.8-cm wavelength.
F. Clark (Kentucky)	Study at 4830 MHz of H ₂ CO in rotating protostellar clouds.
F. Clark (Kentucky) R. Fleck (Kentucky)	Observations at the 4830 MHz line of H ₂ CO in an attempt to measure the rotation in three interstellar clouds.
G. Rossano (Maryland)	Observations of H109 α at 6-cm in selected areas of the Rosette nebula.
E. Grayzeck (Nevada) G. Rossano (Maryland) P. Angerhofer (Maryland)	Recombination line measurements of NGC 7822 at 6-cm wavelength.

The following continuum programs were conducted.

<u>Observer</u>	<u>Program</u>
L. Rudnick	Observations at 22 GHz to verify and map hot gas in clusters of galaxies.
G. Rossano (Maryland)	Mapping of the Rosette nebula at 6-cm wavelength.
E. Grayzeck (Nevada) G. Rossano (Maryland) P. Angerhofer (Maryland)	Measurements of NGC 7822 at 6-cm wavelength.

The following very-long baseline programs were conducted, and the stations used in the experiments are coded as follows:

A - Algonquin, Canada 150-ft	J - Goldstone 210-ft
B - MPIR Bonn, W. Germany 100-m	K - Haystack 120-ft
E - Jodrell Bank, England 250-ft	M - Madrid DSN 210-ft
F - Harvard, Fort Davis 85-ft	N - NRL 85-ft
G - NRAO 140-ft	O - OVRO 130-ft
I - Iowa NLRO 60-ft	S - Onsala, Sweden 66-ft
D - Dwingeloo, Netherlands 25-m	

ObserverProgram

W. Cotton (MIT)	Observations at 3.6 and 13-cm in a search for aligned structure in source components of different ages and sizes, a search for nonuniform components and to examine some steep spectrum sources, using telescopes M, S, J, O, F, K, and G.
M. Ratner (MIT)	
I. Shapiro (MIT)	
J. Wittels (MIT)	
T. Clark (Goddard)	
C. Knight (Haystack)	Additional observations of the expanding structure of 3C 273 using telescopes at F, O, and G.
M. Cohen (Caltech)	
A. Readhead (Caltech)	Observations at 22 GHz to determine the precise positions of H ₂ O masers that are associated with late-type stars and HII regions, with telescopes at K and G.
K. Johnston (NRL)	
J. Spencer (NRL)	
J. Moran (Center for Astrophysics)	
M. Reid	
T. Clark (Goddard)	Observations at 8.4 GHz to measure the positions of and study the small-scale kinematics of the nuclei of various types of radio sources, to improve and validate the geodetic capabilities of VLB techniques, and to validate new VLB instrumentation and techniques, using telescopes at O, K, S, M, and G.
R. Coates (Goddard)	
J. Ryan (Goddard)	
D. Robertson (NGS, Rockville)	
C. Counselman (MIT)	
J. Wittels (MIT)	
I. Shapiro (MIT)	
C. Ma (Maryland)	
H. Hinteregger (Haystack)	
C. Knight (Haystack)	
A. Rogers (Haystack)	
A. Whitney (Haystack)	
J. Moran (Center for Astrophysics)	
G. Resch (JPL)	
C. Kotanyi (Kapteyn Labs, Groningen)	Observations at 18-cm of the nucleus of Vir A, of 3C 236, 3C 345, and Parkes Equatorial sources, using telescopes at B, E, S, D. and G.
R. Schilizzi (Netherlands Foundation for Radio Astronomy)	
G. Miley (Leiden Observatory)	
L. Båårh (Chalmers)	
B. Rönnäng (Chalmers)	

