US/GR BR/

NATIONAL RADIO ASTRONOMY OBSERVATORY

Charlottesville, Virginia

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

0CT 2 4 1980

Quarterly Report

July 1, 1980 - September 30, 1980

RESEARCH PROGRAMS

140-foot Telescope	Hours
Scheduled Observing	1053.75
Scheduled Maintenance and Equipment Changes	772.25
Scheduled Tests and Calibration	378.50
Time Lost Due to: Equipment Failure	18.00
Power	12.75
Weather	26.75
Interference	1.00

The following line programs were conducted during this quarter.

Observer(s)

Program

Interferometric observations of 21-cm hydrogen absorption toward extragalactic continuum sources, using the 300-ft and 140-ft telescopes.

Observations at 1612 and 1667 MHz to verify newly found OH/IR sources.

Observations at 18, 21, and 30 cm to study recombination lines and line to continuum ratios in HII regions.

OH observations at 18 cm to obtain the spectra of those OH masers associated with Ori A and W49.

Observations at 1238 MHz to search for HI fine structure.

Observations at 6 cm to search for excited OH emission toward late-type stars.

A. Winnberg (MPIR, Bonn)H. Matthews (Herzberg Inst.)F. Olnon (Leiden)H. Habing (Leiden)

R. Brown F. J. Lockman

K. Lind (Rice)

J. Dickey

J. Benson

K. Johnston (NRL) S. Hansen

R. Brown

P. Jewell (Illinois)
L. Snyder (Illinois)

D. Crocker (Virginia) S. Goldstein (Virginia)

Search for neutral hydrogen in or near clusters of galaxies.

Program

The following continuum programs were conducted during this quarter.

Observer(s)

P. Angerhofer (USNO) G. Rossano (USN)

Observations at 11 cm to map the CMa Loop.

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

A - Arecibo, 1000-ft B - Effelsberg, 100-m C - Algonquin, 150-ft D - Goldstone, 210-ft F - Fort Davis, 85-ft G - Green Bank, 140-ft H - Hat Creek, 85-ft I - Iowa, 60-ft

Observer(s)

M. Cohen (Caltech) T. Pearson (Caltech) A. Readhead (Caltech) G. Seielstad (Caltech) R. Linfield (Caltech) R. Simon (Caltech) S. Unwin (Caltech)

R. Linfield (Caltech) S. Unwin (Caltech)

T. Pearson (Caltech) A. Readhead (Caltech)

M. Claussen (Iowa) J. Fix (Iowa) R. Mutel (Iowa) J. Benson

M. Aliste (Zaragosa, Spain) B. Geldzahler (MIT) I. Shapiro (MIT) W. Cotton

K - Haystack, 120-ft M - Madrid, 210-ft 0 - Owens Valley, 130-ft S - Onsala, 84-ft V - Illinois, 120-ft W - Westerbork Y - VLA, 25-m

Program

Observations at 2.8 cm of superluminal sources with telescopes at B, F, H, K, 0, and G.

Observations at 2.8 cm of 3C 111 with telescopes at C, F, K, O, and G.

Observations at 6 cm to continue a mapping survey of selected sources found between declinations $+35^{\circ}$ and $+70^{\circ}$ with telescopes B, F, K, O, and G.

Observations of 1612 MHz emission from stellar OH sources with telescopes F, I, 0, A, and G.

Observations at 13 cm to map the polarization structure of 3C 454.3 with telescopes B, S, M, F, D, K, O, and G.

Program

E. Wadiak (Virginia)

D. Shaffer (Phoenix Corp.)
R. Phillips (Brandeis)

S. Kent (Iowa) R. Mutel (Iowa)

A. Witzel (MPIR, Bonn)
M. Reid (CFA)
D. Shaffer (Phoenix Corp.)
F. Owen

H. Aller (Michigan)
R. Mutel (Iowa)
R. Phillips (Brandeis)

B. Geldzahler (MIT)
J. Romney (MPIR, Bonn)
R. C. Walker

Gopal-Krishna (MPIR, Bonn) E. Preuss (MPIR, Bonn) R. Porcas (MPIR, Bonn)

Program

Observations at 13 cm to study size and spectra, magnetic fields and source energetics, and variability of NRAO 150, 3C 147, CTD 93, 3C 380, and 3C 395 with telescopes K, F, I, O, V, and G.

Observations at 18 cm to measure relative positions of OH masers with telescopes I and G.

Observations at 5 GHz to continue a study of QSO proper motion with telescopes B, K, O, Y, and G.

Observations at 6 cm to measure the coordinated flux and the structure of BL Lac with telescopes B, F, O, K, and G.

Observations at 6 cm of SS 433 with telescopes B, F, K, O, and G.

Observations at 6 cm of CTD 93 with telescopes B, S, W, O, and G.

During this quarter the new 1000-channel autocorrelator was installed and tested, and portions of the new 5-25 GHz maser were tested.

300-foot Telescope	Hours
Scheduled Observing	1257.00
Scheduled Maintenance and Equipment Changes	621.25
Scheduled Tests and Calibration	35.50
Time Lost Due to: Equipment Failure	27.75
Power	3.75
Weather	0.00
Interference	0.75

The following line programs were conducted during this quarter.

Observer(s)

Program

B. M. Lewis (Carter Obs.) P. Crane Observations to detect and study sources contained in the Shapley-Ames Catalog at the 21 cm line of neutral hydrogen.

Program

B. Burke (MIT) A. Haschick (CFA)

- P. Crane
- K. Lind (Rice)
- J. Benson
- J. Dickey

Observations to confirm possible 21 cm hydrogen absorption features in quasar/galaxy pairs.

Interferometric observations of 21 cm hydrogen absorption toward extragalactic continuum sources, using the 140-foot and 300-foot telescopes.

The following continuum programs were conducted during this quarter.

Observer(s)

Program

Search at 6 cm for new compact sources.

B. Burke (MIT)C. Bennett (MIT)C. Lawrence (MIT)

J. Broderick (VPI & SU) B. Dennison (VPI & SU) J. Ledden (VPI & SU) S. O'Dell (VPI & SU) J. Condon

T. Balonek (Massachusetts)
W. Dent (Massachusetts)
C. O'Dea (Massachusetts)

G. Rossano (USN) P. Angerhofer (USNO)

R. Braun (British Columbia) P. Gregory (British Columbia) R. Taylor (British Columbia) Observations at 900 and 2400 MHz of low frequency variables.

Polarization and flux density measurements of variable radio sources at 2695 MHz.

Observations at 20 cm to map the CMa Loop.

Survey at 6 cm of the galactic plane for variable radio sources.

At the end of this quarter the installation of the new traveling feed system was begun.

36-foot Telescope	Hours	
Scheduled Observing	736.50	
Scheduled Maintenance and Equipment Changes	1314.50	
Scheduled Tests and Calibration	157.00	
Time Lost Due to: Equipment Failure	19.00	
Weather	47.25	
Power	0.00	
Interference	0.00	

L. Blitz (Calif., Berkeley)

F. Clark (Kentucky)
T. Troland (Calif., Berkeley)

R. Crutcher (Illinois)

W. Dent (Massachusetts) R. Hobbs (NASA-GSFC)

D. Dickinson (JPL) T. Kuiper (JPL)

D. Dickinson (JPL)

P. Ho (Calif., Berkeley) A. Haschick (CFA)

D. Johnson (NBS)
D. Hummer (JILA)
F. Clark (Kentucky)
C. Heiles (Calif., Berkeley)
T. Troland (Calif., Berkeley)

R. Plambeck (Calif., Berkeley)

L. Rickard P. Palmer (Chicago)

N. Scoville (Massachusetts)

J. Good (Massachusetts)

P. Schloerb (Massachusetts)

Very Large Array

The array was scheduled for observations 44.7% (986.5 hours) of the time in the second quarter of 1980. 29.8% (685.25 hours) of the time was devoted to astronomical observing and the remaining 14.9% (328.25 hours) to instrumental development and tests. Approximately 8% of the observing time was lost to instrumental problems. The following research programs were conducted with the VLA during this quarter.

Program

Systematic survey of giant molecular complexes in M31.

Investigation of SiO masers via isotopic transitions.

Molecular observations of dark clouds in front of OB stars.

Evolution of extragalactic radio sources at millimeter wavelengths.

Search for silicon sulfide in the interstellar medium.

Search for shocked molecular sources in the interstellar medium.

Study of the peculiar HII region S128 in CO.

Study of flux and polarization of silicon monoxide maser sources.

Observations of HCO⁺ in the Herbig-Haro region L1551.

Continued study of molecular components to galaxies.

Lunar occultation of IRC+10216.

D. Abbott (Wisconsin) J. Bieging (Calif., Berkeley) E. Churchwell (Wisconsin)

B. Baud (Calif., Berkeley)
A. Sargent (Caltech)

B. Burke (MIT)D. Roberts (MIT)P. Greenfield (MIT)

B. Burke (MIT)D. Roberts (MIT)P. Greenfield (MIT)

B. Burke (MIT)D. Roberts ()MIT)P. Greenfield (MIT)

J. Condon M. Condon (Unaffiliated) C. Hazard (Cambridge, UK)

J. Dreher

G. Dulk (Colorado)

E. Grayzeck (Nevada) P. Angerhofer (Maryland) G. Rossano (USN)

P. Gregory (British Columbia)

S. Gottesman (Florida) J. Hunter (Florida) J. Huntley (IBM)

D. Heeschen J. Heidmann (Meudon Obs.) Q-F. Yin (Peking)

R. Hjellming S. Ewald (NMIMT)

R. Hjellming C. Wade

Program

Mass loss from Wolf-Rayet stars. 6 cm.

Positions of OH/IR sources. 18 cm line.

Search for variations in 0957+561. 6 cm.

Distant, rich, centrally condensed clusters of galaxies: 3C 295, <u>et al</u>. 6 cm.

Double QSO 0957+561. 2 cm.

Survey of two 3° by 3° fields. 20 cm.

3C 390.3. 2 cm.

Solar observations. 6, 17, and 22 cm.

Compact HII regions in Cepheus IV. 6 and 21 cm.

SNR with point central x-ray source. 1.3, 2, 6, and 20 cm.

HI in barred spirals. 21 cm line.

Clumpy irregular galaxies. 2 and 6 cm.

Search for radio emission from x-ray burster. 2, 6, and 20 cm.

Structure of SCO X-1. 6 and 20 cm.

R. Hjellming S. Ewald (NMIMT) G. Ricker (MIT) T. Maccacaro (SAO)

W. JaffeR. White (Virginia)C. Sarazin (Virginia)H. Quintana (DRAO, Canada)

W. Jaffe

P. Kronberg (Toronto) J. Dreher

P. Kronberg (Toronto)
D. Graham (MPIR, Bonn)
R. Wielebinski (MPIR, Bonn)
R. M. Price (New Mexico)

M. R. Kundu (Maryland) P. Bowers

K. Lang (Tufts)
R. Willson (Tufts)
M. Felli (Arcetri, Italy)

K. Mitchell (Penn State)P. Usher (Penn State)J. CondonM. Condon (Unaffiliated)

F. Owen

J. Burns

P. Palmer (Chicago)
K. Johnston (NRL)
T. Wilson (MPIR, Bonn)
J. Forster (NFRA, Dwingeloo)
J. Bieging (Calif., Berkeley)
W. Goss (Groningen)

P. Palmer (Chicago)

E. Partridge (Haverford) B. Corey (MIT) M. Ratner (MIT) I. Shapiro (MIT)

Program

Radio/x-ray sources in the Grus quartet. 2, 6, and 20 cm.

A distant, strong x-ray cD galaxy. 2, 6, and 20 cm.

Survey of high redshift clusters of galaxies. 20 cm.

Structure of 3C 218. 1.3 and 2 cm.

Structure of 3C 445. 6 and 20 cm.

Radio emission from solar type stars. 6 and 21 cm.

Solar active regions. 2 and 21 cm.

Survey of 14 square degrees at the north galactic pole. 20 cm.

Synthesis of NGC 1265. 2 cm.

Formaldehyde in Orion. 6 cm line.

Optically thin NH₂CHO masers in Sagittarius. 20 cm.

Search for background variations of small angular scale. 6 cm.

Observer(s) Program A. Rots Superthin galaxy NGC 784. 21 cm line. J. Goad (KPNO) L. Rudnick (Minnesota) Polarization of variable sources. 1.3, T. Jones (Minnesota) 2, 6, and 20 cm. L. Rudnick (Minnesota) Southern lobe of 3C 33. 2 cm. W. Saslaw (Virginia) P. Crane (ESO) J. Tyson (Bell Labs) M. Simon (SUNY, Stony Brook) Compact infrared source. 2 and 6 cm. J. Fischer (SUNY, Stony Brook) G. Righini-Cohen (SUNY, Stony Brook) M. Felli (Arcetri, Italy) Bright SC galaxies. 20 cm line. R. Sinha V. Rubin (DTM) N. Thonnard (DTM) A. Rots Supernova in M100. 1.3, 2, 6, and 20 cm. R. Sramek K. Weiler (NSF) J. van der Hulst (Minnesota) One-sided extragalactic sources. 6 and G. Swarup (Maryland) V. Kapahi (Tata Institute) 20 cm. R. Sinha Clumps in ammonia clouds. 1.3 cm line. C. Townes (Calif., Berkeley) A. Cheung (Calif., Davis) D. Matsakis (USNO) P. Palmer (Chicago) J. Wardle (Brandeis) Quasars with beams. 2 cm. R. Potash (Brandeis) Low-brightness features in Seyfert A. Wilson (Maryland) galaxies. 6 and 20 cm. J. Ulvestad (Maryland) R. Sramek Fine scale solar structure: measurement H. Zirin (Caltech) during eclipse of August 10. 1.3, 2 and K. Marsh (Caltech) G. Hurford (Caltech) 6 cm. M. Reid (CFA) Relative proper mutation of quasars--1038+528 and others. 6 cm VLB. F. Owen D. Shaffer A. Witzel (MPIR, Bonn)

ELECTRONICS DIVISION

Charlottesville

Development of millimeter wave frequency doublers and triplers is continuing; frequency range and efficiency are continuously being improved. Millimeter mixer work continues in the direction of improved mixers for 115 GHz and 230 GHz.

Four two-stage 4.5-5 GHz FET amplifiers have been completed and shipped to Tucson for replacement of less stable and relible parametric amplifiers. Additional amplifiers have been constructed for the VLA, VLBI, and Green Bank use.

Construction of a second VLBI Mark III terminal and expansion of the VLBI Mark II processor are continuing.

Green Bank

The electronics control package and cabling for the 300-ft traveling feed system is in final testing on the mock-up and will be installed on the telescope early next quarter. The position read-out for this system is complete.

The ruby structure for the Q-band maser is complete. All hardware required to test it is in place. It should be possible to cool it down for initial tests in the next month.

Both 300-500 MHz and 500-700 MHz upconverters have been installed and tested in the 300-1000 MHz cooled-upconverter-GASFET receiver. At least one of the 700-1000 MHz upconverters should be ready by mid-October.

The upconverter-maser receiver was installed on the 140-foot telescope and tested at X-band. A system temperature of 33 K was measured at 10.5 GHz; between 7.2 and 11.2 GHz measured system temperatures were all less than 45 K.

Two Tanberg TD1 1054 tape units have been purchased to replace an antiquated unit at the 300-ft telescope. Presently, interfaces between the DDP 116 and the tape drive, and between the 9825 calculator and the tape drive, are being designed. The latter interface is for off-line testing.

A l6-channel analog multiplexer which interfaces with the 9825 calculator is ready for use. It will be used primarily in measuring telescope surface panels but may be available for general use on a limited basis.

The focal plan measurement receiver was completed and used on the 140-foot telescope in early August. Data reduction from that experiment is incomplete at present.

A K-band maser being constructed for the VLA is 95% complete.

Support was given in the installation and debugging of the Model IV autocorrelator.

A polarimeter calibrator is being constructed. It will be mounted in the 140-foot Cassegrain in the next quarter.

Tucson

The main tasks performed by the electronics groups during the summer shutdown were as follows:

1. A second PDP 11-40 system was installed on the mountain to act as an analysis machine.

2. The 70-120 GHz receiver was overhauled. An LO leveling loop was installed and the parametric amplifiers were replaced by cooled GASFET amplifiers. This has resulted in better stability at the I.F.

3. A 256-channel spectrum expander was installed and tested. This will permit spectral line observations at resolutions of 25 kHz, 12.5 kHz, and 6.25 kHz with 256 channels.

The ³He bolometer system has been tested in the laboratory and gives good results. The laboratory measurements give 4.7 mK $Hz^{-1/2}$ for the 1 mm window, 10.9 mK $Hz^{-1/2}$ for 2 mm, and 16.9 mK $Hz^{-1/2}$ for 3 mm. These figures translate to 1.76 Jy $Hz^{-1/2}$, 2.59 Jy $Hz^{-1/2}$, and 2.2 Jy $Hz^{-1/2}$ at 1, 2, and 3 mm, respectively. The hold times are adequate, although barely so (approximately 20 hours). We will attempt to improve this further.

Work on the 190-290 GHz receiver is progressing well. We expect to have this receiver complete by the end of the year.

COMPUTER DIVISION

Green Bank

A second PANDORA terminal has been installed at Green Bank. The hardware for the RJE card reader upgrade to 300 cards per minute has been installed.

VLA Post-Processing

The MODCOMP Classic computer system was worked on extensively. Memory planes and power supplies were revamped at the factory; a new dual I/O processor and asynchronous controller were installed. Software development continues for post-processing programs.

ENGINEERING DIVISION

Final check out of the new traveling feed for the 300-foot telescope was completed and installation on the telescope was started. Modifications were made to the prototype reflector plate measuring instrument. Engineering assistance was provided in a VLB array preliminary study. Inspection assistance was provided in the painting of sections of the 300-foot. An engineering study of pointing characteristics of the VLA antenna was started. Inspection assistance was provided for the new dome cover for the 36-foot telescope. Routine engineering assistance was provided maintenance and oprations at Charlottesville, Green Bank, Tucson, and the VLA.

VERY LARGE ARRAY

The array was scheduled for observations and tests for approximately 45% of the time during the third quarter. First fringes were obtained on Antenna No. 27 in July and Antenna No. 28 in August. Antenna No. 27 was declared operational in August and Antenna No. 28 in September.

The array was moved to the "C" configuration early in July. At the end of the third quarter the maximum number of antennas used for an astronomical observing program was 25. The maximum usable baseline was approximately 3.4 km.

For the first time, during the month of July, the waveguide communication system was handling all 27 antennas.

AIL is now reliably delivering one paramp per week. The paramp contract with AIL has been renegotiated to reduce the number of paramps to be delivered by 20. These paramps have been replaced by cooled GaAsFet amplifiers. A recent survey of the reliability of front end cooled components gives 193,000 hours MTBF for paramp, 50,000 hours MTBF for upconverters and 77,000 hours MTBF for cooled mixers. These statistics are derived from 950,000 device hours for paramps and 550,000 device hours for upconverters and mixers.

During September the VLA took part in a VLBI network run. The special hardware needed for VLBI observations has been mounted in its own rack and appears to operate satisfactorily.

The design of a new system for the MAPPED control program was begun. It is planned to provide both the user and the system programmer with superior error logging. In addition, the new procedure should allow the clean and self-calibration algorithms to be run in the same way as the standard mapping programs on this system.

The prototype controller from Information Product Systems has been successfully installed on the PDP 11/70 (SORTER). The delivery of the production models should be completed by the end of the quarter and will allow the VLA to operate with a high density tape drive on each of our PDP computers.

Work has progressed on changes in the synchronous system for use with the new pipeline system. Specifically, integration routines were moved from CORA to the array processor and work was begun on the data sort system.

The New Mexico State Highway Department completed the widening of 2.0 miles of highway NM-78 which is the main approach to the VLA site after leaving US-60.

The VAX addition to the library-office building and the third visiting scientists quarters were occupied during the quarter.

Phase V of the wye track construction was 99.5% complete at the end of the quarter. Track work was 100% complete, with only a minor amount of fence work and clean up remaining.

PERSONNEL

Appointments

W. J. Cocke	Visiting Scientist	07/03/80
J.F.C. Wardle	Visiting Scientist	07/07/80
A. H. Bridle	Visiting Scientist	08/05/80
S. T. Gottesman	Visiting Scientist	08/29/80
R. D. Ekers	Senior Scientist/Assistant Director,	0 9 /02/80
W. N. Brouw	Visiting Scientist	09/24/80

Terminations

M. Felli	Visiting Associate Scientist	07/16/80
J. L. Giuliani	Visiting Research Associate	07/18/80
P. E. Palmer	Visiting Scientist	07/21/80
B. Rayhrer	Electronics Engineer I	07/25/80
D. S. De Young	Scientist	07/31/80
W. J. Cocke	Visiting Scientist	08/04/80
R. M. Price	Visiting Scientist	08/04/80
J.F.C. Wardle	Visiting Scientist	08/04/80
J. A. Eilek	Research Associate	08/15/80
J. O. Burns	Research Associate	08/15/80
R. A. White	Research Associate	08/31/80
P. Bowers	Research Associate	08/31/80
L. J Rickard	Associate Scientist	08/31/80
C. L. Sarazin	Visiting Scientist	08/31/80

Change in Status

S.	R.	Spangler	Assistant Sci./Associate Sci.	07/01/80
J.	J.	Condon	Associate Sci./Scientist	07/01/80
R.	A.	Perley	Res. Assoc./System Sci.	07/01/80
J.	A.	Campbell	Elec. Engr. I/Elec. Engr. I &	
		-	Assoc. Div. Hd/VLA Electronics	07/01/80
B.	G.	Clark	Hd. Data Proc. VLA/Sr. Scientist	07/01/80

Changes in Status (continued

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J.	R.	Fisher	Elec. Eng. I/Assistant Director	08/18/80
R.	L.	Brown	Asst. Dir., GB Operations/Scientist	09/01/80
Lea	ave	of Absence		
s.	R.	Spangler	Associate Scientist	07/31/80
Re	turi	n from Leave of Ab	sence	
J.	м.	Torson	Sci. Prog. Anayl.	08/01/80
J.	R.	Fisher	Electronics Engineer I	08/05/80

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NATIONAL RADIO ASTRONOMY OBSERVATORY Charlottesville, Virginia

Quarterly Report

October 1, 1980 - December 31, 1980

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CONTRACTORY

RESEARCH PROGRAMS

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140-foot Telescope	Hours
Scheduled observing	1747.25
Scheduled maintenance and equipment changes	138.25
Scheduled tests and calibration	263.00
Time lost due to: equipment failure	61.25
power	17.75
weather	25.50
interference	4.00

The following line programs were conducted during this quarter.

No.	Observer(s)	Program
G-236	S. Goldstein (Virginia) E. Wadiak (Virginia) D. Crocker (Virginia)	Search for 21-cm hydrogen in or near clusters of galaxies.
M-166	D. Matsakis (USNO) P. Schwartz (NRL)	Observations at 4.5-5.1 and 18.4-26.4 GHz to search for highly redshifted molecular absorption features in the spectra of extra- galactic objects.
C-185	D. Cesarsky (Meudon) E. Falagarone (Meudon) E. Churchwell (Wisconsin)	Observations at 14.488 GHz to measure H ₂ CO line profiles toward reflection nebulae.
C-185	D. Cesarsky (Meudon) E. Churchwell (Wisconsin)	Mapping of 14.488 GHz H2CO in some of the components of the Ceph OB3 molecular cloud complex.
T-145	B. Turner	Search between 13 and 16 GHz for new molecular species.
₩ - 155	F. Briggs (Pittsburgh) A. Wolfe (Pittsburgh)	Attempt at 372.8 MHz to detect highly redshifted HI in absorption in the QSO 0528-250.
B-367	R. Brown	Search for the 327 MHz hyperfine transition of deuterium.

No	Observer(s)	Program
к-263	N. Evans (Texas) M. Kutner (Rensselaer) D. Machnik (Rensselaer)	Observations of 2-cm C76α recombina- tion lines in the vicinity of NGC 1977.
K-261/ K-264	M. Kutner (Rensselaer) D. Machnik (Rensselaer)	Isotopic studies of H ₂ CO at 14.488 GHz and a search at 16 GHz for the deuterium molecule.
L-154	A. Sandqvist (Stockholm Obs.) R. Loren (Texas) H. Wootten (Caltech)	Observations at 14.488 GHz of an $\rm H_2CO$ emission region in the ρ Oph Cloud.
D-124	S. Deguchi (Caltech) D. Muhleman (Caltech)	Search at 12 GHz for vibrationally excited water vapor and the molecules NH3, C10 ¹⁸ 0, and CH ₃ CHO.
D-122	D. Dickinson (JPL) A. Dinger (JPL)	Observations at 22 GHz to search for H ₂ O in the short period, semi-regular variable giants.
W-159	D. Wilkinson (Princeton) J. Uson (Princeton)	Observations at 1.3 cm to search for small-scale anisotropies in the cosmic microwave background.
B-347	R. Brown	Measurements of H and He recombination lines at 1.3 cm in 28 of the brightest galactic HII regions.
H-169	 H. Matthews (Herzberg Inst.) F. Olnon (Leiden) A. Winnberg (MPIR) B. Baud (Berkeley) A. Sargent (OVRO) 	Survey at 22 GHz for H ₂ O sources over a part of the galactic plane.

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

B - Effelsberg, 100-mO - OVF - Fort Davis 85-ftA - ArG - NRAO 140-ftR - SiH - Hat Creek 85-ftS - OnHR - Hartebeesthoek, South Africa 26-mW - WeK - Haystack 120-ftTe

L - Metsahovi, Finland 13.7 m

Observer(s)

No.

