

Lebray

NATIONAL RADIO ASTRONOMY OBSERVATORY
Charlottesville, Virginia

Quarterly Report

October 1, 1980 - December 31, 1980

JAN 25 1981

NATIONAL RADIO ASTRONOMY OBSERVATORY
CHARLOTTESVILLE, VA.

RESEARCH PROGRAMS

140-foot Telescope

	<u>Hours</u>
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 H ₂ CO 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.
W-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.

<u>No.</u>	<u>Observer(s)</u>	<u>Program</u>
K-263	N. Evans (Texas) M. Kutner (Rensselaer) D. Machnik (Rensselaer)	Observations of 2-cm C76α recombination 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 H ₂ CO 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 NH ₃ , ClO ¹⁸ O, 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. Olmon (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.

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

B	- Effelsberg, 100-m
F	- Fort Davis 85-ft
G	- NRAO 140-ft
H	- Hat Creek 85-ft
HR	- Hartebeesthoek, South Africa 26-m
K	- Haystack 120-ft
L	- Metsahovi, Finland 13.7 m

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

<u>No.</u>	<u>Observer(s)</u>	<u>Program</u>
M-171	G. Miley (Leiden Obs.) R. Schilizzi (NFRA, Netherlands) P. Wilkinson (Jodrell Bank)	Observations at 4990 MHz of the structure of 3C 236, with telescopes of the European VLB network and G.

<u>No</u>	<u>Observer(s)</u>	<u>Program</u>
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 A0 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.

<u>No.</u>	<u>Observer(s)</u>	<u>Program</u>
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)	Observations at 22 GHz to determine distances by the measure of proper motion in H ₂ O sources, with telescopes B, R, S, K, O, G, and one of the NRAO VLA antennas.

The following program was conducted during this quarter.

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

300-foot Telescope

	<u>Hours</u>
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.

<u>No.</u>	<u>Observer(s)</u>	<u>Program</u>
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-152	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 measurements of variable radio sources at 2695 MHz.
G-241	J. Burns (New Mexico) G. Gisler	Observations at 6 cm of approximately 300 elliptical and S0 galaxies selected from the Uppsala Catalog.

No.	<u>Observer(s)</u>	<u>Program</u>
M-172	T. Menon (British Columbia)	Observations at 6 cm of sources selected from the 327 MHz Ooty, India telescope survey.
K-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.

36-foot Telescope

	<u>Hours</u>
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

No.	<u>Observer(s)</u>	<u>Program</u>
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 H ₂ CO and CS in three molecular clouds.
H-162	P. Huggins (New York U.)	Observations of the kinematics of the envelope of IRC+10216.

No.	<u>Observer(s)</u>	<u>Program</u>
H-161	J. Hollis (NASA-GSFC) L. Snyder (Illinois) F. Lovas (NBS) R. Suenram (NBS)	Search for confirmers 1 of glycine.
K-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.
K-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.
O-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.

<u>No.</u>	<u>Observer(s)</u>	<u>Program</u>
T-144	B. Turner	Confirmation of CCD in the interstellar medium.
T-146	B. Turner	Search for HCNH ⁺ .
T-147	B. Turner E. Kuiper (JPL) P. Palmer (Chicago) B. Zuckerman (Maryland)	Study of deuterated NH ₃ 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>	<u>Observer(s)</u>	<u>Program</u>
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.

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

<u>No.</u>	<u>Observer(s)</u>	<u>Program</u>
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.
AK-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.
AK-42	M. Kundu (Maryland) J. Schmahl (Maryland) T. Velusamy (Maryland)	Solar magnetic field measurements from simultaneous radio and x-ray observations. 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 circumstellar plasma. 6 cm.
AN-8	R. Newell (NMIMT) J. Burns (New Mexico)	High mass loss stars. 1.3 and 2 cm.
AO-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.

<u>No.</u>	<u>Observer(s)</u>	<u>Program</u>
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.