<u>Observer</u>	<u>Program</u>
continued	
P. Wilkinson (Jodrell Bank)	
R. Booth (Jodrell Bank)	
P. Stannard (Jodrell Bank)	
I. Browne (Jodrell Bank)	
I. Pauliny-Toth (MPIR, Bonn)	
K. Kellermann (MPIR, Bonn)	
R. Phillips (Iowa)	Observations at 18 cm to produce high
R. Mutel (Iowa)	resolution maps of compact continuum sources,
	using telescopes at I, O, F, and G.
K. Johnston (NRL)	Observations at 18 cm of the structure and
J. Moran (Center for Astrophysics)	positions of unidentified Type II OH/IR
M. Reid	stars with telescopes at N, K, and G.
P. Bowers	
K. Kellermann (MPIR, Bonn)	Observations at 2.8 cm using telescopes at
J. Yen (Toronto)	A and G, with the G data transmitted from
N. Broten (NRC, Canada)	the NRAO 85-1 telescope to the Canadian
D. Fort (NRC, Canada)	CTS geostationary satellite, and thence to
W. Waltman (NRL)	Algonquin, Canada to permit on-line data
S. Knowles (NRL)	analysis
G. Swenson (Illinois)	
B. Rayhrer	
M. Cohen (Caltech)	Studies at 2.8 cm of NGC 6251 with tele-
A. Readhead (Caltech)	scopes at B, K, O, and G.
K. Kellermann (MPIR, Bonn)	Observations at 2.8 cm of compact galactic
B. Geldzahler (Pennsylvania)	sources with telescopes at B, K, O, and G.
K. Johnston (NRL)	Observations to map the 22 GHz H ₂ O emission
T. Giuffrida (Bell Labs)	in W49N, W3(OH), and W3(C)H ₂ O, using tele-
R. Walker (Caltech)	scopes at K, O, and G.
J. Moran (Center for Astrophysics)	
B. Burke (MIT)	

In addition to the above programs, tests were conducted in the Cassegrain mode on a subreflector which deforms to correct for telescope surface irregularities when observing away from the zenith.

<u>300-Foot Telescope</u>	<u>Hours</u>
Scheduled observing	2022.00
Scheduled maintenance and equipment changes	145.50
Scheduled tests and calibration	6.00
Time lost due to: equipment failure	7.25
power	11.75
weather	3.25
interference	0.00

The following line programs were conducted during this quarter.

<u>Observer</u>	<u>Program</u>
B. Burke (MIT)	Study of redshifted neutral H I absorption features in radio galaxies.
A. Haschick (MIT)	
W. Baan (Inst. for Advanced Studies)	
J. Broderick (VPI & SU)	Search for 710 MHz emission from proton variants.
J. Ficenec (VPI & SU)	
D. Teplitz (VPI & SU)	
V. Teplitz (VPI & SU)	
F. Briggs (Pittsburgh)	Search for redshifted hydrogen at 696, 698, and 757 MHz in PKS 0424-131, and at 839 MHz in OZ-187.
A. Wolfe (Pittsburgh)	
W. Huchtmeier (Hamburger Sternwarte, W. Germany)	Search for 21-cm hydrogen in Sa galaxies.
H. Wendker (Hamburger Sternwarte, W. Germany)	
G. Tammann (Basel Observatory, Switzerland)	
A. Sandage (Hale Observatory)	
R. Giovanelli (Arecibo)	Observations to complete the mapping of 21-cm hydrogen in the direction of a recently discovered SNR candidate in Cygnus.
M. Haynes (Indiana)	
T. Gull (Goddard)	
R. Brown	Search at 1405 MHz for H_2^+ hyperfine spectral lines.
G. Knapp (Caltech)	Survey of elliptical galaxies for 21-cm hydrogen
N. Krumm (California, Santa Cruz)	
S. Faber (California, Santa Cruz)	
J. Gallagher (Illinois)	
D. Hunter (Illinois)	

<u>Observer</u>	<u>Program</u>
G. Martin (Virginia) T. Thuan (Virginia)	Measurements of 21-cm hydrogen in galaxies in the Perseus supercluster.
J. Knapp (Caltech) G. Martin (Virginia) T. Thuan (Virginia)	Measurements of 21-cm hydrogen redshifts in "single" galaxies and in other selected galaxies.
L. Davis (Toronto) E. Seaquist (Toronto)	Studies of 21-cm hydrogen in interacting galaxies.