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M-171 G. Miley (Leiden Obs.) R. Schilizzi (NFRA, Netherlands) P. Wilkinson (Jodrell Bank)

- 0 OVRO 130-ft
- A Arecibo 1000-ft
- R Simeis, USSR 22-m
- Onsala, Sweden 84-ft
- W Westerbork Synthesis Radio Telescope

Program

Observations at 4990 MHz of the structure of 3C 236, with telescopes of the European VLB network and G.

No	Observer(s)	Program
J-9V	D. Jones (Cornell) Y. Terzian (Cornell) R. Sramek	Observations at 6 cm of the nuclei of normal galaxies with, telescopes F, H, K, O, A, and G.
X-1	L. Baarth (Chalmers) B. Ronnang (Chalmers) D. Graham (MPIR, Bonn) R. Schilizzi (NFRA, Netherlands) S. Pallqueist (U. Helsinki) G. Seielstad (Caltech) B. Geldzahler (MIT) W. Cotton	Observations at 4990 MHz of BL Lac type objects, with telescopes B, L, S, W. HR, K, O, and G.
W-151	 A. Wolfe (Pittsburgh) F. Briggs (Pittsburgh) J. Broderick (VPI & SU) K. Johnston (NRL) J. Condon K. Kellermann 	Observations at 932 MHz of redshifted hydrogen in the BL Lac object AO 0235+164, with telescopes B, A, and G.
R-10V	J. Moran (CFA) M. Reid (CFA)	Observations at 2.8 cm to study the feasibility of detecting proper motion of the Galactic Center, with telescopes K, O, and G.
J-10V	K. Johnston (NRL) J. Spencer (NRL) R. C. Walker R. Brown	Observations at 2.8 cm of 3C 279 and 3C 446, with telescopes B, F, K, O, and G.
M-14V	R. Mutel (Iowa) H. Aller (Michigan) R. Phillips (Brandeis)	Observations at 2.8 cm to measure the coordinated flux and the structure of BL Lac, with telescopes B, F, K, O, and G.
M-12V	J. Marcaide (MIT) I. Shapiro (MIT)	Observations at 2.8 cm of the double quasar 1038+528, with telescopes F, K, O, and G.
R-11V	W. Reich (MPIR, Bonn) R. Porcas (MPIR, Bonn)	Observations at 2.8 cm of the compact radio source 0528+13, with telescopes B, K, O, and G.
P-10V/ P-14V	R. Porcas (MPIR, Bonn)	Observations at 2.8 cm of the sources 0300+47, 1636+47, and 0723+67, with telescopes B, K, O, and G.
C-20V	B. Corey (MIT) I. Shapiro (MIT)	Observations at 2.8 cm to determine absolute motions of features in 3C 345, with telescopes F, K, O, and G.

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No. Observer(s)

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- M-13V B. Ronnang (Chalmers) D. Downes (Institut de Radio Astronomie Millimetrique, France) J. Moran (CFA) R. Genzel (CFA)
 - M. Reid (CFA)
 - A. Haschick (CFA)
 - M. Schneps (CFA)
 - G. Garay (CFA)

300-foot Telescope

Program

Observations at 22 GHz to determine distances by the measure of proper motion in H₂O sources, with telescopes B, R, S, K, O, G, and one of the NRAO VLA antennas.

Hours

The following program was conducted during this quarter.

T-149	J. Taylor (Massachusetts)	Observations within the frequency
	P. Backus (Massachusetts)	range 300-610 MHz of the binary
	M. Damashek	pulsars PSR 0655+64 and PSR 0820+02.

Scheduled	observing	1056.50
Scheduled	maintenance and equipment changes	953.00
Scheduled	tests and calibration	142.50
Time lost	due to: equipment failure	31.00
	power	11.25
	weather	1.00
	interference	4.00

During this quarter the 300-foot telescope was down for a significant amount of time for the installation of the new low-frequency traveling feed system.

No.	Observer(s)	Program
B-339	J. Broderick (VPI & SU) B. Dennison (VPI & SU) J. Ledden (VPI & SU) S. O'Dell (VPI & SU) J. Condon	Observations at 900 and 1400 MHz of low frequency variables.
H -1 52	Q. Yin (Beijing U., People's Republic of China) D. Heeschen	Observations at 3.3 GHz to investigate the variability of a statistically complete sample of sources.
B-335	T. Balonek (Massachusetts) W. Dent (Massachusetts) C. O'Dea (Massachusetts)	Polarization and flux density measure- ments of variable radio sources at 2695 MHz.
G -2 41	J. Burns (New Mexico) G. Gisler	Observations at 6 cm of approximately 300 elliptical and SO galaxies selected from the Uppsala Catalog.

No.	Observer(s)	Program
M-172	T. Menon (British Columbia)	Observations at 6 cm of sources selected from the 327 MHz Ooty, India telescope survey.
К-227	G. Kojoian (Wisconsin) D. Dickinson (JPL)	Survey at 6 cm of approximately 600 galaxies having high surface bright- ness.
P-117	C. Purton (York U.) S. Blackwell (York U.)	Search at 6 cm for emission from stellar planetary nebulae.

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Scheduled	observing	1914.75
Scheduled	maintenance and equipment changes	133.00
Scheduled	tests and calibration	11.25
Time lost	due to: equipment failure	29.00
	weather	104.50
	interference	0.00

Hours

No.	Observer(s)	Program
B-353	T. Bania (Cornell)	CO probe of dynamics of galactic center.
B-354	L. Blitz (Calif., Berkeley)	Systematic survey of giant molecular complexes in M31.
B-368	L. Blitz (Calif., Berkeley) H. Spinrad (Calif., Berkeley)	Observations of molecular lines in Comet Encke.
C-190	E. Churchwell (Wisconsin) J. Bieging (Calif., Berkeley)	Study of distribution of CN emission in molecular clouds.
C-191	E. Churchwell (Wisconsin) J. Bieging (Calif., Berkeley)	Study of relationship of CN to other molecules in dark clouds.
D-121	D. Dickinson (JPL)	Search for shocked molecular sources in the interstellar medium.
E-38	N. Evans (Texas) L. Mundy (Texas) P. Vanden Bout (Texas) P. Goldsmith (Massachusetts) R. Snell (Massachusetts)	2 mm observations of H2CO and CS in three molecular clouds.
H-162	P. Huggins (New York U.)	Observations of the kinematics of the envelope of IRC+10216.

No.	Observer(s)	Program
H-161	J. Hollis (NASA-GSFC) L. Snyder (Illinois) F. Lovas (NBS) R. Suenram (NBS)	Search for confirmer 1 of glycine.
к-257	M. Kutner (Rensselaer) D. Machnik (Rensselaer) N. Evans (Texas)	2 mm observations to further study formaldehyde isotope abundances.
K-258	M. Kutner (Rensselaer) D. Machnik (Rensselaer) N. Evans (Texas)	Study of methane at 2 mm wavelength.
K-259	M. Kutner (Rensselaer) D. Machnik (Rensselaer)	Further study of the dense molecular clouds.
к-260	M. Kutner (Rensselaer) K. Mead (Rensselaer)	Search for giant molecular clouds outside the solar circle.
L-151	D. Lein (Illinois) R. Crutcher (Illinois)	Study of radio CO for comparison to UV CO.
L-153	C. Leung (Rensselaer) M. Kutner (Rensselaer)	Study of CO to probe turbulence in dark clouds.
0-28	F. Owen J. Puschell	Continuum observations of x-ray quasars.
P-115	J. Puschell F. Owen J. Condon T. Jones (Minnesota) L. Rudnick (Minnesota) W. Stein (Minnesota)	Observation of optically selected quasars.
P-114	J. Puschell D. Heeschen R. Goodrich (Caltech)	Observations of compact sources in E and SO galaxies.
S-228	N. Scoville (Massachusetts) P. Schloerb (Massachusetts) J. Good (Massachusetts)	Lunar occultation of IRC+10216.
S-226	P. Schwartz (NRL)	CO observations of IR sources in the Cygnus region.
S-229	P. Schwartz (NRL) A. Cheung (Calif., Davis) R. Evans (Calif., Davis)	Search for C VI hyperfine lines in intercluster gas.
T-138	P. Thaddeus (Inst. for Space Studies)	Confirmation of CCH ⁺ detection at 2 mm wavelength.

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No.	Observer(s)	Program
T-144	B. Turner	Confirmation of CCD in the inter- stellar medium.
T-146	B. Turner	Search for HCNH+.
T-147	B. Turner E. Kuiper (JPL) P. Palmer (Chicago) B. Zuckerman (Maryland)	Study of deuterated NH3 lines.
T-148	B. Turner E. Cohen (JPL)	Confirmation of two new molecules.
W-158	B. Wilking (Arizona) C. Lada (Arizona)	Study of molecular hydrogen in Rho Ophiuchus.
Z-39	B. Zuckerman (Maryland)	Search for H ₂ S and H ₂ CO in transition objects.

The Very Large Array

The array was scheduled for observations 52.9% (4644.5 hours) of the time in the fourth quarter of 1980. The time devoted to astronomical observing was 37.6% (3305.75 hours), and the remaining 15.3% (1338.75 hours) to instrumental development and tests. Approximately 11.2% of the observing time was lost to instrumental problems. The following research programs were conducted with the VLA during this quarter.

<u>No.</u>	Observer(s)	Program
AA-8	D. Abbott (Wisconsin) E. Churchwell (Wisconsin) J. Bieging (Calif., Berkeley)	Mass-loss rates from OB stars. 6 cm.
AB-103/ 104	D. Backer (Calif., Berkeley)	Small sources in Sgr A. 2, 6, and 20 cm.
AB-90	J. Bieging (Calif., Berkeley) R. Martin (MPIR, Bonn) T. Pauls (MPIR, Bonn) T. Wilson (MPIR, Bonn)	Ammonia in the Orion molecular cloud. 1.3 cm line.
AB-100	A. Bridle (New Mexico/NRAO) E. Fomalont J. Palimaka (Queen's U.) R. Hendriksen (Stanford)	Spectrum and polarization of jet in NGC 315. 20 cm.
AB-102/ AS-68	P. Bowers (NRL) K. Johnston (NRL) J. Spencer (NRL)	OH and H ₂ O maser emissions associated with late-type stars. 1.3 and 18 cm line.

Observer(s) No. Program AB-89 B. Burke (MIT) Search for variations in the double D. Roberts (MIT) guasar 0957+561. 6 cm. P. Greenfield (MIT) AB-97 B. Burke (MIT) Double quasar 0957+561. 6 and 18 cm. D. Roberts (MIT) P. Greenfield (MIT) AC-24 J. Condon Active nuclei of spiral galaxies. M. Condon (Virginia) 6 cm. G. Gisler J. Puschell AF-23 B. Feigelson (CFA) Einstein Serendipitous x-ray sources. R. Giacconi (CFA) 6 cm. E. Maccacaro (CFA) G. Zamorani (CFA) AF-25 J. Forster (NFRA, Netherlands) OH masers in NGC 7538 IRS1. 18 cm J. Dickel (Illinois) line. A. Rots W. Goss (Groningen) AG-47 P. Ghigo (Minnesota) 0837-12, a QSO in a distant cluster. L. Rudnick (Minnesota) 6 and 20 cm. K. Johnston (NRL) S. Wyckoff (Arizona State) M-dwarf flare stars. 6 and 20 cm. AG-54 D. Gibson (NMIMT) P. Fisher (NMIMT) AH-43 Mapping 4C QSO's; search for distorted P. Hintzen (NASA-GSFC) J. Scott (Arizona) objects. 20 cm. F. Owen Nova Vulpeculae 1976. 2, 6, and AH-13 R. Hjellming N. Vandenberg (NASA-GSFC) 21 cm. AH-41 P. Ho (Calif., Berkeley) Position of OH masers near compact M. Wright (Calif., Berkeley) HII regions. 18 cm line. A. Haschick (CFA) W. Jaffe AJ-54 Cluster radio sources at 3-5 Gyr H. Butcher (KPNO) look-back times. 20 cm. W. van Bruegel (KPNO) AJ-53 K. Johnston (NRL) Measurement of the positions of the W. B. Waltman (NRL) GPS satellites. 18 cm. A. R. Thompson

No.	Observer(s)	Program
AJ-57	K. Johnston (NRL) E. Fomalont R. Perley R. Sramek C. Wade	Accurate position measurements of calibrators. 6 cm.
AJ-60	K. Johnston (NRL) R. Hjellming	SS433. 1.3, 2, 6 and 21 cm.
АК-23	M. Kundu (Maryland) T. Velusamy (Maryland) F. Erskine (Maryland)	Solar observations during SMM. 1.3, 2, 6, and 20 cm.
AK-41	M. Kundu (Maryland) T. Velusamy (Maryland) E. Schmahl (Maryland) M. Bobrowsky (Maryland)	Solar active regions and flares. 1.3, 2, 6 and 20 cm.
АК-42	M. Kundu (Maryland) J. Schmahl (Maryland) T. Velusamy (Maryland)	Solar magnetic field measurements from simultaneous radio and x-ray observa-tions. 1.3, 2, 6, and 20 cm.
AL-18	R. Lamb (Iowa State U.) J. Basart	Attempt to detect radio emission from x-ray sources. 6 cm.
AL-20	R. Laing	Weak radio galaxies with jets: 3C 272.1 and 3C 296. 6 and 20 cm.
AL-21	R. Laing	3C 20, a luminous source with multiple hot spots. 2 and 20 cm.
AL-16	J. Linsky (Colorado) D. Gary (Colorado)	Late-type stars with large magnetic fields. 1.3, 2, and 6 cm.
AN-7	R. Newell (NMIMT) R. Hjellming A. Underhill (NASA-GSFC)	Early-type supergiants with circum- stellar plasma. 6 cm.
AN-8	R. Newell (NMIMT) J. Burns (New Mexico)	High mass loss stars. 1.3 and 2 cm.
A0-16	F. Owen J. Burns	Multifrequency observations of NGC 1265. 20 cm.
AP-29	E. B. Partridge (Haverford) B. Corey (MIT) M. Ratner (MIT) I. Shapiro (MIT)	Search for background fluctuations. 6 cm.

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No.	Observer(s)	Program
AP-33	R. Perley A. Willis (Westerbork)	Polarization of jet galaxy NGC 6251. 18 and 21 cm.
AR-39	G. Rossano (USN) R. Russell (Cornell)	Infrared object AFGL 2636. 6 and 20 cm.
AR-36	L. Rudnick (Minnesota) W. Saslaw (Virginia) P. Crane (ESO, Switzerland) J. Tyson (Minnesota)	Southern lobe of 3C 33. 20 cm.
AR-41	L. Rudnick (Minnesota) T. Jones (Minnesota) R. Fiedler (Minnesota) W. Golisch (Minnesota)	Spectra and polarization of compact components of extended sources. 1.3, 2, 6, and 21 cm.
AR-42	L. Rudnick (Minnesota) T. Jones (Minnesota) R. Fiedler (Minnesota) W. Golisch (Minnesota)	Spectra and polarization of strong flat spectrum sources. 2, 6, 18, and 20 cm.
AS-59	E. Schreier (CFA) E. Feigelson (CFA) J. Burns (New Mexico)	Centaurus A. 2, 6, and 20 cm.
AS-63	R. Sramek K. Weiler J. van der Hulst (Minnesota)	Supernova in M100. 1.3, 2, 6, and 21 cm.
AV-40	J. van der Hulst (Minnesota) A. Haschick (CFA) W. Golisch (Minnesota)	21 cm absorption in radio galaxy NGC 5128. 21 cm line.
AW-34	A. Wilson (Maryland)	Compact source near supernova remnant G74.9+1.2. 6 and 21 cm.
AW-36	 A. Winnberg (MPIR, Bonn) W. Goss (Groningen, Netherlands) H. Habing (Huygens Lab, Netherlands) 	Peculiar late-type supergiant VY CMa. 21 cm.
AW-39	J. Wrobel (Toronto) D. Heeschen	Structure and spectra of active E/SO galaxies. 1.3, 2, 6, and 20 cm.
AZ-10	H. Zirin (Caltech) K. Marsh (Caltech) G. Hurford (Caltech)	Fine structure in solar flares. 2 cm.

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No. Observer(s)

- M-13V J. Moran (CFA)
 - D. Downes (MPIR)
 - R. Genzel (MPIR)
 - A. Haschick (MIT)
 - M. Reid (CFA)
 - B. Ronnang (Chalmers)
 - M. Schneps (CFA)

ELECTRONICS DIVISION

Charlottesville

Development of millimeter wave frequency doublers and triplers is continuing; frequency range and efficiency are continuously being improved. Millimeter mixer work continues in the direction of improved mixers for 115 GHz and 230 GHz. A quasi-optical local oscillator injection system for testing of these mixers is under construction.

Work has commenced on superconductor-insulator-superconductor (sis) junctions for use as millimeter wave mixers. The junctions are being fabricated by NRAO, using the facilities at the National Bureau of Standards in Boulder, Colorado for a six-weeks period.

A wide-band, 1.3-1.8 GHz, 3-stage FET amplifier has been designed. Two units have been fabricated and shipped to Green Bank for use as paramp replacements. Improvements are being made in the design.

Construction of a second VLBI Mark III terminal and expansion of the VLBI Mark II processor are continuing.

Green Bank

The two lower bands of the 300-1000 MHz receiver were tested on the telescope with very satisfactory results. System temperatures of 50 K and 60 K in the 300-410 MHz and 500-700 MHz bands, respectively, were measured. The upconverters for the 700-1000 MHz band looked good in preliminary tests and should be installed in the next quarter. Construction was started on a 150 MHz IF polarimeter for use with this receiver.

The 300-foot traveling feed was installed early in the quarter. All associated electronics were tested and found operational.

The polarimeter-calibrator is complete. Weather permitting, it will be installed and tested on the 140-foot in January.

The L and C band receiver for Fort Davis is complete. Documentation is almost complete. Receiver temperatures of 16 K and 24 K at 1.4 GHz and 5.0 GHz, respectively, were measured. It will be installed in January.

Program

Proper motion of H₂O maser sources. 1.3 VLB. The paramps in the 6/25 cm receiver were replaced with NRAO dual-stage cooled GASFET's. Improved receiver stability has already been noted by observers.

A K-band maser developed for the VLA is complete and will be sent to the VLA early in the next quarter.

Tests of the Q-band maser look promising. It was possible to obtain gain from one stage. However, 4-stage operation was hampered by low pump power. The pump was returned to Varian for refurbishing. A number of refinements were made on the magnetic structure.

The interface between the new TPI 1054 tape units and the DDP-116 computer was designed and is being constructed. A similar interface to the 9825 calculator is built and awaiting test.

Design work is continuing on the 256-channel, 2 MHz, filter banks and on a 15 GHz cryogenic circulator. Construction of a Mark III VLB system for the VLA is in progress.

Two of the digital standard receiver programs, Beam Switching-Manual Balance and Load Switching-Automatic Balance, were revised to make them easier to operate.

A preliminary investigation on the possibility of using the Hewlett Packard 9825A calculator and associated equipment for automatic receiver testing and calibration was done.

Routine engineering assistance and maintenance was provided at the telescope and lab.

Tucson

During this quarter the He³ bolometer system has been tested on the telescope. The sensitivity of the system was far less than was expected, and we plan further laboratory and telescope tests to resolve this problem.

A data collection system for monitoring wind and telescope parameters at the 36-foot telescope has been fabricated. The data collected from this system will aid in the design of the 25-m astrodome.

The 190-290 GHz is nearing completion. The receiver will initially be single channel and is very similar to our 130-170 GHz receiver.

A new calibration system using a cooled chopper wheel is near completion, and we expect to test this on the telescope in the next quarter.

COMPUTER DIVISION

VLA Post-Processing

The Digital Equipment Corporation VAX 11/780 was shipped to the VLA site and installed there. A dedicated telephone line between Charlottesville and the site permits users at Charlottesville to communicate with the VAX. A replacement VAX to be shared by VLBI/VLA users is scheduled to be delivered to Charlottesville in February 1981. Rearrangement of the post-processing rooms to accommodate the new VAX and its peripherals is now underway.

VLBI Post-Processing

A Sperry-Univac V77-400 mini-computer is being tested as a replacement for the Varian 620-I on-line computer for the VLBI processor. The Varian code runs on the V77 with only minor modifications. Advantage of replacing the 620-I with a V77 are greater speed and more memory, plus more modern technology.

ENGINEERING DIVISION

Installation of the new traveling feed on the 300-foot was completed. Final design was started on the inductosyns for the 85-foot telescopes. The feasibility study for the proposed addition to the interferometer baseline was revised. The engineering study of the pointing characteristics of the VLA antenna continued. Research and study continued on the prototype reflector plate measuring instrument. Design and fabrication of feed support systems for the 140-foot Cassegrain feeds were improved. Routine engineering assistance was provided maintenance and operations at Charlottesville, Green Bank, Tucson, and the VLA.

VERY LARGE ARRAY PROGRAM

The array was scheduled for observations and tests 47% of the time during the fourth quarter. The array was changed to the A configuration during the middle of October. The maximum number of antennas used for astronomical observations was 25. The longest usable baseline is approximately 25 km.

To improve system availability, off-hour coverage with technicians on duty during observing periods to maintain the array was started with the first observing period of November.

The VAX 11/790 computer, which has been in Charlottesville for development of the post-processing system, was shipped to the VLA and has been successfully installed. Its memory capacity has been doubled and three Century 300 Mbyte drives have been added.

Phase V of the wye track construction was essentially complete at the end of the fourth quarter. Waveguide installation was completed on the east arm and tests are in progress. On October 10, 1980 the VLA was formally dedicated at a ceremony attended by 600 guests and staff members. Dr. Frank Press, Science Adviser to the President, was the principal speaker.

On October 24, 1980 the VLA hosted some 200 college and high school students at an open house. On October 25, 1980 the VLA was open to the general public. Approximately 2000 persons attended.

PERSONNEL

Appointments

Kevin Prendergast	Visiting Sc	cientist 1	10/13/80
Timothy J. Cornwell	Research As	ssociate 1	10/22/80
Thomas J. Vestrand	Research As	ssociate 1	L2/08/80

Terminations

Robert F. Fromm	Systems Analyst	10/31/80
Kevin Prendergast	Visiting Scientist	10/24/80
Ramesh P. Sinha	Systems Scientist	10/17/80
William E. Dumke	Electronics Engineer I	12/31/80

FEBRUARY - 1980

List No. 24

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- Benson, J.M. and Mutel, R.L. Multibaseline VLBI Observations of the 1612 MHz OH Masers Toward NML Cygni and VY Canis Majoris.
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- Bowers, P.F.; Kerr, F.J.; Knapp, G.R.; Gallagher, J.S.; and Hunter, D.A.
 Upper Limits on the Gas Content of Southern Globular Clusters.
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- 1038 Burns, J.O. and Owen, F.N. Radio Sources in Zwicky Clusters of Galaxies. II. Detailed Interferometer Observations and Analysis. 1979. ASTRON. J., <u>84</u>, 1478-1499.
- :052 Burns, J.O.; Owen, F.N.; and Rudnick, L. The Wide-Angle Tailed Radio Galaxy 1159+583: Observations and Models. 1979. ASTRON. J., <u>84</u>, 1683-1693.
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- 1029 DeNoyer, L.K. Discovery of Shocked CO Within a Supernova Remnant. 1979. ASTROPHYS. J., <u>232</u>, L165-L168.
- 1053 Dickel, J.R. and Spangler, S.R. Measurements of the Radio Flux Density of Tycho's SNR Separated by a 15-year Interval. 1979. ASTRON. ASTROPHYS., <u>79</u>, 243-244.
- 1045 Dickey, J.M. Observations of the Structure of Galactic H I Absorption on Small Angular Scales. 1979. ASTROPHYS. J., 233, 558-567.
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- Hjellming, R.M.; Wade, C.M.; Vandenberg, N.R.; and Newell, R.T. Radio Emission from Nova Shells.
 ASTRON. J., <u>84</u>, 1619-1631.
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 1979. ASTROPHYS. J., <u>233</u>, 453-462.
- . 1046 Johnson, H.M.; Balick, B.; and Thompson, A.R. VLA Observations of Stellar Planetary Nebulae. 1979. ASTROPHYS. J., <u>233</u>, 919-924.
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 Outflow from the Infrared Star CIT 6.
 1979. ASTROPHYS. J., 233, 140-144.
- 1028 Kutner, M.L.; Dickman, R.L.; Tucker, K.D.; and Machnik, D.E. Ring Structure in the Monoceros Rl Molecular Clouds. 1979. ASTROPHYS. J., <u>232</u>, 724-728.