<u>No.</u>	<u>Observer(s)</u>	<u>Program</u>
M-13V	J. Moran (CFA) D. Downes (MPIR) R. Genzel (MPIR) A. Haschick (MIT) M. Reid (CFA) B. Ronnang (Chalmers) M. Schneps (CFA)	Proper motion of H ₂ O maser sources. 1.3 VLB.

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.

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 Scientist	10/13/80
Timothy J. Cornwell	Research Associate	10/22/80
Thomas J. Vestrand	Research Associate	12/08/80

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

REPRINTS AVAILABLE ON REQUEST

- 1040 Baker, P.L. and Burton, W.B. Self-Absorption and Other Characteristics of High-Angular-Resolution Emission Spectra of Galactic H I. 1979. *ASTRON. ASTROPHYS. SUPPL. SER.*, 35, 129-152.
- 1033 Benson, J.M. and Mutel, R.L. Multibaseline VLBI Observations of the 1612 MHz OH Masers Toward NML Cygni and VY Canis Majoris. 1979. *ASTROPHYS. J.*, 233, 119-126.
- 1044 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. 1979. *ASTROPHYS. J.*, 233, 553-557.
- 1051 Bridle, A.H. and Fomalont, E.B. Radio Structure and Optical Identification of 3C319. 1979. *ASTRON. J.*, 84, 1679-1682.
- 1038 Burns, J.O. and Owen, F.N. Radio Sources in Zwicky Clusters of Galaxies. II. Detailed Interferometer Observations and Analysis. 1979. *ASTRON. J.*, 84, 1478-1499.
- 1052 Burns, J.O.; Owen, F.N.; and Rudnick, L. The Wide-Angle Tailed Radio Galaxy 1159+583: Observations and Models. 1979. *ASTRON. J.*, 84, 1683-1693.
- 1027 Clark, F.O.; Martin, H.M.; and Biretta, J.A. General Calculations of Rotational Effects on Spectral Lines. 1979. *ASTROPHYS. J.*, 232, 624-635.
- 1029 DeNoyer, L.K. Discovery of Shocked CO Within a Supernova Remnant. 1979. *ASTROPHYS. J.*, 232, 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.*, 79, 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.
- 1042 Eilek, J.A. and Caroff, L.J. Cool Regions in Relativistic Plasmas: Thermal Instabilities. 1979. *ASTROPHYS. J.*, 233, 463-478.
- 1039 Fischer, J.; Righini-Cohen, G.; Simon, M.; and Cassar, L. Far Infrared, Near Infrared, and Radio Molecular Line Studies of HFE 2, HFE 3, and FJM 6. 1979. *ASTRON. J.*, 84, 1574-1580.
- 499 Gordon, M.A. and Burton, W.B. Statistical Modeling of CO Emission in the Galaxy. 1979. *IAU SYMP.*, 84, 271-276.
- 503 Haynes, M.P. Intergalactic H I and Tidal Debris Within Groups of Galaxies. 1979. *IAU SYMP.*, 84, 567-573.
- 1050 Hjellming, R.M.; Wade, C.M.; Vandenberg, N.R.; and Newell, R.T. Radio Emission from Nova Shells. 1979. *ASTRON. J.*, 84, 1619-1631.
- 1041 Jaffe, W.J. and Rudnick, L. Observations at 610 MHz of Radio Halos in Clusters of Galaxies. 1979. *ASTROPHYS. J.*, 233, 453-462.
- 1046 Johnson, H.M.; Balick, B.; and Thompson, A.R. VLA Observations of Stellar Planetary Nebulae. 1979. *ASTROPHYS. J.*, 233, 919-924.
- 1034 Knapp, G.R.; Kuiper, T.B.H.; and Zuckerman, B. CO Observations of Mass 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 R1 Molecular Clouds. 1979. *ASTROPHYS. J.*, 232, 724-728.
- A 1049 Liszt, H.S. Radiofrequency Molecular Emission Spectra Observed Toward η 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.*, 84, 343-350.
- A 1035 Lockman, F.J. The Distribution of Dense H II Regions in the Inner Galaxy. 1979. *ASTROPHYS. J.*, 232, 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.*, 233, 498-503.
- A 1026 Mufson, S.L. and Liszt, H.S. The H II Region-Molecular Cloud Complex W51. 1979. *ASTROPHYS. J.*, 232, 451-466.
- A 1048 Myers, P.C.; Ho, P.T.P.; and Benson, P.J. Observations of HC₃N and NH₃ in Taurus. 1979. *ASTROPHYS. J.*, 233, 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.*, 232, 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.*, 84, 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*, 205, 894-896.
- B 497 Roberts, M.S. Large-Scale Structure of Spiral Galaxies: Problems Old and New. 1979. *IAU SYMP.*, 84, 3-7.
- A 1047 Shaffer, D.B. and Marscher, A.P. VLBI Observations of Galactic Nuclei at 18 Centimeters: NGC 1052, NGC 4278, M82, and M104. 1979. *ASTROPHYS. J.*, 233, L105-L108.
- A 1036 Shapiro, I.I.; Wittels, J.J.; Counselman, C.C. III; Robertson, D.S.; Whitney, A.R.; Hinteregger, H.F.; Knight, C.A.; Rogers, A.E.E.; Clark, T.A.; Hutton, L.K.; and Niel, A.E. Submilliarcsecond Astrometry Via VLBI. I. Relative Position of the Radio Sources 3C 345 and NRAO 512. 1979. *ASTRON. J.*, 84, 1459-1469.
- 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.*, 84, 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.*, 232, L89-L93.
- A 1037 Spangler, S.R. The Collimation of Double Radio Sources. 1979. *ASTRON. J.*, 84, 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 → 1 SiO Maser. 1979. *ASTROPHYS. J.*, 232, 143-157.
- B 502 Turner, B.E. General Physical Characteristics of the Interstellar Molecular Gas. 1979. *IAU SYMP.*, 84, 257-270.
- A 1032 Wright, M.C.H. The Tail of M33 and the Adjacent Hydrogen Cloud. 1979. *ASTROPHYS. J.*, 233, 35-38.
- B TC Table of Contents. Reprints Series B 451-500.