The following continuum programs were conducted during this quarter.

<u>Observer</u>	<u>Program</u>
J. Broderick (VPI & SU) J. Condon (VPI & SU) J. Ledden (VPI & SU) R. Brown	Measurements at 6 cm of the number-flux density relation of extragalactic sources in the intensity range 25-100 mJy, and a survey for sources whose flux densities are between 10 and 25 mJy.
P. Myers (MIT) P. Crane	Survey at 6 cm of B stars for HII regions to learn the distribution of HII region emission as a function of spectral type, stellar reddening, and galactic position.
J. Condon (VPI & SU) J. Ledden (VPI & SU) J. Douglas (Texas) F. Owen	Survey at 6 cm of extragalactic sources down to 25 mJy.
J. Burns (Indiana) R. White	Observations at 6 cm of rich and poor clusters which contain dominant galaxies.
T. Balonek (Massachusetts) W. Dent (Massachusetts) M. Hartman (Massachusetts)	Study at 2695 MHz of the polarization and flux density of known extragalactic radio sources.
R. Brown	Observations to map S140-R and NGC 2023.
W. Cotton (MIT) S. Spangler	Observations at 1400 MHz to continue the study of low-frequency variable sources.
C. Bennett (Maryland) W. Erickson (Maryland) S. McCorkle (Maryland)	Measurements of the flux density of Cas A at 57.5 and 73.8 MHz.

The following pulsar programs were conducted.

<u>Observer</u>	<u>Program</u>
M. Damashek (Massachusetts)	Observations at 410 MHz to complete a
J. Taylor (Massachusetts)	northern hemisphere pulsar search.

<u>Interferometer</u>	<u>Hours</u>
Scheduled observing	1898.75
Scheduled maintenance and equipment changes	119.75
Scheduled tests and calibration	77.25
Time lost due to: equipment failure	58.50
power	11.25
weather	8.50
interference	0.25

While several programs used the 45-foot telescope over a 35-km baseline, only those specifically requiring its use are indicated in the program description.

The following continuum programs were conducted at 2695 and 8085 MHz, unless otherwise noted.

<u>Observer</u>	<u>Program</u>
P. Crane	Observations of the Sb galaxy NGC 4102,
J. van der Hulst	using the 45-foot telescope.
K. Lo (Berkeley)	Very high-resolution monitoring of the
R. Brown	flux/time variability of Sgr A, using the
	45-foot telescope.
J. Brandt (Goddard)	Study of comet 1978c at 8085 MHz only.
R. Hobbs (Goddard)	
S. Maran (Goddard)	
H. Martin (Haverford)	Observations to search for fluctuations
R. Partridge (Haverford)	in the cosmic microwave background.
R. Rood (Virginia)	
G. Kaplan (USNO)	Observations to determine UT and polar
W. Klepczynski (USNO)	motion, using the 45-foot telescope.
D. McCarthy (USNO)	
K. Johnston (NRL)	
C. Mayer (NRL)	
J. Spencer (NRL)	
G. Westerhout (USNO)	