- A 1049 Liszt, H.S. Radiofrequency Molecular Emission Spectra Observed Toward ζ Ophiuchi. 1979. ASTROPHYS. J., 233, L147-L150.
- B 500 Liszt, H.S. and Burton, W.B. Molecules in the Inner Few Kpc of the Galaxy. 1979. IAU SYMP., <u>84</u>, 343-350.
- A 1035 Lockman, F.J. The Distribution of Dense H II Regions in the Inner Galaxy. 1979. ASTROPHYS. J., <u>232</u>, 761-781.
- A 1043 Marscher, A.P.; Marshall, F.E.; Mushotzky, R.F.; Dent, W.A.; Balonek, T.J.; and Hartman, M.F. Search for X-ray Emission from Bursting Radio Sources. 1979. ASTROPHYS. J., <u>233</u>, 498-503.
- A 1026 Mufson, S.L. and Liszt, H.S. The H II Region-Molecular Cloud Complex W51. 1979. ASTROPHYS. J., <u>232</u>, 451-466.
- A 1048 Myers, P.C.; Ho, P.T.P.; and Benson, P.J. Observations of HC₅N and NH₃ in Taurus. 1979. ASTROPHYS. J., <u>233</u>, L141-L145.
- A 1025 Peterson, B.A.; Wright, A.E.; Jauncey, D.L.; and Condon, J.J. Redshifts of Southern Radio Sources. V. 1979. ASTROPHYS. J., <u>232</u>, 400-403.
- A 1023 Peterson, S.D. Double Galaxies. II. Data Analysis and a Galaxian Mass (M/L) Determination. 1979. ASTROPHYS. J., 232, 20-33.
- B 501 Rickard, L.J Molecular Structures of Other Galaxies Compared to that of the Galaxy.
 1979. IAU SYMP., <u>84</u>, 413-416.
- A 1031 Roberts, D.H.; Greenfield, P.E.; and Burke, B.F. The Double Quasar 0957+561 A Radio Study at 6-Centimeters Wavelength. 1979. SCIENCE, <u>205</u>, 894-896.
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- B 498 Solomon, P.M.; Sanders, D.B.; and Scoville, N.Z. Giant Molecular Clouds in the Galaxy: Distribution, Mass, Size and Age. 1979. IAU SYMP., <u>84</u>, 35-52.
- A 1030 Solomon, P.M.; Scoville, N.Z.; and Sanders, D.B. Giant Molecular Clouds in the Galaxy: The Distribution of ¹³CO Emission in the Galactic Plane. 1979. ASTROPHYS. J., <u>232</u>, L89-L93.
- A 1037 Spangler, S.R. The Collimation of Double Radio Sources. 1979. ASTRON. J., <u>84</u>, 1470-1477.
- A 1024 Troland, T.H.; Heiles, C.; Johnson, D.R.; and Clark, F.O. Polarization Properties of the 86.2 GHz v = 1, $J = 2 \rightarrow 1$ SiO Maser. 1979. ASTROPHYS. J., 232, 143-157.
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MAY - 1980

List No. 25

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NATIONAL RADIO ASTRONOMY OBSERVATORY Charlottesville, Virginia

Quarterly Report

FAGPERTY OF THE U.S. GOVERNMENT FADIO ASTRONOMY OBSERVATORY CHARLOTTESVIUE, VA.

January 1, 1981 - March 31, 1981

APR 20 1981

Program

RESEARCH PROGRAMS

No.

Observer(s)

140-foot Telescope	Hours
Scheduled observing	1932.75
Scheduled maintenance and equipment changes	211.25
Scheduled tests and calibration	0.00
Time lost due to: equipment failure	43.00
power	0.00
weather	49.25
interference	4.00

The following line programs were conducted during this quarter.

I-1	P. Friberg (Chalmers) A. Hjalmarson (Chalmers) W. Irvine (Chalmers) M. Guelin (Observatoire de Paris)	Search at 19.0 GHz for the N=2 \rightarrow 1 transition of C ₄ H, and at 19.8 GHz for the N=2 \rightarrow 1 transition of C ₃ N in dark clouds.
M-168	P. Myers (MIT) P. Benson (MIT) D. Murphy (MIT)	Observations of the $(J,K)=(1,1)$ and $(2,2)$ rotation inversion lines of NH ₃ at 23.69 and 23.72 GHz, and the J=9+8 transition of HC ₅ N at 23.96 GHz.
B-367	R. Brown	Search for the 327 MHz hyperfine transition of deuterium.
B-311	P. Bowers (NRL)	Studies of 18-cm OH emission from unidentified Type II OH/IR stars.
W-154	R. Willson (Tufts)	Search for the 17-cm hyperfine tran- sition of neutral sodium in dense clouds.
J-90	P. Jackson (Maryland) E. Dahlstrom (Maryland) I. Mirabel (Puerto Rico)	Observations of galactic hydrogen in front of normal galaxies having well determined colors (B-V).
R-174	L. Rickard (Howard)	Search at 1406.2 MHz for $C^+265\alpha$ emission.

VOICUR SK.

- D-117 J. Benson J. Dickey
- T-143 T. Thuan (Virginia) D. Crocker (Virginia)
- L-150 B. Ganzel (Minnesota) J. Lockman
- F-79 K. Fox (Tennessee) D. Jennings (NASA, Goddard)
- M-169 A. Winnberg (MPIR) F. Olnon (Leiden) H. Matthews (NRC, Canada) B. Baud (Calif., Berkeley) A. Sargent (Caltech)
- S-233 L. Buxton (Illinois) E. Campbell (Illinois) W. Flygare (Illinois) P. Jewell (Illinois) L. Snyder (Illinois)
- B-347 R. Brown
- S-237 F. Schloerb (Massachusetts)
 R. Snell (Massachusetts)
 J. Young (Massachusetts)
 W. Langer (Princeton)
- B-351 B. Balick (Washington) E. Wollman (Bates College)

- Interferometric observations between the 300-ft and 140-ft of 21-cm hydrogen absorption toward extragalactic continuum sources.
- Measurements of the 21-cm hydrogen content of blue compact dwarf galaxies.
- Mapping of 21-cm hydrogen in the Mon OB1 and OB2 associations.
- Observations to confirm the detection of interstellar CH_4 by the measurement of transitions near 19 GHz.
- Survey at 22 GHz for H_2O sources over a part of the galactic plane.
- Observations at 20.9 and 24.4 GHz to search for the HCN dimer $(HCN)_2$.
- Observations at 1.3-cm to measure H and He recombination lines in 28 of the brightest Galactic HII regions.
- Search at 22.88 GHz for the $J=9\rightarrow 8$ transition of DC_5N in the TMC 1 interstellar cloud.
- Observations at 22 GHz of the $\rm H66\alpha$ recombination line.
- The following continuum program was conducted during this quarter.

No.	Observer(s)	Program
W-159	D. Wilkinson (Princeton) J. Uson (Princeton)	Search at 1.3-cm for small scale anisotropies in the cosmic microwave background.

The following pulsar program was conducted during this quarter.

<u>No.</u>	Observer(s)	Prog
т-149	P. Backus (Massachusetts) R. Burkhardt (Massachusetts) J. Taylor (Massachusetts)	Observations at 3 pulse arrival tin and PSR 0820+02.

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

- A Arecibo 1000-ft B - Effelsburg 100-m C - Algonquin 150-ft Ds - Madrid 210-ft Dm - Goldstone 210-ft E - South Africa 26-m F - Fort Davis 85-ft G - Green Bank 140-ft H - Hat Creek 85-ft I - Iowa 60-ft

No.

Observer(s)

- S-14V P. Wilkinson (Manchester) C. Bennett (MIT) B. Burke (MIT) R. Mutel (Iowa) A. Moffet (Caltech) A. Readhead (Caltech) R. Simon (Caltech)
- B-372 C. Bennett (MIT) B. Burke (MIT) A. Garcia (MIT) C. Lawrence (MIT)
- M-16V J. Broderick (VPI & SU) A. Marscher (Calif., San Diego)
- C-22V M. Cohen (Caltech) R. Linfield (Caltech) T. Pearson (Caltech) A. Readhead (Caltech)

- J25 Jodrell Bank 25-m J76 - Jodrell Bank 76-m Km - Haystack 120-ft Ν - Maryland Point 85-ft - Owens Valley 130-ft 0 - Crimea 22-m R So - Onsala 26-m Wd - Dwingeloo 25-m - Socorro 25-m Y

Program

Observations at 329 MHz of 5 quasars, a part of a mapping program of radio sources over a wide range of frequencies with telescopes F, H, I, J76, K, O, and G.

Observations at 610 MHz of the quasar 0957+561 with telescopes Km, O, and G.

Observations at 2.8-cm of selected X-ray quasars with telescopes B, F, Km, O, and G.

Observations at 2.8-cm of superluminal radio sources with telescopes F, H, Km, 0, and G.

ram

- 390 MHz to determine mes of PSR 0655+64 and PSR 0820+02.
- M. Damashek

No.	Observer(s)	Program
	G. Seielstad (Caltech) R. Simon (Caltech) S. Unwin (Caltech)	C-22V, continued
K-9V	I. Pauliny-Toth (MPIR) E. Preuss (MPIR) J. Romney (MPIR) K. Kellermann	Observations at 2.8-cm of the nucleus of NGC 1275 with telescopes B, F, Km, O, and G.
W-10V	G. Seielstad (Caltech) S. Unwin (Caltech) J. Benson R. Walker	Observations at 2.8-cm of superluminal motions in 3Cl20 with telescopes B, C, F, Km, O, Y, and G.
F-4V	M. Claussen (Iowa) J. Fix (Iowa) R. Mutel (Iowa) J. Benson	Mapping of 1665 and 1667 MHz OH emission from stellar sources with telescopes F, I, O, Y, and G.
M-12V	J. Marcaide (MIT) I. Shapiro (MIT)	Observations at 18-cm of the double quasar 1038+528 with telescopes B, F, Km, O, So, and G.
H-1V	M. Gorenstein (MIT) R. Hohlfeld (MIT)	Observations at 18-cm of SS443 with telescopes F, Km, O, and G.
J -1 1V	 B. Geldzahler (MIT) K. Johnston (NRL) J. Spencer (NRL) D. Kjer (Pennsylvania) E. Fomalont J. Puschell 	Measurements at 18-cm of the polarized radio emission from 0735+178 and 3C286 with telescopes B, F, H, Km, N, O, Y, and G.
C-18V	L. Baath (Chalmers) N. Cohen (Cornell) B. Geldzahler (MIT) M. Gorenstein (MIT) J. Marcaide (MIT) J. Burns (New Mexico)	Small scale structure measurements at 18-cm of NGC 1265, IC310, and 1159+583 with telescopes B, Km, O, So, and G.
C-23V	L. Baath (Chalmers) J. Romney (MPIR) B. Geldzahler (MIT) K. Johnston (NRL) W. Cotton F. Owen	Observations at 18-cm of the "optically quiet QSO" 2147+147 with telescopes B, Wd, J25, So, F, Km, N, O, Y, and G.

No.	Observer(s)	Program
M-17V	L. Baath (Chalmers) B. Ronnang (Chalmers) G. Nicholson (CSIR, Johannesburg) E. Preuss (MPIR)	Observations at 18-cm of 3C84 and 3C345 with telescopes B, E, J25, R, So, F, O, and G.

- L. Kogan (Inst. for Space Res., USSR)
- V. Kostenko (Inst. for Space Res., USSR)
- L. Matveyenko (Inst. for Space Res., USSR)
- P-122 I. Pauliny-Toth (MPIR) R. Porcas (MPIR)
- F-81 R. Booth (Manchester) J. Forster (NFRA W. Goss (Leiden) R. Graham (MPIR)
- S-238 R. Mutel (Iowa) S. Spangler (Iowa)
- K-256 S. Kent (Iowa) R. Mutel (Iowa)
- W-140 F. Briggs (Pittsburgh) A. Wolfe (Pittsburgh)
- G-251 R. Porcas (MPIR) N. Cohen (Cornell) B. Corey (CFA) R. Preston (JPL) E. Falco (MIT) M. Gorenstein (MIT) J. Marcaide (MIT) I. Shapiro (MIT) B-374 D. Graham (MPIR)

J. Romney (MPIR) R. Preston (JPL) N. Bartel (MIT) C. Counselman (MIT) J. Marcaide (MIT)

Mapping at 18-cm of 3C216 with telescopes B, J76, So, Wd, and G.

Observations at 18-cm of the spatial structure of the OH maser in NGC 7538 with telescopes B, J76, So, Wd, and G.

Observations at 18-cm of the angular broadening of extragalactic radio sources at low galactic latitudes with telescopes I and G.

Measurements at 18-cm to determine the relative positions of OH masers with telescopes I and G.

Observations at 430 MHz of quasars that are candidates for redshifted 21-cm hydrogen absorption with telescopes A and G.

Studies of the double quasar 0957+561 and a search for variability and superluminal effects in the quasar pair 1038+528A, B at 2.3 and 8.1 GHz with telescopes B, Ds, Dm, So, O, and G.

Observations at 2.3 and 8.1 GHz to accurately measure the positions of pulsars.at several epochs with telescopes B, Dm, and G.
No.	Observer(s)	Program
	I. Shapiro (MIT) C. Knight (Phoenix Corp.) N. Vandenberg (Phoenix Corp.)	B374 continued
M-13V	 B. Ronnang (Chalmers) D. Downes (IRAM, France) G. Garay (CFA) R. Genzel (CFA) A. Haschick (CFA) J. Moran (CFA) M. Reid (CFA) M. Schneps (CFA) 	Observations at 22 GHz to determine distances by the measure of proper motions in H ₂ O maser sources with telescopes B, So, R, Km, O, Y, and G.

Scheduled observing2005.50Scheduled maintenance and equipment changes123.00Scheduled test and calibration15.50Time lost due to: equipment failure48.50power0.00weather3.75interference0.00

Hours

300-foot Telescope

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The following line programs were conducted during this quarter.

<u>No.</u>	Observer(s)	Program
в-348	K. Mitchell (Penn State) R. Brown	Search between 1000 and 1420 MHz for redshifted 21-cm absorption toward bright quasars.
L-150	B. Ganzel (Rice) J. Lockman	High angular resolution measurements of neutral hydrogen in areas of special interest in the Mon OB1 and OB2 associations.
H-160	W. Huchtmeier (MPIR) O. Richter (MPIR)	Studies of the global parameters of galaxies and clusters of galaxies from neutral hydrogen observations.
H-153	B. Burke (MIT) A. Haschick (CFA) P. Crane	Observations to confirm possible 21-cm hydrogen absorption features in quasar/ galaxy pairs.

No.	Observer(s)	Program
D-117	J. Benson J. Dickey	Interferometric observations between the 140-ft and 300-ft of 21-cm hydrogen absorption toward extragalactic continuum sources.

The following continuum programs were conducted during this quarter.

No.	Observer(s)	Program
к-227	G. Kojoian (Wisconsin) D. Dickinson (JPL)	Survey at 6-cm of approximately 600 galaxies having high surface brightness.
P-117	C. Purton (York U.) S. Blackwell (York U.)	Search at 6-cm for emission from stellar planetary nebulae.
G-247	D. Gibson (NMIMT) P. Fischer (NMIMT) D. Helfand (NMIMT)	Survey at 6-cm of X-ray stars.
B-359	B. Burke (MIT) C. Bennett (MIT) C. Lawrence (MIT)	Measurements of the 6-cm fluxes of sources in the 611 MHz Arecibo Survey.
B-335	T. Balonek (Massachusetts) W. Dent (Massachusetts) C. O'Dea (Massachusetts)	Polarization and flux density measure- ments of variable radio sources at 2695 MHz.
B-3 39	J. Broderick (VPI & SU) B. Dennison (VPI & SU) J. Ledden (VPI & SU) S. O'Dell (VPI & SU) J. Condon	Observations at 900 and 1400 MHz of low frequency variables.
C-195	J. Armstrong (JPL) V. Boriakoff (Cornell) J. Cordes (Cornell) J. Weisberg (Massachusetts) J. Dickey	Interstellar scintillation measurements over the range of 350-400 MHz and at 890 MHz of a large sample of pulsars.

The following pulsar programs were conducted during this quarter.

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No.	Observer(s)	Program
т-150	J. Taylor (Massachusetts) P. Backus (Massachusetts) M. Damashek	Observations at 610 MHz to determine accurate periods, period derivatives and positions of newly discovered pulsars, and to extend these measure- ments to known pulsars.
C-193	<pre>V. Boriakoff (Cornell) J. Cordes (Cornell) J. Rankin (Cornell) D. Stinebring (Cornell) J. Weisberg (Massachusetts)</pre>	Pulsar polarization studies over the range of 350-410 MHz simultaneous with observations conducted at Arecibo at 1420 and 1667 MHz.
	<u>36-foot Telescope</u>	Hours
	Scheduled observing Scheduled maintenance and equipmen Scheduled tests and calibration Time not scheduled Time lost due to: telescope equipment weather interference	1708.25 t changes 104.25 334.50 24.00 12.00 19.75 241.75 0.00
No.	Observer(s)	Program
B-363	W. B. Burton (Minnesota) H. Liszt	Search for CO counterparts to COS-B gamma-ray sources.
B-370	F. Bash (Texas) L. Munday (Texas) R. Leverault (Texas) D. Leisawitz (Texas)	Observations of CO velocity structure in M81.
B-376	W. B. Burton (Minnesota)	Study of carbon monoxide.
D-114	W. Dent (Massachusetts) R. Hobbs (NASA-Goddard)	Evolution of extragalactic radio sources at millimeter wavelengths.
D-118	D. Dickenson (JPL) T. Kuiper (JPL)	Physical characteristics of dark clouds measured by methyacetylene.
D-122	D. Dickenson (JPL) T. Kuiper (JPL)	Search for water and silicon monoxide in variable stars.
E-37	B. Elmegreen (Columbia) D. Elmegreen (Mt. Wilson)	Maps of CO emission from barred spiral galaxies.
E-39	N. Evans (Texas) L. Munday (Texas) M. Scholtes (Texas) M. Kutner (Rensselaer)	Determination of ortho/para ratio of formaldehyde in dark clouds.

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No.	Observer(s)	Program
G -250	B. Geldzahler (MPIR) H. Kuhr (MPIR)	Observations of NRAO-MPI sources at 9 millimeters.
G - 246	M. Gordon	Beam switched maps at 2 millimeters.
G-249	M. Gordon E. Epstein (Aerospace) J. Heidmann (Observatory de Paris)	Search for CO emission from clumpy irregular galaxies.
H -162	P. Huggins (SUNY)	Kinematic study of small neutral clouds in HII regions.
H-163	P. Huggins (SUNY)	Observations of kinematics of the envelope of IRC +10216
к-268	M. Kutner (Rensselaer) D. Machnik (Rensselaer) N. Evans (Texas)	Study of 2 millimeter methanol lines.
к-269	M. Kutner (Rensselaer) D. Machnik (Rensselaer) N. Evans (Texas)	Observations of DCO+ as a test of fractionation theories.
к-270	M. Kutner (Rensslaer) D. Machnik (Rensslaer)	CO studies of star formation in Canis Majoris.
K-271	M. Kutner (Rensslaer) D. Machnik (Rensslaer)	Observations of 2 mm formaldehyde lines in reflection nebulae.
L-161	C. Lada (Arizona)	Study of high velocity gas towards broad wing CO sources.
L-160	R. Levreault (Texas) N. Evans (Texas)	Study of optically thin CO lines towards pre ms objects.
M-170	P. Myers (MIT)	Investigation of blue shifted lines in dark clouds.
R-178	L. Rickard (Howard) P. Palmer (Chicago)	Continued studies of CO in galaxies.
R-176	L. Rodriquez (Mexico) J. Canto (Mexico) P. Ho (Calif., Berkeley) M. Schneps (CFA)	Observations of cometary nebulae in CO emission.
R-177	L. Rodriquez (Mexico) J. Canto (Mexico) N. Calvet (Calif., Berkeley)	CO observations of molecular clouds containing T-Tauri stars.

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No.	Observer(s)	Program
S-236	D. Sanders (SUNY) J. Barrett (SUNY) P. Solomon (SUNY)	A CO map of the disk of M101
S-232	L. Snyder (Illinois) J. Hollis (NASA-Goddard) D. Blake (Illinois)	Study of HNO and HCO for ex- amination of gas-phase chemistry.
т–153	P. Thaddeus (Inst. for Space Studies)	Confirmation of the detection of C ₃ H in IRC +10216.
T-151	H. Thronson (Arizona) C. Lada (Arizona)	Study of CO emission from nebulae studies in the IR and optical.
т–152	H. Thronson (Arizona) C. Lada (Arizona)	Study of CO emission from optical infrared nebula.
W - 158	B. Wilking (Arizona) C. Lada (Arizona)	Study of molecular hydrogen in Rho Ophiuchos.
X-1	D-L. Xiang (Purple Mountain) H. Liszt W. B. Burton (Minnesota)	CO map of the galactic center.

Very Large Array	Hours
Scheduled astronomical observing	856.25
Scheduled tests and calibration	407.25
Unscheduled time	896.5

Approximately 7.73 percent of the observing time was lost to instrumental, weather and power problems.

The following research programs were conducted with the VLA during this quarter.

No.	Observer(s)	Program
AA-9	P. Angerhofer (USNO) B. Balick (Washington) D. Milne (CSIRO) R. Perley	Cas A and Tycho supernova remnants. 20 cm.
AB-89	B. Burke (MIT) D. Roberts (MIT)	Search for variations in the double guasar 0957+561. 6 cm

P. Greenfield (MIT)

<u>No</u> .	Observer(s)	Program
AB-91/ AS-60	J. Bieging (Calif., Berkeley) M. Cohen (NASA/Ames) P. Schwartz (NRL)	T Tauri stars. 6 cm.
AB-96	B. Burke (MIT) D. Roberts (MIT) E. Turner (Princeton) J. Gott (Princeton)	Search for gravitationally lensed quasars. 6 cm.
AB-98	B. Burke (MIT) D. Roberts (MIT) P. Greenfield (MIT)	Search for radio emission from triple quasar 1115+08. 6 cm.
AB-106	R. Brown K. Johnston (NRL) K. Lo (Caltech) E. Wollman (Bates College)	Observations of the Galactic Center. 1.3 and 2 cm.
AB-109	B. Burke (MIT) C. Canizares (MIT) G. Kriss (MIT) P. Winkler (MIT)	Supernova remnant G27.4+0.0. 20 cm.
AB-113	A. Bridle (New Mexico/NRAO) R. Perley R. Henriksen (Inst. Plasma Res.)	Collimation and polarization of high-luminosity radio jet in 3C 219. 6 cm.
AB-114	A. Bridle (New Mexico/NRAO) E. Fomalont J. Palimaka (Queens) R. Perley	Jet source 3C 341. 20 cm.
AB-116	J. Bally (Bell Labs) C. R. Predmore (Massachusetts)	IR sources, biconical and compact HII regions. 6 cm.
AB-117	D. Backer (Calif., Berkeley) R. Sramek	Proper motion of compact source in Sgr A. 6 cm.
AC-26	W. Cotton S. Spangler (Iowa)	Compact sources with steep spectra. 2, 6, and 20 cm.
AD-26	 A. Downes (Cambridge) M. Longair (Cambridge) M. Perryman (ESTEC, Netherlands) J. Fielden (Cambridge) C. Benn (Cambridge) 	Structures of low-flux density sources. 20 cm.
AD-27	I. de Pater (Arizona) R. Brown (Arizona)	Io. 21 cm. ,

No.	Observer(s)	Program
AD-28	J. Dickey J. Benson F. Briggs (Pittsburgh)	Low latitude hydrogen absorption. 21 cm line.
AD-30	J. Dreher	Class II extragalactic sources. 21 cm.
AD-31	J. Dreher R. Laing	Spectral curvature of hot spots in extragalactic radio sources. 6 and 20 cm.
AD-32	J. Dickey H. Liszt E. Greisen	Structure of galactic HI absorption in front of 3C123. 21 cm line.
AD-35	G. Dulk (Colorado) P. Bornmann (Colorado)	Solar flares and magnetic fields in coronal active regions. 2 and 6 cm.
AE-8	R. Ekers P. Shaver (ESO) W. M. Goss (Leiden) J. Danziger (ESO) R. Fosbury (Royal Greenwich Obs.) J. Wall (Cambridge)	Spiral galaxy 0400-181. 6 and 21 cm.
AE-9	R. Ekers V. Radhakrishnan (Caltech)	X-ray/IR burster MXB 1730-33. 2 and 6 cm.
AF-28	E. Fomalont A. Bridle (New Mexico/NRAO) G. Miley (Leiden)	Extended radio core in 3C236. 1.3 and 2 cm.
AF-29	E. Fomalont W. M. Goss (Leiden) A. Lyne (Manchester) R. Manchester (CSIRO)	Accurate radio positions of pulsars. 20 cm.
AF-33	E. Fomalont B. Geldzahler (MIT)	Fornax A. 2, 6 and 20 cm.
AG-52	B. Geldzahler (MIT)	Objects resembling Sco X-1. 6 and 20 cm.
AG-53/ AH-51	B. Geldzahler (MIT) E. Fomalont R. Hjellming C. Wade	Sco X-1. 6 and 20 cm.

No.	<u>Observer(s)</u>	Program
AG-56	P. Gregory (British Columbia)	X-ray source G109.1-1.0. 1.3, 6, and 20 cm.
Ан-46	D. Hogg	Wolf-Rayet stars. 2 and 6 cm.
Ан-48	H. Habing (Leiden) R. Issacman (Leiden)	Planetary nebulae near the galactic center. 6 cm.
Ан-50	T. Heckman (Arizona) W. van Breugel (KPNO) G. Miley (Leiden) B. Balick (Washington)	Mapping of 3C305. 21 cm.
Ан-52	R. Hjellming K. Johnston (NRL)	Search for jets in radio emitting x-ray stars. 2 and 6 cm.
Ан-54	D. Heeschen Q-F. Yin (Peking) J. Heidmann (Meudon Obs.)	Clumpy irregular galaxies. 21 cm.
AJ-55	D. Jaffe (CFA) J. Moran (CFA) R. Genzel (CFA)	Far infrared sources containing newly formed B stars. 1.3, 2, and 6 cm.
AJ-59	K. Johnston (NRL) C. Wade D. Gibson (NMIMT)	Parallaxes, proper motions, and positions of radio binary stars. 2 and 6 cm.
AJ-60	K. Johnston (NRL) R. Hjellming	SS433. 1.3, 2, 6, and 20 cm.
AJ-62	C. Jenkins (Cambridge) R. Laing	Elliptical and SO galaxies. 6 and 20 cm.
AJ-63	W. Jaffe J. Caldwell (SUNY) T. Owen (SUNY) G. Berg (Caltech)	Uranus. 6 cm
AK-41	M. Kundu (Maryland) T. Velusamy (Maryland) E. Schmahl (Maryland) M. Bobrowski (Maryland)	Solar active regions and flares. 1.3, 2, 6, and 20 cm.
АК-43	P. Kronberg (Toronto) Gopal-Krishna (MPIR) H. Steppe (MIPR)	Double sources with unusually steep spectra. 0015+064, 2105+233 and 2302-025. 2, 6, and 20 cm.