<u>Observer</u>	<u>Program</u>
D. Florkowski (Florida) S. Gottesman (Florida)	Observations of the mass loss from HD193793 using the 45-foot telescope.
D. Aitschuler (Inter-American University, Puerto Rico) J. Wardle (Brandeis)	Monitor the variability of flux and polarization in approximately 80 sources.
R. Brown	Observations to map S140-R and NGC 2023.
P. Angerhofer (Maryland) M. Kundu (Maryland)	Synthesis map at 8085 MHz of the possible supernova CTB80 using the 45-foot telescope.
H. Quintana L. Rudnick	Search for the radio/optical counterparts of high galactic latitude unidentified x-ray sources.
R. Hjellming D. Hogg H. Hvatum	Observations of compact thermal radio emission associated with stars.
J. Lockman (DTM) R. Brown	Observations with the 45-foot telescope to determine the visibility of approximately 40 HII regions whose line emission is now being studied.
J. Broderick (VPI & SU) B. Geldzahler (Pennsylvania) K. Kellermann (MPIR, Bonn) R. Brown	Study of small diameter sources found at low galactic latitude, using the 45-foot telescope.
T. Jones (Minnesota) J. Puschell (Minnesota) W. Stein (Minnesota) J. Warner (Minnesota) F. Owen L. Rudnick	Observations, coordinated with other studies at millimeter, infrared and optical wavelengths, of the polarization properties of BL Lac objects and quasistellar objects.
F. Ghigo (Brandeis)	An attempt to detect a number of ring-type galaxies.
W. Cotton (MIT) M. Ratner (MIT) I. Shapiro (MIT)	Studies with the 45-foot telescope of compact sources to be used as references in the study of pulsar proper motions.
F. Donovan (Florida)	Observations to determine the accurate positions of selected radio sources.

<u>Observer</u>	<u>Program</u>
R. M. Price (NSF) P. Crane	High-resolution observations of spiral galaxies, and monitoring the flux density variations of compact sources within spiral galaxies.
K. Lang (Tufts) R. Willson (Tufts)	Studies of solar active regions, using the 45-foot telescope.
E. Seaquist (Toronto) P. Crane	Maps of the radio emission from normal spiral galaxies.
J. Burns (Indiana) F. Owen L. Rudnick	Detailed mapping of selected head-tail radio sources, using the 45-foot telescope.
F. Maloney (Villanova)	Study the structure of the quasar 3C2.
J. Burns (Indiana)	Observations of the BL Lac object 1400+162.
L. Rudnick	Observations of extended structures in selected 4C sources.
P. Feldman (NRC, Canada) S. Kwok (York, Canada) T. Stiff (York, Canada) C. Purton (York, Canada)	Measurements of emission from early-type emission stars.

Additionally, the 85-1 telescope was used as a link with the Canadian CTS satellite to transmit VLB data from the NRAO 140-foot telescope to Algonquin, Canada.

<u>36-Foot Telescope</u>	<u>Hours</u>
Scheduled observing	1946.50
Scheduled maintenance and equipment changes	180.50
Scheduled tests and calibration	57.00
Time lost due to: equipment failure	45.00
power	0.00
weather	76.00
interference	0.00

<u>Observer</u>	<u>Program</u>
L. Avery (Herzberg Institute) N. Broten (Herzberg Institute) J. MacLeod (Herzberg Institute)	Study of density in the molecular ridge in Heiles Cloud 2.

<u>Observer</u>	<u>Program</u>
A. Barrett (MIT) M. Schneps (MIT) R. Buxton (MIT)	Dynamics of globules around OB clusters.
R. Brown (Monash) P. Godfrey (Monash) J. Storey (California, Berkeley) M. Bassez (Monash)	Search for interstellar glycine.
W. B. Burton P. Baker (MPIR, Bonn) H. Liszt	Correlation of fine-scale structure in galactic CO and HI emission.
W. Dent (Massachusetts) R. Hobbs (Goddard)	The evolution of extragalactic radio sources at millimeter wavelengths.
P. Ho (Massachusetts) R. Martin (MPIR, Bonn) M. Schneps (MIT)	Study of the structure and dynamics of compact HII regions.
P. Jackson (Maryland)	Observations of well-studied, distant HII regions in CO emission.
D. Jennings (Goddard) K. Fox (Goddard)	Observations of interstellar methane.
T. Kuiper (JPL) B. Zuckerman (Maryland) E. Rodriguez-Kuiper (Ball Brothers)	Study of cold molecular gas in the galactic center.
T. Kuiper (JPL) B. Zuckerman (Maryland) E. Rodriguez-Kuiper (Ball Brothers)	Observations of vibrationally excited molecules in selected sources.
T. Kuiper (JPL) B. Zuckerman (Maryland) E. Rodriguez-Kuiper (Ball Brothers)	Study of high-velocity gas toward the Orion Nebula.
C. Lada (Center for Astrophysics) S. Perrenod (Illinois)	Observations of hot gas in superclusters at 9 mm.
H. Liszt W. B. Burton	Behavior of molecular emission from the fundamental distribution of the inner galaxy.