No.	Observer(s)	Program
АК-44	P. Kronberg (Toronto) P. Biermann (MPIR)	M82. 2 and 6 cm.
AL-19	K. Long (Columbia) J. Dickel (Illinois) E. Greisen	Kepler's supernova remnant. 6 and 20 cm.
AL-26	R. Laing	Multiple hot-spots in extra- galactic sources. 2, 6, and 20 cm.
AL-27	R. Laing	3C296, jet radio galaxy. 6, 18, and 21 cm.
AM-30	G. Miley (Leiden) W. van Breugel (KPNO) H. Butcher (KPNO) E. Fomalont T. Heckman (Arizona)	Coma A. 21 cm.
AM-32	J. Moran (CFA) L. Rodriguez (Mexico)	A high-brightness source in NGC 6334. 1.3, 2, and 6 cm.
A0-18	F. Owen J. Puschell	Jodrell Bank quasars. 6 cm.
A0-20	F. Owen J. Puschell	Search for a central component in 3C61.1. 2 cm.
A0-22	F. Owen R. Laing J. Puschell	Distant 3CR radio galaxies. 6 cm.
AP-34	R. Perley A. Readhead (Caltech) T. Pearson (Caltech)	Compact extragalactic objects. 6 and 20 cm.
AP-35	P. Palmer (Chicago)	OH in the nucleus of NGC 253. 18 cm line.
AS-63	R. Sramek K. Weiler (NSF) J. van der Hulst (Minnesota)	Supernova in M100 and NGC 6946. 1.3, 2, 6, and 20 cm.
AS-65/ AS-66	G. Swarup (MPIR) R. Sinha (Sys & Appl Sci) M. Beltrametti (MPIR)	Hot spots and radio lobes in QSOs. 2 and 6 cm.

Program Observer(s) No. Ouasars 3C270.1 and 3C275.1. AS-67 J. Stocke (Arizona) W. Christiansen (North Carolina) 20 cm. J. Burns (New Mexico) AS-68 J. Spencer (NRL) Mapping OH and H₂O maser emission associated with late-type stars. P. Bowers (NRL) 1.3 and 18 cm line. K. Johnston (NRL) AS-71 J. Schreier (CFA) Centaurus A. 20 cm. J. Burns (New Mexico) E. Feigelson (MIT) AS-72 Y. Sofue (Nagoya) Long optical jets in edge-on Y. Fukui (Nagoya) galaxy MCG 5-29-86. 6 and M. Fujimoto (Nagoya) 20 cm. K. Wakamatsu (Gifu Inst. of Tech., Japan) S. Deguchi (Massachusetts) AV-41 J. van der Hulst (Minnesota) HI absorption toward the Galactic W. B. Burton (Minnesota) Center. 21 cm line. M. Ondrechen (Minnesota) H. Liszt AV-43 J. van der Hulst (Minnesota) Interacting galaxies. 6 and 21 cm. E. Hummel (New Mexico) J. van Gorkom C. Kotanyi (Leiden) W. Golisch (Minnesota) AV-44/ J. van der Hulst (Minnesota) Central sources in spiral AD-25 E. Hummel (New Mexico) galaxies. 2, 6, and 20 cm. R. M. Price (New Mexico) W. Golisch (Minnesota) J. Dickey AV-47 W. van Breugel (KPNO) Nuclear region of giant radio A. Willis (NFRA) galaxy DA240. 2 and 6 cm. R. Strom (NFRA) AW-40/ A. Wilson (Maryland) Crab Nebula. 2, 6, and 20 cm. AH-49 D. Hogg AW-44 C. Wade

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KR Aurigae, a possible black hole. 1.3, 2, 6, and 20 cm.

No.	Observer(s)	Program
AZ-11	B. Zuckerman (Maryland) R. Spoka (Maryland) E. Dwek (Maryland) R. Hobbs (NASA, Goddard) A. Michalistianos (NASA, Goddard) M. Kafatos (George Mason)	R Aquarii and other symbiotic and infrared stars. 1.3, 2, and 6 cm.
AZ-12	H. Zirin (Caltech) K. Marsh (Caltech) G. Hurford (Caltech)	Solar flares. 2 and 6 cm.
AV-23	W. Cotton B. Geldzahler (MIT) F. Owen J. Romney (MPIR, Bonn) K. Johnston (NRL) L. Baath (Chalmers)	"Optically Quiet QSO" 2147+145. 18 cm (VLBI).
VF-4	J. Fix (Iowa) R. Mutel (Iowa) M. Claussen (Iowa) J. Benson	Main line OH emission from stellar sources. 18 cm (VLBI).
VJ-10	K. Johnston (NRL) J. Spencer (NRL) C. Walker R. Brown	Quasars 3C 279 and 3C 446. 18 cm (VLBI).
VM-13	J. Moran (CFA)	Proper motions of H ₂ O maser sources. 1.3 cm (VLBI).

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ELECTRONICS DIVISION

Charlottesville

Four mixers for the 230 GHz frequency range have been fabricated. Two units give T_{MXR} = 395 K SSB at 225 GHz and 15 K ambient and have been shipped to Tucson. These are the highest frequency mixers constructed at NRAO and give performance comparable to the best results at other observatories.

Several millimeter-wave frequency multipliers with outstanding efficiency have been completed; best results are given below:

<u>Multiple</u>	Output Frequency	Efficiency
X2	90 GHz	24%
	124 GHz	16%
X2	128-168 GHz	≥ 10%
X2	214 GHz	27%
X3	222 GHz	6%

These devices greatly improve the reliability and operating cost of providing local oscillators for millimeter-wave receivers.

Over 1200 SIS (superconductor-insulator-superconductor) junctions have been fabricated by NRAO, using facilities at the National Bureau of Standards. These are presently being evaluated for millimeter-wave mixer use.

Development of FET amplifiers for the 1.2-1.7 GHz range is continuing. Two matched units, having noise temperature < 10 K, have been shipped to Green Bank for use in an OH receiver; 18 more units will be constructed for use in Green Bank, the VLA, VLB stations, and as IF amplifiers for millimeter-wave receivers. Prototype FET amplifiers for the 15 GHz range have been constructed and development of a low-noise cooled amplifier using unpackaged (chip) FET's is being actively pursued.

Construction of a second VLBI Mark III terminal and expansion of the VLBI Mark II processor are continuing.

Green Bank

Four projects were completed during this quarter. The 300 to 1000 MHz receiver was completed with the addition of the 700 to 1000 MHz upconverter and an IF polarimeter. Spare upconverters are now being fabricated for this receiver. The L-and C-band cooled GASFET receiver, built for Fort Davis, was installed and tested at Fort Davis in January. The receiver performed as expected on the telescope, as best as could be determined, considering weather and cryogenic problems. The installation and testing of new discs on the 140-foot MODCOMPS and of the lab MODCOMP in the "RJE room" were completed. Finally, a new polarimeter calibrator, covering 1 to 2 GHz, was installed and tested on the 140-foot.

Construction and testing is underway in several projects. The upconverter for the C-band part of the first channel of the 140-foot maser receiver was installed in preparation for tests early next quarter. An interface between the TPI 1054 tape drives and the HP 9825 calculator was completed and several diagnostics were written. The interface from the TPI 1054's to the DDP 116 is in construction. Progress is continuing on the Mark III VLB system for the VLA. Three phase calibrator modules were constructed; one power supply module was built and tested. All video converters were completed and tested, as were the head driver and analog reproduce boards. Construction of interfaces for the new interferometer encoders is also in progress. The Q-band maser noise temperature has been measured at 35 ± 3 K. Tunability from 42 to 45 GHz was demonstrated. However, oscillations were present at a few frequencies and work is underway to quell these. Development and construction of the two 256-channel, 2 MHz per channel, filter receivers is continuing. The oscillators and mixers are complete; the design of the filter boards is underway. The polarimeter calibrator for the 300-foot has been completely refurbished and installed.

The 18 and 21-cm receivers are being redesigned using cooled GASFET's as front-ends.

Routine assistance and maintenance were provided at the telescopes and lab.

Tucson

During this quarter the new 200-235 GHz receiver has been tested on the telescope. The receiver performed well, although the noise temperature was somewhat higher than expected (1000 K SSB). The receiver will be scheduled for observer use in the fall quarter.

The H_e3 bolometer was tested on the antenna, and the sensitivity is improved over the previous tests, although still not as high as hoped for. Further improvements will be made during the summer.

During this quarter an interferometer system has been completed and tested. This instrument permits us to measure components over a large frequency range and should prove very useful in the development of short wavelength filters.

ENGINEERING DIVISION

Design and drawings were completed for the new inductosyns for the 85-foot antennas. Prospective sites and the possible use of a surplus antenna for the proposed addition to the interferometer baseline were reviewed. Additional measurements and checks were made on the prototype reflector plate measuring instrument. A study was started of possible methods of reducing astigmatism on the 300-foot. Calculations of VLA antennas relative to pointing characteristics were reviewed and expanded. Stability measurements of the surface conditions of the 36-foot reflector were obtained and reviewed. A program of data collection to study the effect of wind on the 36-foot was established. The design of the interface to replace the encoders with resolvers on the readout system of the adjustable feed mount on the 140 was begun. Routine engineering assistance to maintenance and operations at Charlottesville, Green Bank, Tucson, and the VLA was provided.

COMPUTER DIVISION

VLBI

The Varian 620 I minicomputer has been replaced with a Sperry-Univac V77-400 computer. Plans for the utilization of this faster computer with more memory include record averaging and blocking.

VLA Post-Processing

VAX number 2 (Digital Equipment Corporation VAX 11/780) has been installed in Room 216. In April, 1981 it will be moved to Room 214 which is now being prepared. Ultimately, the VAX and Modcomp Classic main frames and peripherals will each have individual rooms, separated by a third room. CRT terminals will be housed in this room and will enable users and programmers to have access to either machine.

Green Bank

The Modcomp II was moved from the basement of the Jansky Lab to the RJE room and is available to users for processing of 140-foot and 300-foot data.

The 25M byte disk on the 140-foot analysis computer was moved to the control computer and was replaced with a 50M byte disk. Disk dump time was increased from 6 hours to 18 hours.

VERY LARGE ARRAY PROGRAM

The array was scheduled for observations 59 percent of the time during the first quarter. The array went into full operation in January.

The post-processing system is running on the VAX 11/780 at the VLA site. It is now used regularly by astronomers for map processing.

During the quarter the waveguide to the end of the east arm and the retrofit of parametric amplifiers and cryogenics in all receivers were completed, allowing the array to be operated with 27 antennas in the full A array for the first time. This completes the construction of the electronics system except for IF's B and D, which will be brought into operation when data reduction capabilities are adequate.

PERSONNEL

Appointments

Jacqueline van Gorkom	Research Associate	01/01/81
Changes in Status		
R. C. Bignell	Systems Scientist/Head, Array Operations Division	01/01/81
Terminations		
Robert M. Mitchell Eric D. Russell	Electronics Engineer I Scientific Programming Analyst II	12/31/80 01/16/81
Christopher J. Salter	Scientific Programming	03/27/81
Leave of Absence		
Kenneth I. Kellermann Barry E. Turner	Senior Scientist Scientist	01/01/81 02/01/81
Retirement		
John H. Lancaster	Assistant Director/ Head, VLA Program	03/31/81

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AUG 0 5 1981

NATIONAL RADIO ASTRONOMY OBSERVATORY Charlottesville, Virginia

Quarterly Report

April 1, 1981 - June 30, 1981

RESEARCH PROGRAMS

140-foot Telescope	Hours	
Scheduled observing	1948.50	
Scheduled maintenance and equipment changes	212.00	
Scheduled tests and calibration	6.00	
Time lost due to: equipment failure	48.25	
power	1.50	
weather	2.50	
interference	1.50	

The following line programs were conducted during this quarter.

No. Observer(s)

B-347 R. Brown

S-224 P. Jewell

R. Hobbs

L-164 F. J. Lockman

B-361

н-164

к-249

Program

Observations at 2.8 and 6-cm to measure H and He recombination lines in 28 of the brightest galactic HII regions.

Observations at 5 and 6-cm to search for excited OH emission from late-type stars.

Sensitive broadband survey of HI at $b < 20^{\circ}$.

Observations at 20-cm of selected dark clouds and planetary nebulae to ascertain the presence of H_2^+ .

Observations of the 21-cm Hl66 α recombination line in selected areas in the Galactic plane.

Observations of neutral hydrogen in the Canis Major R1 region.

D. Machnik (Rensselaer) K. Mead (Rensselaer)

M. Kutner (Rensselaer)

(Illinois)

(NASA, Goddard)

L. Snyder (Illinois)

W. B. Burton (Minnesota)

Republic of China)

J. Hollis (NASA, Goddard)

Y. Zhang (Nankai U., Peoples

No.	Observer(s)	Program
S-227	J. Kwan (Bell Labs) N. Scoville (Massachusetts) F, J. Lockman	Search for high velocity 21-cm hydrogen emission from the KL nebula.
R-182	L. Rickard (Howard)	Observations at 21-cm to evaluate C⁺ 265α, C⁺266α, and Hα406 (15) transitions in Ori A and M17.
B-377	R. Brown	Search at 91-cm for the hyperfine tran- sition of interstellar deuterium and measurements of hydrogen in the searched areas.

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

В	-	Effelsburg 100-m
С	-	Algonquin 150-ft
F		Fort Davis 85-ft
G	-	Green Bank 140-ft
Η	_	Hat Creek 85-ft
Km		Haystack 120-ft

No. Observer(s)

- M-13V B. Rönnang (Chalmers) D. Downes (IRAM, France) G. Garay (CFA) R. Genzel (CFA) A. Haschick (Haystack) J. Moran (CFA) M. Reid (CFA) M. Schneps (CFA)
- R-14V A. Readhead (Caltech) R. C. Walker
- P-16V I. Pauliny-Toth (MPIR) E. Preuss (MPIR) K. Kellermann

0 - Owens Valley 130-ft
R - Crimea 22-m
So - Onsala 26-m
Wn - Westerbork, n=1-14x26m
Yn - VLA Socorro, n=1-27x25m

Program

Observations at 22 GHz to determine distances by the measure of proper motions in H_2O maser sources with telescopes B, R, So, Km, O, Yn and G.

Observations at 22 GHz to exploit a new mapping technique observing 3C 84, 3C 273, and 3C 345 with telescopes B, C, Km, O, G, and Yn.

Observations at 6-cm of 3C 147 and NGC 315 with telescopes B, F, Km, O, and G.

No.	Observer(s)	Program
B-21V	L. Baath (Chalmers) B. Rōnnang (Chalmers) D. Graham (MPIR) R. Schilizzi (NFRA, Netherlands) G. Seielstad (Caltech)	Studies at 6-cm of the structural variations in the BL Lac type objects MK 421, 1749+70.1, and BL Lac with telescopes B, So, Wn, Km, O, and G.
C-22V	M. Cohen (Caltech) T. Pearson (Caltech) A. Readhead (Caltech) G. Seielstad (Caltech) S. Unwin (Caltech) R. Linfield (Caltech) R. Simon (Caltech)	Observations at 6-cm of superluminal radio sources with telescopes F, H, Km, O, and G.
F-3V	N. Cohen (Cornell) P. Feldman (Johns Hopkins) P. Crane	Observations at 6-cm of RS CVn and similar binaries with telescopes F, Km, O, and G.
K-8V	A. Downes (MPIR) I. Pauliny-Toth (MPIR) E. Preuss (MPIR) D. Shaffer (Phoenix Corp.) K. Kellermann (Caltech) R. C. Walker	Observations at 6-cm of Cyg A with telescopes B, F, H, Km, O, and G.
M-18V	P. Barthel (Leiden) G. Miley (Leiden) E. Preuss (MPIR) R. Schilizzi (NFRA, Netherlands)	Observations at 6-cm of the cores in extended quasars with telescopes B, So, O, and G.
M-171	G. Miley (Leiden) R. Schilizzi (NFRA, Netherlands) P. Wilkinson (Jodrell Bank)	Observations at 6-cm of the structure of 3C 236 with telescopes of the European VLB network and G.
B-372	B. Burke (MIT) C. Bennett (MIT) A. Garcia (MIT) C. Lawrence (MIT) W. Williams (MIT)	Observations at 610 MHz of the quasar 0957+561 with telescopes Km, O, and G; flux measurements of sources from the Arecibo survey.
W-8V	D. Shaffer (Phoenix Corp.) J. Wrobel (Toronto)	Observations at 2.8-cm of active E/SO galaxies with telescopes C, Km, O, and G.

<u>No.</u>	Observer(s)	Program
L-10V	D. Backer (Calif., Berkeley) K. Lo (Caltech)	Observations at 2.8-cm of the Galactic center with telescopes Km, 0, and G.
G-13V	N. Cohen (Cornell) B. Geldzahler (MIT) D. Shaffer (Phoenix Corp.)	Observations at 2.8-cm of 3 compact radio sources in the direction of supernova remnants with telescopes F, Km, O, and G.
U-3V	R. Linfield (Caltech) S. Unwin (Caltech)	Observations at 2.8-cm of 3C 111 with telescopes F, Km, O, and G.
U-7V	T. Pearson (Caltech) A. Readhead (Caltech) S. Unwin (Caltech)	Studies at 2.8-cm of the morphology and spectral index distribution of 3 complex sources with telescopes B, F, Km, O, and G.
C-20V	B. Corey (MIT) I. Shapiro (MIT)	Observations at 2.8-cm to determine absolute motions of features in 3C 345 with telescopes B, F, Km, O, and G.
P-20V	I. Pauliny-Toth (MPIR) K. Kellermann	Observations at 2.8-cm of 3C 454.3 and 2134+004 with telescopes B, F, Km, O, and G.
P-24V	I. Pauliny-Toth (MPIR) R. Porcas (MPIR) F. Mantovani (MPIR)	Observations at 2.8-cm of CTD 93 with telescopes B, F, Km, O, and G.
G-17V	Gopal-Krishna (MPIR) R. Porcas (MPIR)	Observations at 2.8-cm of CTD 93 with telescopes B, Km, O, and G.
B-23V	J. Broderick (VPI & SU) A. Marscher (Calif., San Diego)	Observations at 2.8-cm of the extremely luminous X-ray quasar NRAO 140 with telescopes B, F, Km, O, and G.
P-23V	H. Aller (Michigan) R. Mutel (Iowa) R. Phillips (Kansas)	Observations at 2.8-cm to continue the monitoring of the apparent superluminal expansion of BL Lacertae with telescopes B, F, Km, O, and G.
S-17V	T. Jones (Minnesota) R. Mutel (Iowa) S. Spangler	Observations at 2.8-cm to test models for compact source spectral shapes with telescopes B, F, Km, O, and G.

The following pulsar program was conducted during this quarter.

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Observer(s)

T-149	J. Taylor (Massachusetts)	Observations at 390 MHz to determine
	P. Backus (Massachusetts)	pulsar arrival times of PSR 0655+64
	R. Burkhardt (Massachusetts)	and PSR 0820+02.
	M. Damashek	

Program

300-foot Telesco	pe	Hours
Scheduled observ Scheduled mainter Scheduled test an Time lost due to	ing nance and equipment changes nd calibration : equipment failure power weather	1973.25 146.75 64.00 30.25 1.75 2.00
	interference	0.00

The following line programs were conducted during this quarter.

No.	Observer(s)	Program
L-150	B. Ganzel (Minnesota) F. J. Lockman	High angular resolution measurements of neutral hydrogen in areas of special interest in the Mon OBl and OB2 associations.
H-153	B. Burke (MIT) A. Haschick (Haystack) P. Crane	Observations to confirm possible neutral hydrogen absorption features in quasar/ galaxy pairs.
H-160	W. Huchtmeier (MPIR) O. Richter (MPIR)	Studies of the global parameters of galaxies and cluster of galaxies from neutral hydrogen observations.
L-147	B. Lewis (Carter Obs.) P. Crane	Observations to detect and study sources contained in the Shapley-Ames Catalog at the 21-cm line of neutral hydrogen.
L-163	T. Bania (Virginia) F. J. Lockman	Studies of galactic rotation at locations away from the galactic plane by the use of neutral hydrogen observations.

<u>No.</u>	Observer(s)	Program
B-348	K. Mitchell (Penn State) R. Brown	Search between 1000 and 1420 MHz for redshifted 21-cm absorption lines toward bright quasars.
T-135	T. Thuan (Virginia)	Observations at 21-cm to measure the hydrogen width for a complete sample of 725 edge-on spiral galaxies selected from the Nilson Catalog.
T-142	C. Hazard (Cambridge) R. Terlevich (Cambridge) T. Thuan (Virginia)	Measurements of the neutral hydrogen content of blue compact objects found on UK Schmidt plates.
T-141	T. Thuan (Virginia)	Measurements of the neutral hydrogen content and redshift of the Magellanic- type galaxies found in the Nilson Catalog.

The following continuum programs were conducted during this quarter.

No.	Observer(s)	Program
B-335	W. Dent (Massachusetts) T. Balonek (Massachusetts) C. O'Dea (Massachusetts)	Polarization and flux density measure- ments of variable radio sources at 2695 MHz.
M-172	T. Menon (British Columbia)	Observations at ll-cm of sources selected from the 327 MHz Ooty radio telescope survey.
B-339	J. Broderick (VPI & SU) B. Dennison (VPI & SU) J. Ledden (VPI & SU) S. O'Dell (VPI & SU) J. Condon H. Payne (VPI & SU)	Observations at 900 and 1400 MHz of low frequency variables.
K-266	G. Kojoian (Wisconsin)	Observations at 4.7 GHz of those galaxies exhibiting strong ultraviolet continua and those of high surface brightness.

The following pulsars programs were conducted during this quarter.

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No. Observer(s)

J. Armstrong

V. Boriakoff

J. Weisburg

36-foot Telescope

J. Dickey

V. Boriakoff (Cornell)

D. Stinebring (Cornell) J. Weisberg (Massachusetts)

(JPL)

(Cornell)

(Massachusetts)

J. Cordes (Cornell)

J. Rankin (Cornell)

V. Cordes (Cornell)

C-193

C-195

Program

Pulsar polarization studies over the range 350-410 MHz simultaneous with observations conducted at Arecibo at 1420 and 1667 MHz.

Interstellar scintillation measurements over the range of 350-410 MHz of a large sample of pulsars.

Hours

		Hourb
Scheduled observir	ıg	1754.00
Scheduled maintena	89.75	
Scheduled test and	l calibration	291.75
Time not scheduled	1	49.00
Time lost due to: telescope		7.50
	equipment	10.75
	weather	116.00
	interference	0.00

No. Observer(s)

Program

Test of dicarbon sulfide as a source of some U-lines.

- A-055 L. Avery (NRC) J. MacLeod (NRC) N. Broten (NRC) J. Ramsey (NRC)
- A-057 T. Armstrong (MIT) A. Barrett (MIT)
- B-363 W. B. Burton (Minnesota) H. Liszt
- B-371 L. Blitz (Calif., Berkeley)
- B-373 L. Blitz (Calif., Berkeley) R. Mathieu (Calif., Berkeley)
- C-197 E. Churchwell (Wisconsin) A. Merer (British Columbia)
- C-198 E. Churchwell (Wisconsin) C. Walmsley (MPIR)

CO survey at high angular resolution and search for $\mathrm{C}^{18}\mathrm{O}$ in Sag A West.

Search for CO counterparts to cos-B gamma-ray sources.

Search for extragalactic CO in M33, Seyferts and Zwicky 18 and 40.

Search for continuum emission from spirals with flat rotational curves.

Search for iron oxide.

Observations of $H^{13}CN$ in molecular clouds.

Observer(s) Program No. D-126 W. Dent (Massachusetts) Evolution of extragalactic radio sources R. Hobbs (NASA, Goddard) at millimeter wavelengths. T. Balonek (Massachusetts) CO observations of molecular clouds near J. Dickel (Illinois) D-127 L. Denoyer (Cornell) the Cygnus Loop. Search for CO emission from near F-080 J. Fix (Iowa) IRC+10420. G-252 E. Grayzeck (Nevada) CO observations of the CEP IV star P. Angerhofer (USNO) formation region. G. Rossano (unaffiliated) A test of the usefulness of 12CO as a H-166 L. Blitz (Calif., Berkeley) galactic tracer. Search for circumstellar $HC^{3}N$. J-098 P. Jewell (Illinois) L. Snyder (Illinois) D. Blake (Chicago) J-099 D. Jaffe (Chicago) CO observations of galactic submillimeter R. Hildebrand (Chicago) continuum sources. J. Keene (Chicago) Observations of DCO+ as a test of K-269 M. Kutner (Rensselaer) D. Macnick (Rensselaer) fractionation theories. N. Evans (Texas) K-272 M. Kutner (Rensselaer) Further CO observations of molecular clouds outside the solar circle. K. Mead (Rensselaer) L-162 H. Liszt Study of the spatial and kinematics of W. B. Burton (Minnesota) CO emission in the galactic core. M-178 M. Morris (Columbia) Observations of filamentary molecular R. Maddalena (Columbia) clouds with high spatial resolution. P-115 J. Puschell Millimeter wave observations of optically F. Owen selected QSO's. J. Condon T. Jones (Minnesota) L. Rudnick (Minnesota) W. Stein (Minnesota) S-239 P. Schwartz (NRL) Study of intensities and velocity J. Spencer (NRL) structure of SiO masers. P. Bowers (NRL) B. Zuckerman (Maryland)

No.	Observer(s)	Program
s-242	P. Schwartz (NRL)	Observations of torsionally excited methanol.
W-162	P. Wannier (Caltech) N. Scoville (Massachusetts)	Study of magnetic fields and millimeter polarization.

Very Large Array	Hours
Scheduled observing	1355
Scheduled tests and calibration observing	829

Approximately 4.8 percent of the observing time was lost to instrumental, weather and power problems.

The following research programs were conducted with the VLA during this quarter.

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No.	Observer(s)	Program
AA-10	R. Antonucci (Calif., Santa Cruz) E. Fomalont	Polarization of radio cores of galaxies. 6 and 20 cm.
AA-11	D. Abbott (Colorado) J. Bieging (Calif., Berkeley)	Mass loss from associationinter- stellar bubbles? 6 cm.
AB-100	A. Bridle (New Mexico) E. Fomalont	Spectrum and polarization of jet in NGC 315. 6 cm.
AB-112	J. Burns (New Mexico) S. Gregory (Bowling Green State U.)	4C sources in Zwicky clusters. 20 cm.
AB-119	D. Branch (Oklahoma) J. Cowan (Oklahoma)	Search for young extragalactic SNR's. 20 cm.
AB-125	B. Baud (Calif., Berkeley) A. Sargent (Caltech) H. Habing (Leiden)	Positions of Type II OH masers. 18 cm line.
AB-129	B. Burke (MIT) D. Roberts (Brandeis) P. Greenfield (MIT)	Monitoring double QSO 0957+561. 6 cm.
AB-130	B. Burke (MIT) C. Lawrence (MIT) C. Bennett (MIT)	Snapshot of Arecibo and Green Bank survey sources. 6 cm.

No.	Observer(s)	Program
AB-132	F. Biraud (Meudon) J. Schneider (Meudon) T. Cornwell	Search for gravitationally lensed images of quasars 3C 268.4 and PKS 1311-270. 2 and 6 cm.
AC-26	W. Cotton S. Spangler	Compact sources with steep spectra. 2, 6 and 20 cm.
AC-28	M. Claussen (Iowa) R. Mutel (Iowa) R. Gaume (Iowa) J. Fix (Iowa)	Intense variable OH maser G351.8-0.5 and its continuum. 2, 6 and 18 cm line.
AC-30	T. Cornwell D. Graham (MIPR) G. Hunt C. Salter (Bologna)	3C 433high altitude circular source. 2 and 6 cm.
AD-30	J. Dreher	Class II extragalactic sources. 21 cm.
AD-34	I. de Pater (Arizona) J. Caldwell (SUNY, (Stony Brook) W. Jaffe T. Owen (SUNY, Stony Brook)	Atmosphere and magnetosphere of Jupiter. 6 and 18 cm.
AD-38	H. Dickel (Illinois) A. Lubenow (Illinois) W. M. Goss (Leiden) A. Rots J. Forster (NFRA)	H ₂ O absorption toward DR 21. 6 cm line.
AD-40	J. Dreher R. Laing	Spectra of hot spots in extragalactic sources. 2 and 6 cm.
AD-42	G. Dulk (Colorado)	Solar flare patrol. 6 and 20 cm.
AE-11	R. Ekers W. M. Goss (Groningen) U. Schwartz (Groningen)	Spectral index distribution in Sgr A. 21 cm.
AE-12	 R. Ekers P. Shaver (Leiden) W. M. Goss (Leiden) R. Fosbury (ESO) J. Danziger (ESO) J. Wall (Cambridge) D. Malin (Anglo Australian Obs.) 	Complete sample of radio galaxies. 21 cm.

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No.	Observer(s)	Program
AG-57	P. Gregory (British Columbia) A. Taylor (British Columbia) A. Gower (Univ. Victoria)	Periodic radio star LSI +61°303. 6 cm.
AG-58	 A. Gower (Univ. Victoria) D. Crampton (Dominion Astrophys. Obs.) J. Hutchings (Dominion Astrophys. Obs.) 	Quasars with optical structure. 6 and 20 cm.
AG-60	Gopal-Krishna (MPIR) R. Sramek	Ooty occultation sources. 6 and 20 cm.
AH-48	H. Habing (Leiden) R. Issacman (Leiden)	Planetary nebulae near the Galactic center. 6 cm.
Ан-50	T. Heckman (Arizona) W. van Breugel (KPNO) G. Miley (Leiden) B. Balick (Washington)	3C 305. 6 and 21 cm.
АН-53	R. Hjellming S. Ewald T. Cline (NASA, Goddard)	Radio counterparts of transient gamma ray sources. 6 and 20 cm.
AH-55	D. Helfand (Columbia) G. Chanan (Columbia) B. Margon (Washington)	X-ray selected active galaxy nuclei. 6 and 21 cm.
AH-58	P. Hintzen (NASA, Goddard) F. Owen J. Scott (Arizona)	Search for distorted QSO's. 20 cm.
АН-62	G. Hunt C. Salter (Bologna) I. McHardy (Leichester, UK) D. Schwartz (CFA)	X-ray source 3A 0004+726 in SNR CTA 1 2, 6 and 20 cm.
АН-63	E. Hummel (New Mexico) J. van der Hulst (Minnesota) G. Shostak (Leiden)	NGC 1961spiral arm component. 21 cm.
АН-64	D. Helfand (Columbia) R. White (Columbia) L. Lucy (Columbia) R. Becker (Columbia)	Stellar wind of P Cygni. 6 cm.
AJ-60	K. Johnston (NRL) R. Hjellming	SS 433. 1.3, 2, 6, and 20 cm.

Observer(s) No. M. Kundu (Maryland) AK-41 T. Velusamy (Maryland) E. Schmahl (Maryland) M. Bobrowski (Maryland) P. Kronberg (Toronto) AK-45 L. Noreau (Toronto) AK-46 S. Kwok (NRC) H. Matthews (NRC) C. Purton (NRC) T. Spoelstra (NRC) R. C. Bignell AK-47 S. Kwok (NRC) R. C. Bignell AL-29 J. Linsky (Colorado) D. Gary (Colorado) K. Lang (Arcetri) AL-30 F. Drago (Arcetri) R. Willson (Tufts) AL-31 R. Laing A. Bridle (New Mexico) AL-32 R. Laing AL-33 R. Lamb (Iowa) J. Basart T. Markert (MIT) G. Miley (Leiden) AM-30 W. van Breugel (KPNO) H. Butcher (KPNO) T. Heckman (Arizona) E. Fomalont AM-33 G. Miley (Leiden) W. van Breugel (KPNO) H. Butcher (KPNO) T. Heckman (Arizona) E. Fomalont H. Matthews (NRC) AM-35 S. Kwok (NRC) B. Turner A. Winnberg (MPI)

Program

Solar active regions and flares. 1.3, 2, 6, and 20 cm.

Radio galaxy 3C 303. 2, 6, and 20 cm.

Monitoring of HM Sge. 1.3, 2, 6 and 20 cm.

AFGL 618--nascent planetary nebula? 1.3, 2, 6 and 20 cm.

Late-type stars with large X-ray fluxes. 2 and 20 cm.

Solar flares and active regions. 2 and 6 cm.

Weak jets and outer lobes in M84. 6 and 20 cm.

3C 20--double source with luminous hot spots. 2 and 6 cm.

Center for SNR W28. 2, 6 and 20 cm.

Coma A. 6 cm.

3C 310--relaxed wide double with complex features. 6 cm.

Central cavities in ultracompact HII regions. 1.3 and 2 cm.

<u>No</u> .	Observer(s)	Program
AM-36	H. Matthews (NRC) J. van Gorkom A. Rots	Recombination lines and ammonia in W3(OH). 1.3 and 2 cm line.
AM-37	M. Morris (Columbia) P. Bowers (NRL) B. Turner B. Zuckerman (Maryland)	OH emission of bipolar nebulae. 18 cm line.
AM-38	R. Mutel (Iowa) J. Fix (Iowa)	Stellar OH masers. 18 cm line.
AN-9	R. Newell (NMIMT) R. Hjellming	Compact thermal sources made by evolved stars. 1.3 and 2 cm.
A0-16	F. Owen J. Burns (New Mexico)	NRC 1265. 6 cm.
A0-23	F. Owen R. White (NASA, Goddard) J. Burns (New Mexico)	Nearby Abell clusters. 20 cm.
AP-36	B. Peterson (Ohio State) L. Rudnick (Minnesota)	Morphology of quasars compared to absorption line systems. 6 and 20 cm.
AP-40	P. Palmer (Chicago) K. Johnston (NRL)	Accurate ground and excited state positions for OH masers in W3 and W49. 6 and 18 cm line.
AP-42	R. Potash (Brandeis) J. Wardle (Brandeis)	Jet quasar 4C 32.69. 6 cm.
AP-43	S. Pottasch (Groningen) J. van Gorkom W. M. Goss (Leiden) R. Gathier (Leiden)	Planetary nebulae near Galactic center. 6 cm.
AR-42	L. Rudnick (Minnesota) T. Jones (Minnesota) R. Fiedler (Minnesota) W. Golisch (Minnesota)	Polarization angles in compact extra- galactic sources. 2, 6 and 20 cm.
AR-45	L. Rudnick (Minnesota) P. Crane J. Dreher W. Saslaw (Virginia) S. Simkin (Michigan State) J. Tyson (Bell Labs)	Optical-radio lobe coincidence in 3C 33. 2 and 6 cm.

No.	Observer(s)	Program
AR-46	V. Radhakrishnan (Raman Inst.) R. Ekers J. van Gorkom K. Johnston (NRL) C. Salter (Bologna)	Compact objects at centers of SNR. 6 and 20 cm.
AR-48	L. Rudnick (Minnesota)	Radio quiet BL Lac objects? 2 and 6 cm.
AR-49	L. Rudnick (Minnesota) J. Burns (New Mexico) W. Golisch (Minnesota) M. Ondrechen (Minnesota)	Jet widths in 3C 129. 6 cm.
AS-69	S. Spangler W. Cotton	Search for weak central components in non-variable sources. 6 and 20 cm.
AS-74	S. Spangler	Luminous jet galaxies 3C 166 and 3C 327.1. 2, 6 and 20 cm.
AS-75/ AW-50	D. Shaffer (Phoenix Corp.) T. Clark (NASA, Goddard) N. Vandenberg (NASA, Goddard) R. C. Walker	Reference sources for VLBI astrometry. 6 and 20 cm.
AS- 76	E. Seaquist (Toronto) N. Duric (Toronto) P. Crane J. Auman (British Columbia) B. Campbell (CFH, Hawaii)	Peculiar spiral galaxy NGC 3310. 6 and 20 cm.
AS-79	S. Spangler W. Cotton	Multifrequency monitoring of low- frequency variables. 1.3, 2, 6 and 20 cm.
AS-80	R. Sramek J. van der Hulst (Minnesota) K. Weiler (NSF)	Supernovae in M100 and NGC 6946. 2, 6 and 20 cm.
AT-15	<pre>C. Townes (Calif., Berkeley) D. Matsakis (USNO) S. Subramanian (Calif., Berkeley) A. Hjalmarson (Chalmers) P. Palmer (Chicago) A. Cheung (Calif., Davis)</pre>	OH in DR 21. 18-cm line.
AT-16	A. Tubbs F. Briggs (Pittsburgh) J. Dickey	21-cm absorption of quasar 0241+011 by galaxy NGC 1073. 21-cm line.

No.		Observer(s)	Program
AT-17	J. T J. D B. B	urner (Calif., Berkeley) reher aud (Calif., Berkeley)	Continuum and masers in ON-1. 1.3, 2, 6 and 20-cm line and continuum.
AV-41	J. v W. B M. P H. L	an der Hulst (Minnesota) • Burton (Minnesota) • Ondrechen (Minnesota) iszt	21-cm HI absorption toward the Galactic center. 21-cm line.
AV-43	J. v E. H J. v C. K W. G	an der Hulst (Minnesota) ummel (New Mexico) an Gorkom otanyi (Minnesota) olisch (Minnesota)	Interacting galaxies. 6 and 20 cm.
AV-52	J. v R. S K. W	an der Hulst (Minnesota) ramek eiler (NSF)	Monitoring extragalactic supernovae. 2, 6 and 20 cm.
AW-35	J. W. C. B G. G M. V	all (Royal Greenwich Obs.) enn (Royal Greenwich Obs.) rueff (Bell Labs) igotti (Bell Labs)	Positions of sources in 5C 12 survey. 20 cm.
AW-37	J. W. D. R	ardle (Brandeis) oberts (Brandeis)	Quasars with jets. 6 cm.
AW-43	A. W J. U	ilson (Maryland) lvestad (Maryland)	Nuclei of Seyfert and emission line galaxies. 2, 6 and 20 cm.
AW-47	G. W E. B	ynn-Williams (IFA, Hawaii) ecklin (IFA, Hawaii)	Galaxies with multiple nuclear con- densations. 2, 6 and 20 cm.
AW-48	C. W. P. S K. J	ade idelmann (USNO) ohnston (NRL)	Astrometric observations of minor planets. 1.3 and 2 cm.
АҮ-1	P. Y. J. G J. K L	oung (Caltech) unn (Caltech) ristian (Mt. Wilson & as Campanas)	An ultra-deep survey. 6 and 20 cm.
AZ-13	H. Z K. M G. H	irin (Caltech) arsh (Caltech) urford (Caltech)	Solar flares and active regions. 1.3, 2, 6 and 20 cm.
EVN80-6	R. S G. M T. C	chilizzi (Leiden) iley (Leiden) ornwell	VLBI observations of the core of 3C 236. 6-cm VLBI.

ELECTRONICS

Charlottesville

Development of solid-state millimeter-wave local oscillators continues. Gunn diode oscillators giving 60 mW at 72 GHz and a doubler which gives 9.2 \pm 1.2 dB conversion loss without tuning over the entire 80-120 GHz band have been fabricated.

SIS junctions tested for mixer use at 115 GHz have given poor results (~ 10 dB conversion loss) and poor reliability. Modifications in the junction fabrication technique are planned.

Six FET amplifiers operating in the 1.0 to 1.7 GHz range have been completed for use as replacements for paramps in Green Bank. A two-stage 15 GHz amplifier giving 60 K noise temperature and 20 dB gain has been constructed. This type of amplifier will be used to increase VLA sensitivity by a factor of 3 at a wavelength of 2 cm.

Green Bank

An investigation of a future VLBI correlator using recirculating techniques has been started.

The C-band subsystem of the 140-foot maser receiver was tested during this quarter. System temperature at zenith is 50 K or less from 4.7 GHz to 7.0 GHz, 40 K or less from 5.0 GHz to 6.1 GHz, and 34 K or less from 5.7 to 6.1 GHz.

Four receivers, the 25 cm, 4-feet 21 cm, 21 cm, and 18 cm, are being retrofitted to use GASFET's as front-ends. The 25-cm is still in the system design stage, while the latter three are under construction and will be available in the fall.

One of the TPI 1054 tape drives is ready for testing at the telescope. A spare unit is under contruction.

Design of the final board, the filter/detector board, for the 256-channel, 2 MHz per channel, filter receivers is complete. The fabrication of the boards is now out for bids. All parts for these units are now in hand or on order.

Focus and polarization readouts for the 140-foot telescope have been procured and interfaced to the present system.

In an attempt to get a maser amplifier to span 18 GHz to 26 GHz, a new ruby structure was machined, with tolerances closely maintained. The new structure phased very nicely, and preliminary tests indicate that the desired frequency coverage is achievable.

Field patterns and return losses of the C and X band feeds for the 140-foot Cassegrain system have been measured to verify the design. The

radiation pattern of a 3-cm dual hybrid mode feed was optimized and its efficiency measured.

A JPL program to analyze scatter from a generalized surface, given the incident field and surface, has been modified to some extent and used to analyze the performance of the subreflector on the 140-foot telescope.

All modules, except the Analog Reproduce Modules, and heads for the second NRAO Mark III VLB system were delivered to the VLA and tested. Except for some minor bugs, the system is operational. A second version of the Analog Reproduce Modules is now under construction, since the design of the first set resulted in poor signal-to-noise ratio. The heads have been partially tested, and no problems are anticipated with them.

A reflector for the upgraded interferometer link has been purchased. Design on both the upgraded and new links is in progress.

Spare upconverters for the 300 to 1000 MHz receiver have been fabricated and tested. A report documenting the upconverters is in press.

Tucson

During this quarter, the 200-235 GHz receiver has been tested on the telescope. The noise temperature was slightly over 800 K SSB, the aperture efficiency of the telescope was 5 percent and the beam efficiency approximately 40 percent.

A new, fast beam-switching device for continuum use has been tested at a wavelength of 3 mm, and we now have a sensitivity of 1.5 Jy in one second. This is an improvement of 1.4 over our present sensitivity.

A new calibration system has been tested during this quarter. This calibration scheme used a cooled chopper and will permit more accurate calibration of spectral line data.

COMPUTER DIVISION

VLA Post-Processing

Two mega-bytes of solid-state memory have been added to the VAX 11/780, bringing the total capacity to three mega-bytes.

Six Visual 400 terminals have been purchased for the VAX. Four are located in the CRT room and the others will be placed in strategic locations elsewhere.

The following improvements to the astronomical imaging processing system have recently been made: Syntax modification for minimum matching, additional u-v mapping capability, implementation of a self-calibration algorithm, one-dimensional/profile software, TV wedge and Roam software. The AIPS on the VAX at the VLA is being used to capacity. AIPS software is being exported to several institutions' VAX computers.

VERY LARGE ARRAY

The array was scheduled for observations 62 percent of the time during the second quarter.

During the quarter, the DEC 10 upgrade components (a DEC 10 KL and a VAX) were received. The conversion to the DEC 10 KL and the installation of the DEC NET software in the DEC computers at the site was also begun.

The array was reconfigured to the B array on 27 April. A major structural failure on transporter No. 2 was successfuly repaired. A MK III VLBI terminal was delivered to the site from Green Bank in June. Installation and testing of the unit were completed, giving the VLA full VLBI observing capability with both MK II and MK III recording systems. A new observing mode --the "autocorrelation mode"--was introduced during the quarter. In this mode, the digitized IF signals from many antennas are added together to create a pseudo-IF signal. This pseudo-IF is then fed back into the correlator in place of two antennas so that its spectrum can be measured. The technique is essentially the same as using the VLA as a large single-dish spectrometer.

ENGINEERING DIVISION

Preliminary planning was started for the assembly and measurement of a new 12-meter surface and back-up structure for the 36-foot. Conceptual designs for a 12-meter back-up structure were developed. The conceptual designs and procedures for measuring and setting the 12-meter surface were started.

Sites for the passive reflectors and the antenna for the addition to the interferometer were reviewed and definite locations decided upon. Specifications were completed and an RFP issued for a new antenna for the interferometer addition.

A procedure was developed and parts fabricated to relocate the adjustable feed mount in the focal point structure of the 140-foot. Design of the interface for a new read-out system on the 140-foot adjustable feed mount was completed and parts fabricated.

Routine engineering assistance was provided operations and maintenance at Charlottesville, Green Bank, Tucson, and Socorro. PERSONNEL

Appointments

R.	W. Lowe	Scientific Programmer I	04/13/81
R.	P. Escoffier	Electronics Engineer I	04/27/81
с.	L. Sarazin	Visiting Associate Scientist	05/18/81
D.	C. Wells	Systems Scientist	06/15/81
Μ.	P. Sierra	Visiting Elect. Engineer I	06/10/81
J.	Ulvestad	Research Associate	06/23/81
Ρ.	E. Palmer	Visiting Scientist	06/19/81

Terminations

s.	т.	Gottesman	Visiting Scientist	05/29	/81
5.	1.	Gollesman	visiting scientist	· UJ/2:	7

Return from Leave of Absence

s.	R.	Spangler	Associate Scientist	05/25/81
K.	I.	Kellermann	Senior Scientist	06/22/81

Changes in Status

B.	G.	Clark	Senior Scientist	07/01/81
J.	Μ.	Dickey	Associate Scientist	07/01/81
G.	R.	Gisler	Associate Scientist	07/01/81
R.	J.	Havlen	Associate Scientist	04/01/81
F.	J.	Lockman	Assistant Scientist	07/01/81

SUMMER STUDENT PROGRAM

Announcements of the summer student program were sent to over 100 colleges and universities in November 1980. From the applications received, 21 students were chosen to participate in the program as research assistants to the scientific staff and in the electronics and computer divisions. Fourteen students are working in Charlottesville, one in Green Bank, and six in Socorro. A series of lectures is being given by the staff on various topics in radio astronomy and instrumentation. Students also attend the regular NRAO colloquia and seminars. They will each spend one week in Green Bank assisting in the Public Education Program of the Observatory.

US/GR BK/

NATIONAL RADIO ASTRONOMY OBSERVATORY Charlottesville, Virginia

Quarterly Report

RADIERTH GF THE TOO GO THAMEIT RADIO ASTRONOMY OBSERVATORY CHARLOTTESVILLE, VA.

July 1, 1981 - September 30, 1981

NOV 0 4 1981

RESEARCH PROGRAM

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140-foot Telescope	Hours
Scheduled observing Scheduled maintenance and equipment changes	17 99. 00 221.00
Scheduled tests and calibration	188.00
Time lost due to: equipment failure	154.75
power	5.50
weather	0.50
interference	0.50

The following line programs were conducted during this quarter.

<u>No.</u>	Observer(s)	Program
R-172	L. Rodriguez (Mexico) G. Garay (CFA)	Observations at 3.3 GHz of the H125α recombination line in extended HII regions.
B-346	R. Brown	Search at 9 cm for stimulated radio recombination line emission from quasars.
W-161	S. Federman (Texas) R. Willson (Tufts)	Observations at 3.335 GHz of the F=1-1 transition of CH in the direction of bright stars.
B-311	P. Bowers (NRL)	Studies of 18 cm OH emission from unidentified Type II OH/IR stars.
R-166	L. Rickard (Howard)	Observations at 6.3 cm to measure the ${}^{2}\pi_{\frac{1}{2}}$, J= ¹ / ₂ transition of OH in DR21.
R-170	B. Lewis (Carter Obs., New Zealand) L. Rickard (Howard)	Observations at 4990 MHz to search for H_2CO in anomalous absorption in the disks of other galaxies.

No.	Observer(s)	Program
G-201	M. Claussen (Iowa) J. Fix (Iowa) M. Cobb (Iowa)	Observations at 5 cm of excited state OH maser emission from AU Gem.
V-38	R. Loren (Texas) P. Vanden Bout (Texas) R. W. Wilson (Bell Labs) H. Wootten (Caltech)	Observations of 6.3 GHz H ₂ CS (thio- formaldehyde) in selected molecular clouds.
S-224	P. Jewell (Illinois) L. Snyder (Illinois) M. Schenewerk (Illinois)	Observations at discrete frequencies in the range of 5 to 6 cm to search for excited OH emission toward late-type stars.
B-347	R. Brown	Observations at 2.8 and 9 cm to measure H and He recombination lines in 28 of the brightest galactic HII regions.
T-156	I. Kazes (Meudon, France) B. Turner	Study of extended 1720 MHz OH emission in the galactic plane and a survey of the new spiral arm beyond the sun in the 18-cm OH lines.
К-262	M. Kutner (Rensselaer) D. Machnik (Illinois)	Search at 10.5 GHz for carbon recombination lines in reflection nebulae.
M-182	M. Bell (NRC, Canada) H. Matthews (NRC, Canada) T. Sears (NRC, Canada)	Survey near 7.3 GHz for excited rotational states of CH.

M-184 H. Matthews (NRC, Canada) T. Oka (NRC, Canada) T. Sears (NRC, Canada)

R-173 L. Rickard (Howard)

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Search at 9.48 GHz for the lower rotational states of H_2C = CH-CN (vinyl cyanide).

Search for the 3-cm fine structure transition of hydrogen.

The following continuum program was conducted during this quarter.

<u>No.</u>	Observer(s)	Program
P-125	R. Price (New Mexico) P. Crane	Observations at 10.52 GHz to search for a suspect gamma ray source.
The following pulsar program was conducted during this quarter.

Observer(s)

T-149 J. P. R. M.	Taylor (Princeton) Backus (Massachusetts) Burkhardt (Massachusetts) Damashek	Observations at 300-410 MHz to determine pulse arrival times of PSR 0655+64 and PSR 0820+02.

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

B - Effelsburg 100-m J - Jodrell	1 Bank 250-ft
F - Fort Davis 85-it K - Haystad	CK 120-IT
G - Green Bank 140-ft 0 - Owens V	/alley 130-ft
H - Hat Creek 85-ft Wn - Westerh	oork, n=1-14x26m
I – Iowa 18-cm Yn – VLA Soc	corro, $n=1-27x25m$

Observer(s) No.

T. Clark (Goddard)

W. Erickson (Maryland)

C. Knight (Phoenix Corp.)

D. Shaffer (Phoenix Corp.)

V-1V

No.