<u>Observer</u>	<u>Program</u>
M. Morris (Columbia) M. Guélin (Inst. for Space Studies) P. Thaddeus (Inst. for Space Studies)	Observations of the relative abundances of HC_3N , HC_5N , and HC_7N in molecular clouds.
P. Myers (MIT) R. Buxton (MIT) M. Schneps (MIT)	Study of CO in absorption against HII regions.
F. Owen J. Condon	90 GHz observations of radio-quiet quasars.
P. Palmer (Chicago) M. Morris (Columbia) B. Zuckerman (Maryland) D. Gilra (California, Berkeley)	Study of SiS and SiO in carbon-rich stars.
R. Partridge (Haverford)	Search for fluctuations in the microwave background.
W. Peters (Texas) N. Evans II (Texas)	Lunar occultations of Sharpless 255 in CO emission.
L. Rickard B. Turner P. Palmer (Chicago)	A study of CO emission in galaxies.
L. Rudnick F. Owen T. Jones (Minnesota) W. Stein (Minnesota) J. Puschell (Minnesota) J. Warner (Minnesota)	Polarization and emission of BL Lac objects.
L. Snyder (Illinois) R. Crutcher (Illinois) J. Hollis P. Thaddeus (Inst. for Space Studies)	Study of quadrupole splitting of N_2H^+ .
L. Snyder (Illinois) D. Buhl (Goddard) L. Brown (Goddard) J. Hollis F. Lovas (NBS) R. Sueram (NBS)	Search for interstellar glycine.
P. Thaddeus (Inst. for Space Studies) M. Guélin (Inst. for Space Studies)	Search for C_5N and C_6N radicals and maps of C_4H .

<u>Observer</u>	<u>Program</u>
W. Wilson (Aerospace) R. Kakar (JPL) M. Klein (JPL)	Observations of CO in Venus and other planets.
H. Wooten (Texas) N. Evans II (Texas) R. Snell (Texas) P. Vanden Bout (Texas)	Determination of electron densities in molecular clouds using H_2CO , HCO^+ , and DCO^+ .
B. Zuckerman (Maryland)	Search for SiO masers in IR sources.
B. Zuckerman (Maryland) D. Gilra (California, Berkeley) P. Palmer (Chicago) B. Turner	Study of CO emission in evolved stars.

ELECTRONICS DIVISION

Charlottesville

Model IV autocorrelator development is continuing. Work has started on the IF section of the instrument in Green Bank.

VLB Mark III record terminal work is continuing; the first terminal will have a complete complement of video converters and an updated formatter by November, when a further experiment with Haystack is planned.

Work has continued on improving the performance of the 2-mm mixers. The 1-mm harmonically pumped mixer has been modified to improve the signal and local oscillator tuning.

Green Bank

The deformable, correcting subreflector was installed and tested on the 140-foot telescope in early June. Although the deformation was limited by the available actuators, substantial improvements in aperture efficiency were measured. The largest gains of as much as a factor of two at 22 GHz were realized in the southeast pointing directions. There is a strong east-west asymmetry in the aperture efficiency curve of the 140-foot which remains to be explained. This asymmetry is accentuated by the correcting subreflector. Only first order astigmatic deformations produced much improvement. The new subreflector without deformation showed a higher efficiency than the old one so it could be that the first one had deteriorated with time.