W-11V	R. Booth (Manchester)	Observations at 609 MHz of suspected low-
	P. Wilkinson (Manchester)	frequency variable radio sources with
	T. Pearson (Caltech)	telescopes J, F, I, O, and G.
	A. Readhead (Caltech)	

Observations at 610 MHz to measure apparent angular diameters and proper motions of selected pulsars with telescopes F, K, O, and G. N. Vandenberg (Phoenix Corp.)

Program

Program

- S-17V T. Jones (Minnesota) Observations at 6 cm to test models for R. Mutel (Iowa) compact source spatial shapes with S. Spangler telescopes B, F, H, I, K, O, Yn, and G.
- W-12V F. Briggs (Pittsburgh) Observations at 6 cm to measure the K. Johnston (NRL) structure of A0235+164 with telescopes A. Wolfe (Pittsburgh) B, Wn, F, K, N, O, Yn, and G.
- W-14V G. Seielstad (Caltech) Observations at 6 cm of superluminal S. Unwin (Caltech) motions in 3C 120 with telescopes B, F, J. Benson H, K, O, Yn, and G. R. Walker
- P-20V I. Pauliny-Toth (MPIR) Observations at 6 cm of 3C 454.3 and K. Kellermann 2134+004 with telescopes B, F, H, K, O, and G.

No.	Observer(s)	Program
P-19V	R. Porcas (MPIR)	Observations at 6 cm of "optically quiet quasars" with telescopes B, F, K, O, and G.
P-22V	B. Corey (MIT) I. Pauliny-Toth (MPIR) R. Porcas (MPIR) D. Shaffer (Phoenix Corp.)	Observations at 6 cm of "optically selected quasars" with telescope B, K, and G.
P-23V	H. Aller (Michigan) R. Mutel (Iowa) R. Phillips (Kansas)	Observations at 6 cm to continue the monitoring of the apparent superluminal expansion of BL Lac with telescopes B, F, H, I, K, O, Yn, and G.
R-13V	T. Pearson (Caltech) A. Readhead (Caltech)	Observations at 4990 MHz of sources selected from the S4 and S5 catalog with telescopes B, F, K, O, and G.

300-foot Telescope	Hours
Scheduled observing	1743.50
Scheduled maintenance and equipment changes	289.00
Scheduled test and calibration	175.50
Time lost due to: equipment failure	9.50
power	3.00
weather	0.00
interference	0.00

The following line program was conducted during this quarter.

<u>No.</u>	<u>Obser</u>	ver(s)	Program
B-348	K. Mitchell R. Brown	(Penn State)	Search between 1000 and 1420 MHz for redshifted 21-cm hydrogen absorption lines toward bright quasars.
	The following	continuum programs	were conducted during this quarter.

<u>No.</u>	<u>Obse</u>	rver(s)	Program
к-266	G. Kojoian	(Wisconsin)	Observations at 4.7 GHz of loose galaxies exhibiting strong ultraviolet continua and those of high surface brightness.

<u>No.</u>	Observer(s)	Program
D-128	B. Dennison (VPI & SU)	Observations at 1400 MHz to confirm highly extended structures in 3C 293 and 3C 345.
B-33 9	J. Broderick (VPI & SU) B. Dennison (VPI & SU) J. Ledden (VPI & SU) S. O'Dell (VPI & SU) H. Payne (VPI & SU) J. Condon	Observations at 900 and 1400 MHz of low- frequency variables.
SS-1	D. Crocker (Virginia) J. Lewis (Virginia) R. Nakatsuka (Virginia) E. Sturgis (Michigan) R. Skuppin (Iowa) D. Tucker (Stanford) S. Ratcliff (Princeton) D. Wolpert (Princeton) G. Gisler	Observations at 6 cm of selected BL Lac objects and QSOs.
B-359	C. Bennett (MIT) B. Burke (MIT) J. Hewitt (MIT) C. Lawrence (MIT)	Survey at 6 cm of sources at 0 ⁰ <δ<20 ⁰ .
B-335	T. Balonek (Massachusetts) W. Dent (Massachusetts) C. O'Dea (Massachusetts)	Polarization and flux density measurements of variable radio sources at 2695 MHz.
G-255	P. Gregory (British Columbia) R. Taylor (British Columbia)	Variable source survey of the galactic plane at 6 cm.
	36-foot Telescope	Hours
	Scheduled observing Scheduled maintenance and equipme Scheduled tests and calibration Time lost due to: telescope equipment weather interference	ent changes 1221.50 124.50 1.50 17.50 77.50 0.00

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No.	Observer(s)	Program
B-371	L. Blitz (Calif., Berkeley)	Search for extragalactic CO in M33, Seyferts and Zwicky 18 and 14.
C-199	F. Clark (Kentucky) T. Troland (Kentucky) D. Johnson (NBS)	Systematic study of SiO maser processes.
D-126	W. Dent (Massachusetts) R. Hobbs (Goddard) T. Balonek (Massachusetts)	Evolution of extragalactic radio sources at millimeter wavelengths.
F-82	Y. Fukui (Nagoya Univ.) S. Deguchi (Haystack)	Search for interstellar diacetylene.
H-166	L. Blitz (Calif., Berkeley) P. Ho (Calif., Berkeley)	A test of the usefulness of ¹² CO as a galactic tracer.
L-161	C. Lada (Arizona)	Study of high-velocity gas toward broadwing CO sources.
L-162	H. Liszt W. B. Burton (Minnesota)	Study of the spatial and kinematics of CO emission in the galactic core.
R-180	L. Rickard (Howard) P. Palmer (Chicago)	Search for CO emission and mapping of CO structure in galaxies
R-183	L. Rodriguez (Mexico) J. Canto (Mexico) N. Calvet (CIDA, Venezuela)	Observations of $12CO$ and $13CO$ in selected Be and Ae stars.
S-23 5	J. Sewall (Maryland) P. Wannier (Caltech) J. Stacy (Maryland)	Observations of CO associated with distant HII regions in Perseus.
S-241	S. Spangler W. Cotton	Multifrequency monitoring of low-frequency variables.
T-154	H. Thronson (Arizona) C. Lada (Arizona)	Study of high-density structure in high- velocity molecular clouds.
T-1`55	H. Thronson (Arizona) C. Lada (Arizona)	CO maps of molecular clouds surrounding M17.

Very Large Array

The quarter was scheduled 100 percent of the time.

Astronomical	1578.7 hours	(71.3 percent)
Test	635.3 hours	(28.7 percent)

The average downtime was 4.45 percent.

The following research programs were conducted with the VLA during this quarter.

No.	Observer(s)	Program
AA 9	P. Angerhoffer (USNO) B. Balick (Washington) D. Milne (CSIRO) R. Perley	Evolution of small-scale structure in Cas A and Tycho supernova remnants. 6 cm.
AA 11	D. Abbott (JILA) J. Bieging (Calif., Berkeley)	Mass loss from OB associations. 6 cm.
AA 14	H. Andernach (MPIR, Bonn)	Large head-tail source NGC 7385. 20 cm.
AB 120	B. Balick (Washington) G. Boeshaar (Washington)	Bubble nebulae: NGC 2359, 6302, 6826, 6888 and 7635. 2, 6, and 20 cm
AB 126	J. Benson K. Johnston (NRL)	Masers in compact HII regions. 1.3 and 20 cm (includes 3^{h} line).
AB 129	B. Burke (MIT) D. Roberts (Brandeis) P. Greenfield (MIT)	Monitoring double QSO 0957+561. 6 cm.
AB 136	F. Bash (Texas) M. Kaufman (Ohio State)	Central part of M81. 6 and 20 cm.
AB 137	A. Barrett (MIT) T. Armstrong (MIT) P. Ho (Calif., Berkeley) S. Vogel (Calif., Berkeley)	Ammonia in Sgr A. 1.3 cm line.
AB 140	R. C. Bignell	Dumbbell nebula (NGC 6853). 6 and 20 cm.
AB 143	B. Burke (MIT) C. Bennett (MIT)	Source survey in support of 140-ft background fluctuation measurement. 6 and 20 cm.
AB 144	B. Burke (MIT) J. van der Hulst (Minnesota)	Interacting galaxies NGC 4038-39. 21 cm.

No.	Observer(s)	Program
AB 147	B. Balick (Washington) E. Skillman (Washington)	"Jumbo" HII regions in NGC 2366 and NGC 3310. 21 cm line.
AC 32	J. Crovisier (Meudon) J. Dickey I. Kazes (Meudon)	HI toward Verschuur's Cloud A. 21 cm line.
AC 33	R. Crutcher (Calif., Berkeley) J. Bieging (Calif., Berkeley)	OH absorption toward Cas A and NGC 2024. 18 cm line.
AD 43	I. de Pater (Arizona) J. Dickel (Illinois) T. Owen (SUNY, Stony Brook) D. Hunten (Arizona) B. Smith (Arizona)	Saturn. 1.3 2, 6, and 20 cm.
AD 45	J. Dreher R. Ekers S. Simkin (Michigan State)	Hot spots in galaxies. 6 cm.
AD 46	G. Dulk (Colorado)	EUV rocket flight and search for cyclotron lines in the sun. 1.3, 2, 6, and 20 cm.
AD 49	A. Downes (Cambridge, UK) J. van Gorkom G. Hunt C. Salter (Bologna)	Total power and polarization of SNRs. 20 cm.
AD 50	L. Dressel (Goddard) R. Ekers	Extended sources in SO galaxies. 20 cm.
AD 51	J. Dickey J. van Gorkom S. Kulkarni (Calif., Berkeley) C. Heiles (Calif., Berkeley)	Low-latitude 21 cm absorption. 21 cm line.
AF 36	E. Feigelson (MIT) J. Burns (New Mexico) E. Schreier (CFA)	The jet in Centaurus A. 6 cm.
AF 37	J. Fix (Iowa)	Positions for unidentified OH sources. 18 cm line.
AF 38	M. Felli (Arcetri, Itlay) M. Massi (Arcetri, Italy) H. Staude (MPIR, Bonn)	Bipolar nebula $M1-19 = S106$. 1.3 and 2 cm.

No.	Observer(s)	Proposal
AG 63	B. Geldzahler (MIT)	Central region of SNR 3C 58. 20 cm.
AG 65	B. Geldzahler (MIT)	Objects resembling Sco X-1. 6 and 20 cm.
AG 67	B. Geldzahler (MIT) N. Cohen (MIT)	HD44179, the Red Rectangle. 20 cm.
AG 68	G. Garay (CFA) J. Moran (CFA) M. Reid (CFA)	Recombination lines from compact HII regions with masers. 1.3 cm.
AG 71	A. Gower (Victoria, Canada)	IC 310. 2, 6, and 20 cm.
AG 72	D. Gibson (NMIMT) P. Fisher (NMIMT) D. Helfand (Columbia)	Confirmation of radio stars found with 300-ft telescope. 6 cm.
АН 60	V. Hughes (Queen's, Canada) J. Wouterloot (Leiden)	Cep OB-3 star formation region. 6 cm.
AH 65	D. Helfand (Columbia) R. Becker (Columbia) K. Long (Columbia)	Small diameter SNR. 2 and 6 cm.
АН 67	P. Ho (Calif., Berkeley) R. Martin (MPIR, Bonn)	Ammonia in spiral galaxy IC 342. 1.3 cm line.
AH 69	E. Hummel (New Mexico) J. van der Hulst (Minnesota)	Barred spiral NGC 1097. 6 and 20 cm.
АН 70	E. Hummel (New Mexico) J. van der Hulst (Minnesota) W. Golisch (Minnesota)	High frequency radio emission from a sample of spirals. 2 and 6 cm.
AH 71	G. Hunt C. Salter (Bologna, Italy) J. van Gorkom	Seven suspected SNR's. 21 cm.
AJ 65	K. Johnston (NRL) H. Kuhr (Arizona) P. Strittmatter (Arizona)	The S5 sample. 2, 6, and 20 cm.
AJ 67	D. Johnson (Battelle) S. T. Gottesman (Florida)	HI in NGC 185 and NGC 205. 21 cm line.

Proposal Observer(s) No• Formaldehyde in molecular clouds. 6 cm K. Johnston (NRL) AJ 68 line. T. Wilson (MPIR, Bonn) C. Henkel (MPIR, Bonn) J. Martin (MPIR, Bonn) J. Bieging (Calif., Berkeley) Radio emission from quasar X-ray jets. K. Johnston (NRL) AJ 69 6 and 20 cm. P. Biermann (MPIR, Bonn) H. Kuhr (MPIR, Bonn) A. Witzel (MPIR, Bonn) P. Strittmatter (Arizona) Formaldehyde in Orion A. 6 cm line. AJ 70 K. Johnston (NRL) P. Palmer (Chicago) J. Bieging (Calif., Berkeley) T. Wilson (MPIR, Bonn) Continuum and water masers in W49 N. K. Johnston (NRL) AJ 71 1.3 cm line and 6 cm continuum. H. Mark (NRL) J. Dreher R. C. Walker J. Welch (Calif., Berkeley) AFGL 618--nascent planetary nebula? S. Kwok (NRC, Canada) AK 47 1.3, 2, 6, and 20 cm. R. C. Bignell SNR in M33. 6 and 20 cm. C. Kumar (Howard) AK 48 L. Rickard (Howard) Solar active regions and flares. 1.3, M. Kundu (Maryland) AK 51/ 2, 6, and 20 cm. E. Schmahl (Maryland) AS 90 M. Bobrowsky (Maryland) F. Erskine (Maryland) X-ray SNR in M33. 6 and 20 cm. AL 35 K. Long (Columbia) R. Becker (Columbia) Prolate jet galaxy NGC 3801. 6 and AL 36 R. Laing 20 cm. C. Jenkins (Cambridge, UK) Coronae of late-type stars. 6 and 20 cm. J. Linsky (JILA) AL 37 D. Gary (JILA) Formaldehyde absorption toward Sgr A AL 42 H. Liszt (west). 6 cm. R. Ekers J. van der Hulst (Minnesota) W. B. Burton (Minnesota)

]	No.	Observer(s)	Program
AM	40	J. Moran (CFA) G. Garay (CFA) M. Reid (CFA) R. Genzel (CFA)	Compact HII regions in the Orion molecular cloud. 2 and 6 cm.
AM	44	R. Mutel (Iowa) S. Kulkarni (Calif., Berkeley) J. Dickey	VLB survey of Scintars. 18 cm.
AO	20	F. Owen J. Puschell	Search for central component in 3C 61.1. 2 cm.
A 0	26	J. Ostriker (Princeton) E. Turner (Princeton) J. Condon	Normal high-redshift galaxies. 6 cm.
AP	37	V. Pankonin (NSF) F. Gardner (CSIRO) J. Whiteoak (CSIRO)	Formaldehyde absorption against Agr A and Sgr B2. 6 cm line.
AP	49	P. Palmer (Chicago)	Hydrogen absorption in clusters with cooling cores. 21 cm line.
AR	44	L. Rickard (Howard) T. Bania (Virginia) B. Turner	Molecular disks in the nuclei of late- type galaxies. 18 cm line.
AR	52	J. Robertson (AAO, Australia) R. Hunstead (Sydney, Australia)	Sources for the Molonglo catalog. 20 cm.
AS AW	75/ 50	D. Shaffer (Goddard) T. Clark (Goddard) N. Vandenberg (Phoenix Corp.) R. C. Walker J. Wrobel (Toronto)	Reference sources for VLBI astrometry. 6 and 20 cm.
AS	79	S. Spangler W. Cotton	Multifrequency monitoring of low- frequency variables. 1.3, 2, 6, and 20 cm.
AS	80	R. Sramek J. van der Hulst (Minnesota) K. Weiler (NSF)	Supernova in M100 and NGC 6946. 2, 6, and 20 cm.
AS	85	J. Stocke (Arizona) W. Christiansen (North Carolina) J. Burns (New Mexico)	Quasars 4C 25.01 and 4C 28.59. 20 cm

No.	Observer(s)	Program
AS 88	K. Sellgren (Caltech) R. White (Columbia) R. Becker (Columbia) S. Pravdo (Caltech)	Reflection nebulae NGC 7023, 2023, 2068, and 1999. 6 and 20 cm.
AS 91	E. Seaquist (Toronto) M. Bell (NRC, Canada) R. C. Bignell	H110 α recombination line maser in the nucleus of M82. 6 cm line.
AS 92	R. Strom (NFRA, Netherlands) W. van Breugel (KPNO) J. Robertson (AAO, Australia)	Distorted source 4C 59.08. 6 cm.
AS 94	 M. Simon (SUNY, Stony Brook) G. Righini-Cohen (SUNY, Stony Brook) M. Felli (Arcetri, Italy) 	Compact BN-type objects. 1.3 and 2 cm.
AS 95	M. Simon (SUNY, Stony Brook) L. van Speybroech (CFA) R. Hjellming	The bulge of M31. 6 and 20 cm.
AS 97	L. Smarr (Illinois) D. Sumi (Illinois) R. Ekers	Luminosity function of contact elliptical galaxies. 6 and 20 cm.
AS 99	O. Slee (CSIRO, Australia)	Steep-spectrum sources in galaxy clusters. 20 cm.
AS 100	G. Shostak (Groningen) R. Sanders (Groningen) R. Ekers J. van Gorkom	HI absorption in radio galaxies. 21 cm line.
AS 101	G. Shostak (Groningen) E. Hummel (New Mexico)	HI absorption in halo of our galaxy. 21 cm line.
AS 102	S. Spangler R. Laing	Radio galaxy 3C 192. 20 cm.
AS 107	M. Stevens (Calif., Berkeley) C. Heiles (Calif., Berkeley) S. Kulkarni (Calif., Berkeley) J. Bieging (Calif., Berkeley) J. Dickey	OH absorption in galactic nuclei. 18 cm line.

Program Observer(s) No. OH absorption in galactic nuclei. 18 cm. M. Stevens (Calif., Berkeley) AS 108 B. Baud (Leiden) Ammonia in Orion. 1.3 cm line. C. Townes (Calif., Berkeley) AT 19 S. Subramanian (Calif., Berkeley) D. Matsakis (USNO) A. Hjalmarson (Onsala) P. Palmer (Chicago) (Calif., Davis) A. Cheung Ammonia in Sgr B2. 1.3 cm line. (Calif., Berkeley) C. Townes AT 20 R. Genzel (Calif., Berkeley) S. Vogel (Calif., Berkeley) (Calif., Berkeley) P. Ho D. Matsakis (USNO) P. Palmer (Chicago) Massive star formation in nearby spiral J. Turner (Calif., Berkeley) AT 21 nuclei. 1.3, 2 and 6 cm. (Calif., Berkeley) P. Ho Monitoring extragalactic supernovae. 2, J. van der Hulst (Minnesota) AV 52 6, and 20 cm. R. Sramek (NSF) K. Weiler Central source in M31. 20 cm. (Minnesota) J. van der Hulst AV 53 P. Crane R. Brown M. Ondrechen (Minnesota) OH absorption in Sgr B2. 28 cm. S. Vogel (Calif., Berkeley) AV 55 P. Ho (Calif., Berkeley) R. Genzel (Calif., Berkeley) D. Watson (Calif., Berkeley) 4C 26.42 and 4C 29.30: Radio galaxies AV 57 W. van Breugel (KPNO) with optical emission lines in the lobes. T. Heckman (Arizona) 6 and 20 cm. G. Miley (Leiden) H. Butcher (KPNO) Disks of spiral galaxies M51 and J. van der Hulst (Minnesota) AV 59 NGC 6946. 2, 6 and 20 cm. P. Crane R. Kennicutt (Minnesota) R. Allen (Groningen) Halo of NGC 253. 6 and 20 cm. J. van der Hulst (Minnesota) AV 60 E. Hummel (New Mexico) M. Ondrechen (Minnesota)

No.	Observer(s)	Program
AW 51	J. Wall (Royal Greenwich Obs.) E. Fomalont K. Kellermann	Deep survey. 6 cm.
AW 53	L. Weliachew (Grenoble) E. Fomalont E. Greisen	HI and OH absorption in M82. 18 and 21 cm line.
AW 56	C. Wade R. Perley	Optically flaring quasar 1156+295. 1.3, 2, 6 and 20 cm.
AZ 13	H. Zirin (Caltech) K. Marsh (Caltech) G. Hurford (Caltech) K. Topka (Caltech)	Solar flares and active regions. 1.3, 2, 6, and 20 cm.
AZ 14	H. Zirin (Caltech) K. Marsh (Caltech) G. Hurford (Caltech)	Large-scale structures of solar flares. 2 and 6 cm.
VG 13	B. Geldzahler (MIT) D. Shaffer (Goddard) N. Cohen (Cornell)	CTB 80. 6 cm Mark III VLB.
VG 16	B. Geldzahler (MIT) E. Fomalont	Sco X-1. 6 cm Mark III VLB.
VS 17	S. Spangler R. Mutel (Iowa) T. Jones (Minnesota)	Spectral component spatial isolation. 6 cm VLB.
VW 12	A. Wolfe (Pittsburgh) F. Briggs (Pittsburgh) K. Johnston (NRL)	AO235+164. 6 cm VLB.
VW 14	R. C. Walker G. Seielstad (Caltech) S. Unwin (Caltech) J. Benson	3C 12O superluminal motion. 6 cm VLB.

ELECTRONICS DIVISION

Green Bank

Extensive performance tests of the cooled-GASFET 18-cm receiver were performed. The receiver has been installed on the telescope, has proven stable and reliable, and has achieved the expected $T_{\rm sys}$ of about 50 K. The bandpass is presently defined by RF filters to be 1560 MHz to 1760 MHz.

The cooled-GASFET 21-cm receiver is undergoing system integration and test. It will be ready in November.

The maser amplifier for the second channel of the 140-foot Cassegrain receiver system is complete. A decision was reached not to try to extend the bandpass of this amplifier to 26 GHz, as this required extensive redesign. This amplifier will be integrated into a system over the next 10 to 12 months.

Both TPI 1054 tape drives are now in service at the 300-foot telescope. A report documenting these is in press.

Printed circuit boards for the two 256-channel, 2 MHz/channel filter receivers are now being fabricated. An automatic test system for testing and tweeking the filters is being designed and evaluated.

The design and debug of the new interferometer inductosyn interface is complete; construction of the cards and chasses is in progress.

Possible approaches for obtaining a time/frequency standard for the VLA are being studied. These include both conventional time/frequency standards, such as hydrogen masers, and satellite-based systems.

Efforts to characterize and optimize the Q-band maser, with sufficient pump power, are underway. Preliminary results indicate a tuning range of 41.5 GHz to 44.5 GHz, with an instantaneous bandwidth of 40 MHz.

A report has been written documenting NRAO's modifications to a JPL program to calculate diffraction patterns from a generalized surface and detailing much of the theory involved.

The remainder of the hardware required to complete the Mark III VLBI system at the VLA was built, tested, and delivered. The performance of the reproduce heads turned out to be poor. However, replacement of these heads with new high-density heads about a year away has not been deemed cost-effective. Assistance was provided for the first Mark III experiment at the VLA.

System design of the additional baseline to the interferometer is progressing. Several designs for the microwave links are being evaluated.

Charlottesville

A compact, all solid-state 230 GHz receiver, giving a SSB receiver temperature of 1250 K at room temperature, has been completed. The receiver utilizes NRAO-developed gunn oscillator, tripler, and mixer. It will be used for telescope and atmospheric tests at the 36-foot telescope. A cooled-mixer operating at 230 GHz with a 460 K SSB receiver noise temperature has been completed. This is believed to be the lowest noise mixer receiver contructed at that wavelength except for very narrow-band InSb receivers.

A new batch of superconducting tunnel junctions has been fabricated at NBS and are being evaluated. Progress is being made on fabrication of niobium-lead junctions through contract with the University of Virginia.

Development work of GASFET amplifiers at 15 GHz and, recently, 10.7 GHz continues. A 3-stage, 10.7 GHz amplifier giving 30 dB gain, 1.5 GHz bandwidth, and 30 K noise temperature has been constructed. A noise temperature of 7.2 K \pm 0.5 K has been measured for a 1.4 GHz amplifier, and two amplifiers of this type have been delivered to the VLA.

A liquid-nitrogen noise temperature standard has been developed. Investigations of a next-generation VLBI processor and also data recording techniques continue.

During this quarter, 20 technical visitors, including 14 from 8 foreign countries, came to the laboratory predominantly to look at the results which have been obtained on GASFET amplifiers and millimeter-wave mixers and multipliers.

Socorro

A dual-channel maser receiver, built at Green Bank, was installed on antenna 09 as a preamplifier ahead of the existing 22.24 GHz cooled mixer receiver. This will provide good sensitivity on one antenna for VLBI and spectral-line experiments. The system temperature of the new system is approximately 90 K, and work will continue to lower this to the goal of 70 K.

During the quarter, testing continued on antenna 22 to determine if coating the antenna with thermally insulating foam improves the pointing performance of the antenna. The tests indicate that the effect of temperature differentials on this antenna are significantly reduced.

ENGINEERING DIVISION

Detail design continued on a reference jig, a template and other components to be used in measuring and setting the surface of the 12-meter diameter antenna. Preliminary design of the electronics hardware interface for the new structure was started. Design of the backup structure for the 12-meter diameter antenna was completed and drawings were sent out for proposals to fabricate the structure.

Assistance was provided 36-foot operations in overhauling and servicing the dome door.

Engineering assisted in soliciting and evaluating proposals for a new antenna for the interferometer addition.

COMPUTER DIVISION

VLBI

The cross assembler which enables Varian source code to be assembled into Varian object code on the IBM computer has been rewritten and is now capable of acceping the Sperry Univac V77-400 instruction repertoire.

An AM9511 arithmetic processing unit has been interfaced to the V77-400. Although slow by modern hardware standards, this device provides programs with floating point capability and all common transcendental functions.

As a consequence of these two improvements to the VLBI system, record averaging software has been added to the on-line program. This software is now in final checkout stage.

Green Bank

A Tektronix 4012 graphics CRT terminal has been purchased for the lab Modcomp. This terminal will also be used to communicate with the Charlottesville DEC VAX 11/780 computer, giving observers at Green Bank access to the image processing system at Charlottesville.

Image Processing

A System Industries 9-track, triple density tape drive has been added to the VAX 11/780 computer. This gives reading and recording densities of 800, 1600, and 6250 BPI. The hardware for the star chart measuring machine is basically complete. Upon completion of software, digital TV images will be read into the VAX where positions will be determined accurately and automatically.

<u>Socorro</u> The major event in this quarter was the completion of the DEC-10 upgrade. At the end of July, the old processor was prepared for shipment; in the second week of August the new processor was released to users. The programs that run exclusively on the DEC-10 have been running successfully since the change-over. There have been, however, several problems that have caused the communication between the DEC-10 and the other computer systems to be unreliable. The most important of these are the real-time transfer of data from the synchronous system to the DEC-10 and the transfer of mapping requests to the PDP-11/70 (MAPPER).

Since the AIPS system is gaining widespread support, both inside the Observatory and outside on other systems, due to the increased number of application programs available, the decision was made to use the VAX purchased with the new DEC-10 for post-processing under the AIPS system. The conversion will require additional hardware, which has been ordered, but will involve little software effort. It will serve to take part of the load from the DEC-10 in the area of map making rather than in calibration as was originally conceived.

The "pipeline" system comprising the PDP-11/70 (SORTER) and PDP-11/44 (GRIDER) is progressing. The system will be available for testing by users in the new year.

PERSONNEL

Appointments

E. R. Seaquist M. P. Havnes	Visiting Scientist Assistant Director, Green Bank	07/06/81
iii i naynes	Operations	09/14/81
R. Giovanelli	Systems Scientist	09/14/81
Changes in Status		
J. M. Benson	Research Associate to Systems Scientist	07/01/81

G .	C.	Hunt	Associate Division Head to	
			Head VLA Computer Division	07/01/81
J.	R.	Fisher	Assistant Director, Green Bank	
			Operations to Electronics	
			Engineer I	09/14/81

Terminations

Ρ.	E. Palmer	Visiting Scientist	09/19/81
J•	J. Puschell	Research Associate	07/24/01
G.	D. van Albada	Research Associate	07/28/81
J.	Dreher	Research Associate	08/13/81
J.	Basart	Systems Scientist	08/14/81
С.	L. Sarazin	Visiting Associate Scientist	08/18/81
W •	N. Brouw	Visiting Scientist	08/26/81

Leave of Absence

Μ.	B. Hagstrom	Electronics Engineer	09/01/81
W.	Jaffee	Systems Scientist	09/01/81

Return from Leave of Absence

C. R. Moore

08/01/81

NATIONAL RADIO ASTRONOMY OBSERVATORY Charlottesville, Virginia

CROCERTY G. THE C. S. GOLERIMENT GADIO ASTRONGMY OBSERVATORY CHARLOTTESVILLE, VA.

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Quarterly Report

JAN 2 9 1982

October 1, 1981 - December 31, 1981

RESEARCH PROGRAMS

140-foot Telescope	Hours
Scheduled observing	1955.75
Scheduled maintenance and equipment changes	179.25
Scheduled tests and calibration	1.00
Time lost due to: equipment failure	34.75
power	9.50
weather	133.25
interference	0.00

The following line programs were conducted during this quarter.

No.	Observer(s)	Program
T-156	I. Kazes (Meudon, France) B. Turner	Observations to study giant molecular clouds at the main 18 cm OH line frequencies.
т-145	B. Turner	Search within the 13-16 GHz range for new molecular species.
S-233	L. Buxton (Illinois) E. Campbell (Illinois) W. Flygare (Illinois) P. Jewell (Illinois) M. Schenewerk (Illinois) L. Snyder (Illinois)	Observations at 20.9 and 24.4 GHz to search for the HCN dimer (HCN) ₂ .
B-381	R. Brown	Observations at 5-cm to confirm and extend the detection of recombination line emission from 3C 245 and a search for this type of emission from other QSOs.
S-246	M. Bell (NRC, Canada) E. Seaquist (Toronto)	Search at 5 cm for recombination lines in compact extragalactic sources.

<u>No.</u>	Observer(s)	Program
M-176	L. Avery (NRC, Canada) N. Broten (NRC, Canada) J. MacLeod (NRC, Canada) H. Matthews (NRC, Canada	Observations at 18.2 GHz of the J=2→1 transition of HC ₃ N, generally toward dark clouds.

The following continuum programs were conducted during this quarter.

No.	Observer(s)	Program
C-194	M. Condon (unaffiliated) J. Condon K. Kellermann	Survey at 14.5 cm of extragalactic sources at all right ascensions whose $b > 10^{\circ}$ in the declination range of $30^{\circ} < \delta < +40^{\circ}$.
W-15 9	D. Wilkinson (Princeton) J. Uson (Princeton)	Observations at 1.3 cm to search for small-scale anisotropies in the cosmic microwave background.
к-273	J. Knapp (Princeton) D. Spergel (Princeton)	Observations at 1.3 cm of the "halo" planetary nebulae.

The following pulsar program was conducted during this quarter.

T-149	Ρ.	Backus (NASA, Ames)	Observations at 300-410 MHz to
	R.	Burkhardt (Massachusetts)	determine pulse arrival times
	J.	Taylor (Princeton)	of PSR 0655+64 and PSR 0820+02.
	М.	Damashek	

Program

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

B - Effelsburg 100-m J_{II}- Jodrell Bank MkII 80X120-ft N^{II}- NRL Maryland Point 85-ft C - Algonquin 150-ft D5 - Madrid DSN 64-m 0 - Owens Valley 130-ft E - South Africa Aries R - Crimea USSR 30-m F - Fort Davis 85-ft So - Onsala 26-m Km - Haystack 120-ft Kw - Westford 60-ft

No.

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T. Oka (Chicago)

Observer(s)

G - Green Bank 140-ft - Hat Creek 85-ft Н I – Iowa 60-ft Observer(s) No. M-19V F. Mantovani (MPIR) R. Porcas (MPIR) J. Romney (MPIR) P-26V R. Porcas (MPIR) P-25V H. Aller (Michigan) R. Mutel (Iowa) R. Phillips (Kansas) L-12V S. Unwin (Caltech) R. Laing G-21V B. Burke (MIT) G. Garay (CFA) A. Garcia (MIT) J. Moran (CFA) M. Reid (CFA) M. Schneps (CFA) H-3V D. Backer (Berkeley) M. Hodges (Iowa) R. Mutel (Iowa) J-13V A. Witzel (MPIR) K. Johnston (NRL) J. Spencer (NRL) W. Cotton E. Fomalont R. Perley B-23V J. Broderick (VPI & SU) A. Marscher (Boston) S-17V T. Jones (Minnesota) R. Mutel (Iowa) S. Spangler

Wn - Westerbork n=1-9x26m Yn - VLA Socorro n=1-27x25m

Program

Observations at 2.8 cm of faint radio sources having strong low-frequency variability with telescopes B, F, Km, O, and G.

Observations at 2.8 cm of the quasar 3C 179 with telescopes B, Km, O, and G.

Monitoring at 2.8-cm of apparent superluminal expansion in BL Lac with telescopes B, F, Km, O, and G.

Observations at $2.8 \, \mathrm{cm}$ of the central components in extended extragalactic radio sources with telescopes Km, 0, and G.

Observations at 18 cm to determine the spatial distribution of OH maser emission with telescopes F, Km, O, Yn, and G.

Polarization maps at 18 cm of compact extragalactic radio sources with telescopes F, H, Yn, and G.

Observations at 18 cm of a sample of compact radio sources with telescopes B, F, H, Km, N, O, Yn, and G.

Observations at 18 cm of the extremely luminous X-ray quasar NRAO 140 with telescopes B, F, H, Km, O, and G.

Observations at 18 cm to test models for compact source spectral shapes with telescopes B, F, H, I, O, Yn, and G.

No.	Observer(s)	Program
W-12V	F. Briggs (Pittsburgh) K. Johnston (NRL) A. Wolfe (Pittsburgh)	Observations at 18 cm to measure the structure of A 0235+164 with telescopes B, Wn, F, H, Km, N, O, Yn, and G.
R-15V	N. Bartel (MIT) R. Fanti (Bologna, Italy) A. Ficarra (Bologna Italy) L. Padrielli (Bologna, Italy) J. Romney (MPIR) K. Weiler (NSF)	Observations at 18 cm of sources having superluminal flux variations with telescopes of the European VLB network; the Crimea, USSR; the Hartebeesthoek, South Africa; the U.S. telescopes F, O, and G.
S-16V	G. Kaplan (USNO) C. Ma (Goddard) D. Shaffer (Phoenix Corp.)	Observations at 6 and 18 cm of lunar occultations of radio sources with telescopes F, Km, O, and G.
E-2V	P. Biermann (MPIR) A. Eckart (MPIR) K. Johnston (NRL) A. Witzel (MPIR)	Observations at 18 cm of 13 compact radio sources whose declinations are > + 70 [°] with telescopes of the European VLB network and the U.S. telescopes O, and G.
D-130	A. de Bruyn (NFRA, Netherlands) P. Wilkinson (Manchester)	Mapping at 18 cm of M82 with telescopes of the European VLB network and G.
G-256	L. Baath (Chalmers) D. Graham (MPIR)	Observations at 18 cm of the radio galaxy DA 240 with telescopes of the European VLB network and G.
V-41	<pre>J. Ball (CFA) R. Capallo (Haystack) W. Carter (NGS) T. Clark (Goddard) R. Coates (Goddard) C. Knight (Phoenix Corp.) G. Lundqvist (Chalmers) C. Ma (Goddard) D. Robertson (Nat. Geo. Survey) A. Rogers (Haystack) B. Rönnäng (Chalmers) J. Ryan (Goddard) D. Shaffer (Phoenix Corp.) I. Shapiro (MIT) N. Vandenberg (Phoenix Corp.)</pre>	Observations at S and X bands to study tectonic plate stability and relative motion, UTl and polar motion, and a survey for reference source with telescopes So, F, Km, Kw, O, and G.

A. Whitney (Haystack)

Observations at 22 GHz to determine M-13V D. Downes (IRAM, France) distances by the measure of proper G. Garay (CFA) R. Genzel (CFA) motions in H₂O maser sources with telescopes B, R, So, Km, O, Yn, A. Haschick (Haystack) J. Moran (CFA) and G. M. Reid (CFA) R. Ronnang (Chalmers) M. Schneps (CFA) Observations at 1.3 cm of the Galactic L-11V D. Backer (Berkeley) K. Lo (Caltech) Center with telescopes Km, Yn, and G. J. Moran (CFA) M. Reid (CFA) M-23V A. Moffet (Caltech) Observations at 1.3 cm of 3C 84 and R. L. Moore (Caltech) 3C 345 with telescopes B, C, Km, O, A. Readhead (Caltech) Yn, and G. R. Walker Polarization measurements at 6 cm of R-16V B. Burke (MIT) R. Potash (Brandeis) strong extragalactic radio sources D. Roberts (Brandeis) with telescopes Km, O, Yn, and G. A. Rogers (Haystack) J. Wardle (Brandeis) W-14V G. Seielstad (Caltech) Observations at 6 cm of superluminal S. Unwin (Caltech) motions in 3C 120 with telescopes B, J. Benson F, H, Km, O, Yn, and G. R. Walker U-6V S. Unwin (Caltech) Observations at 6 cm of the NGC 6251 jet with telescopes B, F, Km, O, and G. I. Pauliny-Toth (MPIR) P-24V Observations at 6 cm of 3C 216 with R. Porcas (MPIR) telescopes B, F, Km, O, and G. F. Mantovani (MPIR) N-2V S. Neff (NFRA, Netherlands) Observations at 6 cm to study "S" R. Brown shaped radio morphologies in quasars with telescopes B, J_{TT}, F, Km, O, Yn, and G.

J-16V D. Jones (Caltech) W-15V D. Shaffer (Phoenix Corp.) J. Wrobel (Toronto)

Observations at 6 cm of NGC 1052, 0812+20, and the SO galaxy N 3894 with telescopes F, H, Km, O, Yn, and G.

Program

Observer(s)

No.

The following continuum programs were conducted during this quarter.

<u>No.</u>	Observer(s)	Program
B-359	C. Bennett (MIT) B. Burke (MIT) J. Hewitt (MIT) C. Lawrence (MIT)	Survey at 6 cm of sources at 0 ⁰ < δ < 20 ⁰ .
G-255	P. Gregory (British Columbia) R. Taylor (British Columbia)	Variable source survey of the Galactic Plane at 6 cm.
B -339	J. Broderick (VPI & SU) B. Dennison (VPI & SU) J. Ledden (VPI & SU) S. O'Dell (VPI & SU) H. Payne (VPI & SU) J. Condon	Observations at 900 and 1400 MHz of low-frequency variables.
A-56	D. Altschuler (Puerto Rico)	Resurvey at 5 GHz of the NRAO 5 GHz Radio Source Survey.
B-335	T. Balonek (Massachusetts) W. Dent (Massachusetts) C. O'Dea (Massachusetts)	Polarization and flux density measurements of variable radio sources at 2695 MHz.

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The following pulsar programs were conducted during this quarter.

No.	Observer(s)	Program
C-193	V. Boriakoff (Cornell) J. Cordes (Cornell) J. Rankin (Vermont) D. Stinebring (Cornell) J. Weisberg (Princeton)	Pulsar polarization studies over the range of 350 – 410 MHz simultaneous with observations conducted at Arecibo at 1420 and 1667 MHz.
T-149	P. Backus (NASA, Ames) J. Taylor (Princeton) R. Burkhardt (Massachusetts) M. Damashek	Observations at 300 - 410 MHz to determine pulse arrival times of PSR 0655+64 and PSR 0820+02.

36-foot Telescope Scheduled observing Scheduled maintenance and equipment changes

Scheduled test and calibration282.25Time not scheduled51.25Time lost due to: telescope17.50equipment33.25weather131.75

No. Observer(s)

Proposal

Interstellar line observations C-202 R. Crutcher (Illinois) You-Hau Chu (Illinois) toward optical objects. D-126 W. Dent (Massachusetts) Evolution of extragalactic radio R. Hobbs (Goddard) sources at millimeter wavelengths. T. Balonek (Massachusetts) Nine millimeter observations of G-253 B. Geldzahler (MPIR) H. Kuehr (MPIR) sources in the 6 cm NRAO-MPI survey. H-167 J. Hollis (Goddard) Confirmation of further transi-L. Snyder (Illinois) tions of new interstellar F. Lovas (NBS) molecules. R. Suearam (NBS) P. Huggins (SUNY, Stony Brook) H-168 Search for C_{2H} in circumstellar envelopes and hot molecular clouds. J-101 P. Jewell (Illinois) Search for HCN and HC3N in circum-L. Snyder (Illinois) stellar shells. K-274 M. Kutner (Rensselaer) Observations of DCO⁺ in NGC 1977 as D. Machnik (Rensselaer) a test of fractionation. K. Mead (Rensselaer) N. Evans (Texas) K-275 M. Kutner (Rensselaer) Study of 2 mm formaldehyde in lines D. Machnik (Rensselaer) in reflecton nebulae. K-276 M. Kutner (Rensselaer) Further observations of CO clouds K. Mead (Rensselaer) in the inner galaxy. K-277 M. Kutner (Renssaler) Observations of 2 millimeter K. Mead (Rensselaer) formaldehyde in molecular clouds in

the outer galaxy.

Hours

1753.00

121.50

No.	Observer(s)	Proposal
L-152	R. Landau (Minnesota) E. Epstein (Aerospace Corp.) T. Jones (Minnesota) J. Puschell (Calif., San Diego) J. Rather (W.J. Schafer & Assoc.	Study of spectral distributions of extragalactic compact sources.
L-165	C. Lada (Arizona)	Study of high velocity gas toward broad-wing CO sources.
P-115	J. Puschell (Calif., San Diego)	Millimeter wave observations of optically selected QSOs.
P-120	J. Puschell (Calif., San Diego) D. Heeschen	Bolometric observations of E/SO galaxies at l and 3 mm.
P-121	J. Puschell (Calif., San Diego) J. Condon T. Jones (Minnesota) S. O'Dell (VPI & SU) F. Owen L. Rudnick (Minnesota) W. Stein (Minnesota)	Bolometric observations of optically selected quasars.
P-123	J. Philips (Queen Mary College, England) G. White (Queen Mary College, England)	Detection of shock enhanced molecules in supernovae remnants.
R-162	L. Rickard (Howard) J. van der Hulst (Minnesota)	Study of millimeter continuum emis- sion from spiral galaxies.
R-184	L. Rickard (Howard)	CO studies of galaxies.
S-241	S. Spangler W. Cotton	Multi-frequency monitoring of low frequency variables.
S-243	P. Schwartz (NRL) B. Zuckerman (Maryland) J. Bologna (NRL)	Search for 1 mm lines of SiO in late-type stars.
S-245	M. Scholtes (Texas) M. Kutner (Rensselaer) N. Evans (Texas) L. Munday (Texas)	Re-examination of the orth/para ratio of formaldehyde.

THE VERY LARGE ARRAY

The quarter was scheduled 97.2 percent of the time.

Astronomical	1446.13 ho	ours (67.2	percent)
Test	706.87	(32.8	percent)

The average downtime was 4.55 percent.

The following research programs were conducted with the VLA during this quarter.

No.	Observer(s)	Proposal
AA-12	H. Andernach (MPIR) R. Schilizzi (NFRA, Netherlands) J. Wall (Royal Greenwich Obs.)	Wide-angle tail source 3C 40. 6 and 20 cm.
AA-14	H. Andernach (MPIR)	Large head-tail source NGC 7385. 20 cm.
AB-60	R. C. Bignell E. Seaquist	Supernova remnant in NGC 4449. 2, 6 and 21 cm.
AB-129	B. Burke (MIT) D. Roberts (Brandeis) P. Greenfield (MIT)	Monitoring double QSO 0957+561. 6 cm.
AB-133	R. Becker (Columbia) D. Helfand (Columbia) A. Szymkowiak (Goddard)	Crab-like SNR3C 58 and Vela X. 2 and 6 cm.
AB-134	G. Bothum (Washington) B. Balick (Washington)	HI extent in highly inclined late- type galaxies. 21 cm line.
AB-141	R. Brown F. J. Lockman	HII region emission measure distri- bution. 6 cm.
AB-145	A. Bosma (Columbia)	Barred spiral NGC 1389. 21 cm line.
AB-150	P. Bowers (NRL) G. Knapp (Princeton)	HI in circumstellar envelopes. 21 cm line.
AB-151	R. Brown J. van Gorkom	Recombination lines of young, com- pact HII regions. 2 cm line.

No.	Observer(s)	Proposal
AB-158	J. Basart (Iowa State) M. Andrews (Iowa State) R. Lamb (Iowa State)	Dark cloud Rho Ophiuchi. 6 and 20 cm.
АВ-159/ АН-76	F. Bertola (Padua, Italy) R. Laing R. Ekers E. Hummel (New Mexico) C. Kotanyi (Groningen)	Elliptical galaxies with dust lanes. 6 and 20 cm.
AB-161	S. Bowyer (Calif., Berkeley) P. Henry (CFA) J. Clarke (Calif., Berkeley)	X-ray sources detected in deep Einstein exposure on 3C 295. 6 and 20 cm.
AB-162	J. Bally (Bell Labs) R. Snell (Massachusetts) R. Predmore (Massachusetts)	Ionized gas associated with high velocity overflow in molecular clouds. 1.3, 2 and 6 cm.
AC-34	J. Condon M. Condon (unaffiliated) K. Mitchell (Penn State)	Deep survey of background sources. 20 cm.
AC-36	J. Condon M. Condon (unaffiliated)	Spiral galaxies with high disk brightness temperature. 20 cm.
AC-37	T. Cornwell A. Bridle (Queen's, Canada) E. Fomalont	Large-scale bridge and lobe structure of 3C 293. 6 and 20 cm.
AC-41	G. Chincarini (Oklahoma) R. Giovanelli M. Haynes	HI distribution in cluster galaxies. 21 cm line.
AC-42	E. Churchwell (Wisconsin) D. Abbott (Colorado) J. Bieging (Calif., Berkeley) R. C. Bignell	Variation of flux and spectral index in P Cyg, 9 Sgr, VI Cyg Nos. 9 and 12. 2 and 6 cm.
AD-30	J. Dreher (MIT)	Class II double sources. 2 cm.
AD-50	L. Dressel (Goddard) R. Ekers	Extended sources in SO galaxies. 20 cm.
AD-52	P. Dewdney (DAO, Canada) R. Roger (DAO, Canada)	HI-HII interface surrounding Lk H alpha 101. 21 cm line.
AD-53	G. Dulk (Colorado) G. Chanmugam (Louisiana State)	AM Herculis binary stars. 6 cm.

No.	Observer(s)	Proposal
AD-54	G. Dulk (Colorado)	Particle acceleration in solar flares. 2 and 6 cm.
AD-56	J. Dreher (MIT) R. Ekers P. Kronberg (Toronto) S. Simkin (Michigan State)	Hydra A. 6 cm.
AD-57	J. Dreher (MIT) R. Laing	Spectrum of hot spots in extra- galactic sources. 2 cm.
AE-11	R. Ekers W. M. Goss (Groningen) U. Schwarz (Groningen)	Sagittarius A. 6 cm.
AE-14	R. Ekers G. Bicknell (Mt. Stromlo) N. Killeen (Mt. Stromlo)	Southern jet radio galaxies; IC 4296. 2, 6, and 21 cm.
AF-32	D. Florkowski (USNO)	Mass loss from Zeta Puppis. 2 and 6 cm.
AF-36	E. Feigelson (MIT) J. Burns (New Mexico) E. Schreier (CFA)	The jet in Centaurus A. 6 cm.
AF-39	D. Florkowski (USNO)	W Ursae Majoris stars. 6 cm.
AF-41	E. Feigelson (MIT) G. Clark (MIT)	Middle NE radio lobe of Centaurus A. 6 and 20 cm.
AG-48	P. Gregory (British Columbia)	SNR G109.1-1.0. 20 cm.
AG-74	R. Genzel (Calif., Berkeley) P. Ho (Calif., Berkeley) D. Downes (IRAM, Grenoble)	Ammonia inversion lines in the Orion-KL region. l.3 cm line.
AG-78	D. Gary (Colorado) J. Linsky (Colorado)	Stellar coronal radio sources. 6 and 21 cm.
AG-79	F. Ghigo (Minnesota) J. van der Hulst (Minnesota) B. Hine (Minnesota)	HI in ring galaxy NGC 2793. 21 cm line.
AG-81	S. Gottesman (Florida) T. Hawarden (Royal Obs., Scotland)	HI in galaxies NGC 1512/10 and NGC 5291. 21 cm line.

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No.	Observer(s)	Proposal
AG-83	D. Gordon (Sys. & App. Sci.) S. Gottesman (Florida)	HI in blue compact galaxies. 20 cm line.
Ан-50	T. Heckman (Arizona) W. van Breugel (KPNO) G. Miley (Leiden) B. Balick (Washington)	3C 305a spiral radio galaxy. 2 cm.
Ан-59	P. Ho (Calif., Berkeley) R. Genzel (Calif., Berkeley)	Mass outflow in the W51-IRS2 region. 1.3 cm line.
AH-63	E. Hummel (New Mexico) J. van der Hulst (Minnesota) G. S. Shostak (Leiden)	Spiral arms in NGC 1961 and NGC 4414. 6 and 20 cm.
AH-66	C. Heiles (Calif., Berkeley) T. Troland (Kentucky) W. M. Goss (NFRA) R. Forster (NFRA)	Structure of Zeeman splitting in Orion A absorption line. 21 cm line.
Ан-68	D. Hogg A. Wilson (Maryland)	Crab Nebula. 2, 6, and 20 cm.
AH-72	D. Hogg	Radio spectral index of WR stars. 1.3, 2, 6, and 20 cm.
AH-75	P. Ho (Calif., Berkeley) A. Haschick (Haystack) J. van Gorkom	Recombination lines in compact HII structures in G10.6-0.4. 2 and 6 cm line.
Ан-78	E. Hummel (New Mexico) C. Kotanyi (Groningen)	Disk component of SO galaxies. 20 cm.
AH-80	E. Hummel (New Mexico) M. Zeilik (New Mexico)	Selected area in M31. 6 cm.
AJ-68	K. Johnston (NRL) T. Wilson (MPIR) C. Henkel (MPIR) J. Martin (MPIR) J. Bieging (Calif., Berkeley)	Formaldehyde in molecular clouds. 6 cm line.
AJ-72	M. Janssen (JPL) D. Muhleman (Caltech) G. Berg (Caltech) M. Klein (JPL)	"Weather" on Venus. 1.3 and 2 cm.