A new Versatec printer/hard copy unit was installed on the 140-foot to replace a much less reliable Varian device.

Bandwidths as wide as 560 MHz have been achieved with a longer magnet on the 22 GHz masers. All future masers will incorporate the new magnet. The first 8.2-10.8 GHz upconverter was delivered by AIL in April, and work is well under way for incorporating it in the second phase of the 140-ft Cassegrain system which will also include a 12-16 GHz upconverter. A corrugated, conical horn, Cassegrain feed which provides a constant illumination taper and VSWR $< 1.2:1$ from 11.5 to 15.5 GHz was built in the Green Bank shop.

A 22 GHz dual, movable feed correlation radiometer is being built to measure the focal plane field distribution on the 140-foot in an effort to understand the surface deformations.

Tucson

Progress has been made this quarter with the 130-170 GHz mixers. Present performance is now equal to that originally hoped for and comes as a result of a new batch of University of Virginia 1.5 micron diodes.

One of these mixers has been successfully cooled and will be incorporated in a 1 mm/2 mm cooled mixer receiver that is currently being developed.

A baud rate converter to interface the DEC 11/45 computer with slower peripherals has been built during this quarter.

Another 1020 refrigerator compressor is being assembled in Tucson and is almost completed.

ENGINEERING DIVISION

The correctable subreflector was completed and installed on the 140-foot telescope for a test observation period. Design of a new traveling feed with supporting back-up structure continued for the 300-foot. A surface measurement was made on four radii of the 140-foot telescope using the new "stepping bar" method for surface measurements. Preliminary work was started to measure 48 radii, the complete surface, of the 140-foot with the "stepping bar". Conceptual design and research continued for a future 25-m millimeter wave telescope in such areas as structures, astrodome, door covering fabrics, site and buildings. Design of stow pins for the 36-foot was completed and drawings turned over to the shop for fabrication. Routine engineering assistance was provided operations and maintenance in Charlottesville, Green Bank and Tucson.

COMPUTER DIVISION

IBM 360/65 System

HASP has been updated to release 4.1c. The operating system has been updated to release 21.8E, which is IBM's penultimate operating system for the 360 series. The latest PL1 compiler and ASMG assembler are currently being tested by selected users.

140-Foot Telescope

Two procedures (POINT and PEAK) have been added to the control program. 'POINT' drives the telescope through a source in right ascension and declination, calculates the best gaussian fit through the half-power points and calculates the pointing correction. 'PEAK' automatically calculates the position of the peak and positions the telescope there.

VLBI

The spectral-line post-processing package is available to users. Mark Reid has volunteered his services as consultant. The missing 15% fringe amplitude on the B-C baseline has been restored at the processor. See VLBI newsletter No. 103, March 23, 1977, B. Clark, D. Shaffer, and B. Rayhrer for an explanation.

Map Processor

Bids have been accepted for the purchase of an array processor and an image display system.

VERY LARGE ARRAY PROGRAM

The array was scheduled for observations and test 55% of the time during the second quarter of 1978. At the last of June the array was operating with 12 antennas on an 11.5 km baseline. The eighteenth antenna was accepted from E-Systems on June 19, 1978.

The electronics group completed the current retrofit program with all antennas now having the same electronics. In the cryogenics area, planning is in progress for a new cryogenics laboratory and clean room. The new CTI 1020 cryogenics systems are being purchased for \$9,900; this compares very favorably with prices of \$16,490 for the old CTI system and \$17,900 for the Air Products system. Six extra systems are being purchased to allow retrofitting of Air Products or Cryomech systems. In the digital area, work is

progressing satisfactorily towards a first test of the new correlator system in July. First fringes were obtained with antenna number 13 on April 28, 1978 and with antenna 14 on June 22, 1978.

In the computer area, an additional 32 K words of memory and a 179 MByte disk have been delivered for the map display (PDP 11/40) system. The Modcomp backup system (named "Backus") has been delivered, and some software work is under way to make it a convenient background system for doing software work while observing. The RSX-11 operating system for the PDP-11 display computer has been generated and installed (this system supports the large RP06 disk and the DA-28 communications system to the DEC-10). A remote terminal for access to the DEC-10 has been installed in Socorro.

The additional Visiting Scientist Quarters and Library-Office buildings were completed and partially occupied during the quarter. Work on the archaeological excavation has been completed. Phase IV construction contracts were awarded on June 23, 1978.

PERSONNEL

Appointments

John W. Dreher	Research Associate	6/27/78
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Terminations

Lewis E. Somers	Applied Physicist	4/30/78
George H. Patton	Electronics Engineer I	4/30/78
James L. Dolan	Electronics Engineer I	6/23/78

Promotion

Campbell M. Wade	To Acting Assistant Director for VLA Operations/Scientist	6/07/78
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STUDENT PROGRAM

Announcements were sent to more than 100 colleges and universities in November 1977 requesting applications to our summer student program. From the more than 150 applications received, 24 students were selected to participate in the program as research assistants to the scientific staff and in the electronics and computer divisions. Thirteen students are working in Charlottesville, four in Green Bank, five in Socorro, and two in Tucson.

Twenty-one lectures will be given by the staff on various topics in radio astronomy and instrumentation. Students are encouraged to attend our regular NRAO colloquia and seminars. They will also assist as tour guides in the public education program in Green Bank.

Since its beginning in 1959, 468 students have participated in the summer programs. Several students have returned as thesis students and some have returned as full-time employees.

The names of the 1978 students, their academic year and school are given below.

Name	Academic Year	School
Ashby, Mark	U-4	West Virginia University
Bertschinger, Edmund	U-3	Caltech
Buckman, Marlene	U-3	VPI
Fiedler, Ralph	G-1	Minnesota
Freuh, Marian	G-2	Purdue
Hanisch, Robert	G-2	Maryland
Harris, Andrew	U-4	California, Davis
Heiligman, Gary M.	U-4	MIT
Herter, Terry	G-2	Rochester
Jones, Michael	U-4	Illinois
Keel, William	U-4	Vanderbilt
MacDowell, Robert	U-4	Swarthmore
MacMinn, Stephen	U-4	Lehigh
Miller, Guy	U-3	Caltech
Morton, Douglas	U-4	Maine
Newell, Robert	G-2	New Mexico Tech
Norrod, Roger	U-1	Tennessee Tech. University
Pimentel, Juan	G-2	Virginia
Sewall, James	U-4	Massachusetts
Tereby, Susan	G-1	California, Berkeley
Tiitus, Annika	G-1	Chalmers, Sweden
Ulvestad, James	G-2	Maryland
Verter, Frances A.	U-4	Brooklyn
Wallenhorst, Steven	G-2	Wisconsin

OBSERVATORY COLLOQUIA

The thirty-two speakers in the NRAO colloquium program for the year ending June 30, 1978, are outlined below. The speakers are usually invited by the scientific staff, and talk on topics of current interest in radio astronomy

or closely allied fields. The Astronomy Department of the University of Virginia also invites speakers to their own colloquium series. These series are jointly announced and well attended by our staff, university physicists and astronomers, and students.

Name	Institution
Allen, Mark	Institute for Space Studies
Assousa, George	Dept. of Terrestrial Magnetism
Aveni, Anthony F.	Colgate University
Bosma, Albert	Kapteyn Astronomical Institute
Brecher, Kenneth	Massachusetts Inst. of Technology
Burbidge, E. Margaret	University of California, San Diego
Cesarsky, Catherine	Centre d'Etudes Nucleaires de Saclay
Cordes, James	University of Massachusetts Five College Radio Observatory
Crovisier, J.	Observatoire de Paris
Davidson, Arthur F.	Johns Hopkins University
Elitzur, Moshe	University of Illinois
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