No.	Observer(s)	Proposal
AJ-73	D. Jaffe (Chicago) D. Harper (Chicago) C. Telesco (Hawaii)	Nearby spiral galaxies. 6 cm.
AJ-74	K. Johnston (NRL) P. Seidelman (USNO) C. Wade M. A'Hearn (Maryland)	Radio brightness of Ceres and Pallas. 2 and 6 cm.
AJ-75	K. Johnston (NRL) P. Angerhofer (USNO) R. Hjellming	Rapidly variable stellar sources. 2, 6, and 20 cm.
АК-47	S. Kwok (NRC, Canada) R. C. Bignell	AFGL 618nascent planetary nebula? 1.3, 2, 6 and 20 cm monitoring.
AK-50	S. Kwok (NRC, Canada) H. Matthews (NRC, Canada)	Circumstellar envelopes about late-type stars. 1.3 cm line.
AK-51	M. Kundu (Maryland) E. Schmahl (Maryland) M. Bobrowsky (Maryland) F. Erskine (Maryland)	Solar active regions and flares. 1.3, 2, 6, and 20 cm.
AK-52	G. Knapp (Princeton) D. Spergel (Princeton)	Envelopes of Red Giant stars. 6 cm.
AL-25	R. Landau (Minnesota) E. Epstein (Aerospace Corp.) T. Jones (Minnesota) J. Puschell (Calif., San Diego) J. Rather (BDM Corp.)	Spectra of compact sources. 1.3, 2, 6 and 20 cm monitoring.
AL-39	K. Lo (Caltech) W. Sargent K. Young (Caltech)	HI in four faint dwarf galaxies. 21 cm line.
AL-40	R. Laing A. Bridle (Queen's)	Outer lobes of M84. 6 cm.
AL-41	R. Laing	3C 20. 2 cm.
Ам-30	G. Miley (Leiden) W. van Breugel (KPNO) H. Butcher (KPNO) E. Fomalont T. Heckman (Arizona)	Coma A. 2 cm.

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Since the AIPS system is gaining widespread support, both inside the Observatory and outside on other systems, due to the increased number of application programs available, the decision was made to use the VAX purchased with the new DEC-10 for post-processing under the AIPS system. The conversion will require additional hardware, which has been ordered, but will involve little software effort. It will serve to take part of the load from the DEC-10 in the area of map making rather than in calibration as was originally conceived.

The "pipeline" system comprising the PDP-11/70 (SORTER) and PDP-11/44 (GRIDER) is progressing. The system will be available for testing by users in the new year.

PERSONNEL

Appointments

E. R. Seaquist	Visiting Scientist	07/06/81
M. P. Haynes	Assistant Director, Green Bank Operations	09/14/81
R. Giovanelli	Systems Scientist	09/14/81
Changes in Status		
J. M. Benson	Research Associate to Systems Scientist	07/01/81
C C Weint	Associate Division Head to	

	Abbociate bivibion note of	
	Head VLA Computer Division	07/01/81
J. R. Fisher	Assistant Director, Green Bank	
	Operations to Electronics	
	Engineer I	09/14/81

Terminations

Ρ.	E. Palmer	Visiting Scientist	09/19/81
Τ.	I. Puschell	Research Associate	07/24/81
с.	D. van Albada	Research Associate	07/28/81
Ι.	Dreher	Research Associate	08/13/81
J.	Basart	Systems Scientist	08/14/81
c.	L. Sarazin	Visiting Associate Scientist	08/18/81
w.	N. Brouw	Visiting Scientist	08/26/81
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Leave of Absence

Μ.	B. Hagstrom	Electronics Engineer	09/01/81
w.	Jaffee	Systems Scientist	09/01/81

Return from Leave of Absence

C. R. Moore

08/01/81

<u>No</u> .	Observer(s)	Proposal
AR-43	S. Reynolds (Virginia) R. Chevalier (Virginia) S. Neff (Virginia)	Young SNRs: Kepler, Tycho, SN1006. 6 and 20 cm.
AR-54	A. Rots J. Goad (KPNO) M. Roberts	Neutral H in a super-thin galaxy, NGC 7321. 20 cm line.
AS-76	E. Seaquist (Toronto) N. Duric (Toronto) P. Crane J. Auman (British Columbia) B. Campbell (CFHT, Hawaii)	Peculiar spiral galaxy NGC 3310. 6 and 20 cm.
AS-79	S. Spangler W. Cotton	Multifrequency monitoring of low- frequency variables. 1.3, 2, 6, and 20 cm.
AS-80	R. Sramek J. van der Hulst (Minnesota) K. Weiler (NSF)	Supernovae in M100 and NGC 6946. 2, 6, and 20 cm.
AS-96	L. Smarr (Illinois) R. Ekers W. van Breugel (KPNO)	Dumbbell galaxies. 20 cm.
AS-102	S. Spangler R. Laing	Spectral index maps of 3C 192. 6 cm.
AS-103	J. Stocke (Arizona)	Isolated "head-tail" radio galaxy candidates. 6 and 20 cm.
AS-105	R. Sancisi (Leiden) R. Ekers M. Shapiro (NRL)	Halo of edge-on spiral NGC 4631. 6 and 21 cm.
AT-21	J. Turner (Calif., Berkeley) P. Ho (Calif., Berkeley)	Massive star formation in nearby spiral nuclei. 1.3, 2 and 6 cm.
AU-7	M. Ulmer (Northwestern) R. Brown R. Cruddace (NRL)	Possible SNR associated with X-ray/ radio complex. 6 and 20 cm.
AU-9	M. Ulmer (Northwestern) R. Hanisch (Maryland)	Survey of binary and trinary X-ray emitting rich clusters of galaxies. 20 cm.

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No.	Observer(s)	Proposal
AV-43	J. van der Hulst (Minnesota) E. Hummel (New Mexico) J. van Gorkom C. Kotanyi (Groningen) W. Golisch (Minnesota)	Interacting galaxiesnoncentral components. 6 and 20 cm.
AV-52	J. van der Hulst (Minnesota) R. Sramek K. Weiler (NSF)	The next four supernovae. 2, 6, and 20 cm.
AV-53	J. van der Hulst (Minnesota) P. Crane R. Brown M. Ondrechen (Minnesota)	Central source in M31. 6 cm.
AV-58	J. van der Hulst (Minnesota) A. Haschick (Haystack) A. Tubbs J. van Gorkom	HI emission from Centaurus A. 20 cm line
AV-59	J. van der Hulst (Minnesota) P. Crane R. Kennicutt (Minnesota) R. Allen (Groningen)	Disks of spiral galaxies NGC 5194 and NGC 6946. 6 cm.
AV-60	J. van der Hulst E. Hummel (New Mexico) M. Ondrechen (Minnesota)	Halo of NGC 253. 6 and 20 cm.
AV-62	J. van Gorkom J. van der Hulst (Minnesota) E. Hummel (New Mexico) M. Ondrechen (Minnesota)	Peculiar barred spiral NGC 1097. 21 cm line.
AV-64	W. van Breugel (KPNO) T. Heckman (Arizona) G. Miley (Leiden) H. Butcher (KPNO)	Radio galaxies 4C 26.42 and 4C 29.30 with optical emission lines in lobes. 2 cm.
AV-65	W. van Breugel (KPNO) G. Miley (Leiden) T. Heckman (Arizona) H. Butcher (KPNO)	Fine structure in 3C 310. 6 cm.
AV-66	S. Vogel (Calif., Berkeley) W. J. Welch (Calif., Berkeley)	Compact HII region K3-50. 1.3, 2 and 6 cm.

No.	Observer(s)	Proposal
AW-51	J. Wall (Royal Greenwich Obs.) E. Fomalont K. Kellermann	Deep survey. 6 cm.
AW-56	C. Wade R. Perley	Optically flaring quasar 1156+295. 1.3, 2, 6 and 20 cm.
AW-58	R. Windhorst (Leiden) G. Miley (Leiden) F. Owen T. Thuan (Virginia)	Deep survey of optical and X-ray selected areas. 6 and 20 cm line.
AW-61	C. Wynn-Williams (Hawaii)	Hot spots in NGC 2903. 2 cm.
AW-63	T. Wilson (MPIR) R. Martin (MPIR) T. Pauls (Koln, Germany) S. Guilloteau (IRAM, France) C. Kahane (IRAM, France)	Search for a masering transition of ammonia. 1.3 cm line.
AZ-15	B. Zuckerman (Maryland) R. Sopka (Maryland) A. Michalitsianos (Goddard) R. Hobbs (Goddard) M. Kafatos (George Mason)	Radio spectrum and extended structure of R Aquarii. 1.3, 2, 6, and 20 cm.
AZ-16	H. Zirin (Caltech) K. Marsh (Caltech) G. Hurford (Caltech) K. Topka (Caltech)	Solar flares and active regions. 2 and 6 cm.
AZ-17	H. Zirin (Caltech) K. Topka (Caltech) K. Marsh (Caltech)	Nearby O, F and dME stars. 6 and 20 cm.
VB-24	L. Baath (Chalmers) W. Cotton G. Seielstad (Caltech) D. Graham (MPIR)	Fine structure in BL Lac type objects. 1.3 cm single antenna VLB.
VG-19	B. Geldzahler (MIT) D. Shaffer (Phoenix Corp.) L. Pauliny-Toth (MPIR)	G127.11+0.54. 6 cm phased array MK III VLB.

No.	Observer(s)	Proposal
VG-21	G. Garay (CFA) J. Moran (CFA) M. Reid (CFA) M. Schneps (CFA) A. Garcia (MIT) B. Burke (MIT)	Polarized OH maser emission. 18 cm line MK III VLB.
VH-3	M. Hodges (Iowa) R. Mutel (Iowa) D. Backer (Calif., Berkeley)	Polarization of compact extra- galactic sources. 18 cm VLB.
VJ-13	K. Johnston (NRL) J. Spencer (NRL) E. Fomalont R. Perley W. Cotton A. Witzel (MPIR)	Maps of 18 compact extragalactic objects. 18 cm VLB.
VJ-16	D. Jones (Caltech) J. Wrobel (Toronto) D. Shaffer (Phoenix Corp.)	NGC 1052. 6 cm phased array VLB.
VL-11	K. Lo (Caltech) J. Moran (CFA) D. Backer (Calif., Berkeley)	Galactic center. 1.3 cm single antenna MK III VLB.
VM-13	J. Moran (CFA) D. Downes (IRAM, France) R. Genzel (Calif., Berkeley) A. Haschick (MIT) M. Reid (CFA) R. Ronnang (Chalmers) M. Schneps (CFA)	Proper motions of water masers. 1.3 cm line single antenna VLB.
VM-23	R. Moore (Caltech) A. Readhead (Caltech) A. Moffet (Caltech)	3C 84 and 3C 345. 1.3 cm single antenna VLB.
vn-2	S. Neff (Virginia) J. Benson R. Brown	Cores of objects with "S" dis- tortions. 6 cm single antenna VLB.
VR-16	D. Roberts (Brandeis) J. Wardle (Brandeis) R. Potash (Brandeis) B. Burke (MIT) A. Rogers (Haystack)	Polarization measurements of extra- galactic sources. 6 cm phased array MK III VLB.

No.	Observer(s)	Proposal
VW-12	A. Wolfe (Pittsburgh) F. Briggs (Pittsburgh) K. Johnston (NRL)	Absorption line source AO235+164. 18 cm VLB.
VW-14	R. C. Walker G. Seielstad (Caltech) S. Unwin (Caltech) J. Benson	3C 12O superluminal motion. 6 cm phased array VLB.
VW-15	J. Wrobel (Toronto) D. Jones (Caltech)	NGC 3894. 6 cm phased array. MK III VLB.

D. Shaffer (Phoenix Corp.)

ELECTRONICS DIVISION

Charlottesville

Improved mixers for use at the 36-foot telescope at 115 GHz have been fabricated and are undergoing tests and diode selection. Work is continuing on a 200-300 GHz receiver and broadband triplers.

The development of 15 GHz GASFET amplifiers for the VLA continues. Three-stage amplifiers, giving 25 dB gain and 40 K to 60 K noise temperature, have been designed, and three units are undergoing final tests. A waveguide noise standard for evaluating the amplifiers has been completed. Several more 1.4 GHz amplifiers have been completed this quarter.

Work continues on the testing of superconducting tunnel junctions for millimeter mixer use.

An investigation of the use of video tape recorders for VLBI data recording at a date rate of 16 to 20 mb/s has started.

Green Bank

The cooled-GASFET 21-cm receiver was installed on the 300-foot telescope for the first time during this quarter. As expected, the system temperature achieved at zenith was 45 K. Various sources of interference were encountered with this receiver; a detailed memo listing these was generated.

Construction of the 5-25 GHz receiver is continuing. Problems with the refrigerator on the 140-foot system have apparently been cured by replacing the 4° switch; all transitions have been installed and the system has cooled down properly and maintained temperature for the past few months.

Modification of the 4-feed, 21-cm receiver with GASFET's is in progress; this receiver will be available in late spring.

The NRAO 43 GHz maser-amplifier was integrated into a system at Haystack, with some assistance from Green Bank. From 41.5 GHz to 47.5 GHz, the receiver exhibited 20 dB of gain, an instantaneous bandwidth of 70 MHz, and a system temperature of 90 K, including the radome.

A 22 GHz maser amplifier was mechanically modified to allow testing of 1-5 GHz upconverters. Design work has been done to improve the match of these upconverters to the maser.

A 16-channel differential multiplexer which interfaces with the APPLE computer was built and tested.

Hardware improvements to the Digital Standard Receiver were made in order to improve the interface to the MODCOMP. Substantial software development has been done to accommodate various observing modes, both at the 140-foot and 300-foot telescopes. The receiver was used very successfully at the 140-foot. Benchmark tests of various computers considered for future Digital Standard receiver implementation were run. The popular home computers faired poorly against the HP 9825; details can be found in Electronics Division Technical Note 103.

Baseline stability tests of the Model IV autocorrelator have been performed. Also, tests to determine the effects of reduced clipper bandwidth in autocorrelator and other sampling systems have been performed. Reports on both these are forthcoming.

Design of the microwave link for the additional baseline to the interferometer is almost complete. Various components are now out for bid. A new reflector was installed in the existing microwave link early in the quarter. Thus far, its performance over wide extremes of temperature has been satisfactory.

Some contributions have been made to the rewriting of the VLBA proposal.

Tucson

During this quarter the telescope has been used for scheduled 1 mm programs in both line and continuum. The He3 bolometer on the antenna achieves a sensitivity of 8 Jy in one second at 1.1 mm and the 230 GHz cooled mixer receiver has a sensitivity of 15 Jy in one second at 1.3 mm. Factors of 2-3 improvement in the bolometer performance are still possible, and the resurfacing of the antenna should give a further factor of eight.

A prototype dual polarization diplexer has been built and tested during this quarter. This device will be used for the L.O. injection and image termination in the new generation of millimeter wave receivers.

Socorro

During this quarter the array observed for the first time in the D array which is the most compact configuration. Problems with antenna
shadowing and cross-talk between the antennas were experienced for the first time.

Several new sources of radio interference in the vicinity of the protected hydrogen band of frequencies were detected. The interference problems will be solved by replacing the cooled parametric upconverters in the receiver with cooled FET amplifiers built by the Central Development Lab. This change was successfully made and tested in the receiver on antenna 10.

Finally, the hydrogen maser clock on loan to the VLA from the Smithsonian Astrophysical Observatory (SAO) was returned to them. Until a new maser can be obtained, all VLBI experiments using the VLA will use a Rubidium frequency standard.

COMPUTER DIVISION

Charlottesville

<u>CPU Change</u> - The IBM Model 360/65 central processing unit (CPU) has been replaced by an IBM Model 4341 Group I. With minor exceptions, the peripherals remain the same. The new CPU currently runs the same operating system and same applications software; it is plug compatible with the old system.

Work has begun on bringing up IBM's CMS software (conversational monitor system) to support interactive programming.

IBM/AIPS Development - Work has commenced on running AIPS (less array processor or I^2S display tube) on the IBM system. The intent is to make the system look to the user as the one which runs on the VAX. The idea is that the user will use the VAX or MODCOMP for work requiring the I^2S and the IBM for work not requiring the display system. The IBM will not have an array processor but should be considerably faster on I/O bound operations, i.e., sorts, etc.

Remote Users - Modest support for remote computing on the IBM system now exists. This will not permit general purpose computing, but will let a user run one of NRAO's standard programs on his data tape stored in the computer tape library. Eventually remote AIPS processing will be possible on the VAX computer. At present, remote use is still considered an experiment, and the procedure is somewhat clumsy.

<u>VLBI</u> - Remote processing is now supported on the IBM system. Eventually, remote post-processing will be available on the VAX.

Green Bank

Telephone Modem Use for Continuum Observing - It is now possible for off-site observers with the proper equipment (Racal-Vadic Modem and

Tektronix 4012 or 4010 CRTs) to process continuum data on the 300-foot telescope with the analysis MODCOMP computer utilizing commercial telephone lines.

Digital Receiver - The digital standard receiver Mark III has been interfaced to the MODCOMP computer at the 140-foot telescope and used for continuum observing.

Socorro

Communication between the VLA computers has progressed substantially with the installation of DECNET network software on all machines. The DEC-10 and PDP-11's communicate regularly, as do the VAX at Charlottesville and one VAX at the VLA. However, complete connections of all computers is awaiting further hardware to be delivered in mid-1982.

The AIPS system on the VAX continues to be heavily used and the hardware to duplicate AIPS on the second VAX at the VLA has been delivered. It will be installed during the first week of January, 1982.

Computer hardware fault/maintenance reporting has been incorporated into the system used for antennas and electronics. This allows accumulation of failure statistics for computer equipment and streamlines the reporting of hardware problems. On the DEC-10, a program now provides monthly summaries of the usage of that machine, broken down by time of day and user class; it also monitors the activity of some of the major data reduction programs.

ENGINEERING

The Engineering Division concentrated on the new 12-meter project, which included design, procurement of materials and fabrication of some components for the reference jig, measuring template, back-up structure, surface plates, mirror selection system, receiver support system and inductosyns.

Site development was started at the Monterville site for the interferometer addition. A contract was negotiated for a new antenna for the interferometer addition.

Assistance was provided other NRAO sites with their engineering problems.

PERSONNEL

New Hires

Donald S. Retallack	Assoc. Division Head, VLA Computer Division	09/22/81
Renzo Sancisi	Visiting Scientist	10/05/81
Barbara A. Williams	Research Associate	10/12/81
David R. Merritt	Research Associate	12/15/81
Terminations		
Galen R. Gisler	Associate Scientist	10/31/81
Duane D. Madron	Head/Plant Maintenance	12/31/81
Albert H. Steinemann	Head/Shops Division	12/31/81
Riccardo Giovanelli	Systems Scientist	12/28/81
Retirements		
Julian M. Hamed	Mechanical Engineer I	12/31/81
William D. Kuhlken	Technical Specialist I	12/31/81
Howard H. Brown	Technical Specialist I	12/31/81
Leave of Absence		
Harvey S. Liszt	Scientist	11/01/81
Return from Leave of Ab	sence	
Magne B.R. Hagstrom	Electronics Engineer	10/19/81

APPENDIX

January 1981

List No. 28

REPRINTS AVAILABLE ON REQUEST

- A 1134 Archer, J.W.; Caloccia, E.M.; and Serna, R. An Evaluation of the Performance of the VLA Circular Waveguide System. 1980. IEEE TRANS. MICRO. THEORY TECH., <u>MTT-28</u>, 786-791.
- A 1153 Balonek, T.J. and Dent, W.A. A Second Correlated Radio-Optical Outburst in the BL Lacertae-Type Quasi-Stellar Object 0235+164. 1980. ASTROPHYS. J., <u>240</u>, L3-L5.
- A 1151 Churchwell, E. Observations and Analyses of Interstellar Cyanogen. 1980. ASTROPHYS. J., <u>240</u>, 811-827.
- A 1152 Clegg, R.E.S. and Wootten, H.A. Circumstellar Chlorine Chemistry and a Search for AlCl. 1980. ASTROPHYS. J., 240, 828-833.
- A 1150 Cook, D.B. and Spangler, S.R. The Production of Flat Radio Spectra by Superposition of Source Subcomponents. 1980. ASTROPHYS. J., <u>240</u>, 751-758.
- A 1148 Elmegreen, B.G.; Elmegreen, D.M.; and Morris, M. On the Abundance of Carbon Monoxide in Galaxies: A Comparison of Spiral and Magellanic Irregular Galaxies. 1980. ASTROPHYS. J., <u>240</u>, 455-463.
- A ll60 Epstein, E.E.; Landau, R.; and Rather, J.D.G. Extragalactic Radio Sources: Rapid Variability at 90 GHz. 1980. ASTRON. J., <u>85</u>, 1427-1433.
- A 1164 Fix, J.D.; Mutel, R.L.; Benson, J.M.; and Claussen, M.L. VLBI Observations of Main-Line OH Emission from U Orionis. 1980. ASTROPHYS. J., 241, L95-L98.
- A 1162 Gilmore, W. and Seaquist, E.R. Aperture Synthesis of the Radio Structure of SS433. 1980. ASTRON. J., 85, 1486-1495.
- A 1136 Giovanelli, R. Studies of High-Velocity Clouds. I. A High-Sensitivity
 - Survey. 1980. ASTRON. J., <u>85</u>, 1155-1181.
- A 1143 Granlund, J. Resistance Associated with FET Gate Metallization. 1980. IEEE ELECTRON DEVICE LETT., <u>EDL-1</u>, 151-153.
- A 1158 Greenfield, P.E.; Burke, B.F.; and Roberts, D.H. The Double Quasar 0957+561 as a Gravitational Lens: Further VLA Observations. 1980. NATURE, <u>286</u>, 865-866.
- A 1138 Haschick, A.D.; Crane, P.C.; Greenfield, P.E.; Burke, B.F.; and Baan, W.A.
 High-Resolution Observations of the Neutral Hydrogen Absorption and Radio Continuum Emission of the Radio Source 3C 178.
 1980. ASTROPHYS. J., <u>239</u>, 774-782.
- B 515 Hjellming, R.M. Radio Aspects of Stellar Activity in Close Binaries. 1980. HIGHLIGHTS ASTRON. 5, 857.
- A 1161 Kojoian, G.; Tovmassian, H.M.; Dickinson, D.F.; and Dinger, A.S.C. Radio Survey of Markarian Galaxies at 6 and 11 cm. 1980. ASTRON. J., <u>85</u>, 1462-1467.
- A 1137 Kronberg, P.P.; Clarke, J.N.; and van den Bergh, S. The Quasar 3C351: VLA Maps and a Deep Search for Optical Emission in the Outer Lobes. 1980. ASTRON J., <u>85</u>, 973-980.
- A 1140 Kundu, M.R. and Velusamy, T. Observation with the VLA of a Stationary Loop Structure on the Sun at 6 Centimeter Wavelength. 1980. ASTROPHYS. J., <u>240</u>, L63-L67.

- B 513 Liszt, H.S. Atomic and Molecular Gas in the Inner Regions of the Milky Way and Other Galaxies. 1980. HICHLIGHTS ASTRON., 5, 149-161.
- A 1157 Loren, R.B.; Wootten, A.; Sandqvist, Aa.; and Bernes, C. 2 Centimeter H₂CO Emission in the ρ Ophiuchi Cloud. 1980. ASTROPHYS. J., <u>240</u>, L165-L169.
- A 1155 Marsh, K.A. and Hurford, G.J. Two-Dimensional VLA Maps of Solar Bursts at 15 and 23 GHz with Arcsec Resolution. 1980. ASTROPHYS. J., <u>240</u>, L111-L114.
- A 1154 Martin, H.M.; Partridge, R.B.; and Rood, R.T. Interferometric Limits on Very Small-Scale Fluctuations in the Cosmic Microwave Background. 1980. ASTROPHYS. J., <u>240</u>, L79-L82.
- A 1156 Rodríguez, L.F.; Ho, P.T.P.; and Moran, J.M. Anisotropic Mass Outflow in Cepheus A. 1980. ASTROPHYS. J., 240, L149-L152.
- A 1141 Rots, A.H. A Neutral Hydrogen Mapping Survey of Large Galaxies. I. Observations. 1980. ASTRON. ASTROPHYS. SUPPL. SER., 41, 189-197.
- A 1145 Sandqvist, Aa. and Bernes, C. Formaldehyde as a Probe of Dark Clouds. 1980. ASTRON. ASTROPHYS., <u>89</u>, 187-197.
- A 1146 Schneps, M.H.; Ho, P.T.P.; and Barrett, A.H. The Formation of Elephant-Trunk Globules in the Rosette Nebula: CO Observations. 1980. ASTROPHYS. J., <u>240</u>, 84-98.
- A 1142 Schwab, F.R. Adaptive Calibration of Radio Interferometer Data. 1980. SPIE PROC., 231, 18-24.
- A 1163 Seaquist, E.R.; Gilmore, W.; Nelson, G.J.; Payten, W.J.; and Slee, O.B. The Quiescent Radio Spectrum of SS 433. 1980. ASTROPHYS. J., <u>241</u>, L77-L81.
- A 1135 Thompson, A.R. and Sinha, R.P. An Upper Limit to the Mass Loss Rate fro the Nuclei of Planetary Nebulae. 1980. ASTRON. J., <u>85</u>, 1240-1241.
- A 1139 Tubbs, A.D. Galactic Spiral Shocks: Vertical Structure, Thermal Phase Effects, and Self-Gravity. 1980. ASTROPHYS. J., <u>239</u>, 882-892.
- B 514 van der Hulst, J.M. Radio Continuum Emission from the Nuclei of Normal Galaxies. 1980. HIGHLIGHTS ASTRON. <u>5</u>, 177-184.
- A 1144 von Hoerner, S. Strong Coma Lobes from Small Gravitational Deformations. 1980. IEEE TRANS. ANT. PROP., <u>AP-28</u>, 652-657.
- A 1159 Weinreb, S. Low-Noise Cooled GASFET Amplifiers. 1980. IEEE TRANS. MICRO. THEORY TECH., <u>MTT-28</u>, 1041-1054.
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