MAY - 1980

List No. 25

REPRINTS AVAILABLE ON REQUEST

- 1060 Archer, J.W. TE_{on}-Mode Filters for the V.L.A. Circular Waveguide System. 1979. ELECTRON. LETT., 15, 343-345.
- 1061 Bridle, A.H.; Fomalont, E.B.; Miley, G.K.; and Valentijn, E.A. The Radio Properties of the X-ray Cluster Abell 2256. 1979. ASTRON. ASTROPHYS., 80, 201-211.
- 505 Briggs, F.H. and Andrew, B.H. Microwave Radiometry and Interferometry of Uranus. 1980. ICARUS, 41, 269-277.
- 1071 Burns, J.O. and Owen, F.N. Dual Curved Jets in the Tailed Radio Galaxy 1638+538 (4C53.37). 1980. ASTRON. J., 85, 204-214.
- 1070 Burns, J.O.; White, R.A.; and Hanisch, R.J. Radio Emission in the Directions of cD and Related Galaxies in Poor Clusters. II. 1400-MHz Pencil Beam Observations. 1980. ASTRON. J., 85, 191-197.
- 1065 Clark, F.O.; Biretta, J.A.; and Martin, H.M. A Rotational Explanation of the High-Velocity Molecular Emission from the Orion Molecular Cloud. 1979. ASTROPHYS. J., 234, 922-931.
- 1067 Condon, J.J.; O'Dell, S.L.; Puschell, J.J.; and Stein, W.A. Radio Emission from Radio-Quiet Quasars. 1980. NATURE, 283, 357-358.
- 1072 Ghigo, F.D. Radio Continuum Emission in Ring Galaxies. 1980. ASTRON. J., 85, 215-225.
- 1074 Haynes, M.P. Bright Galaxies in Nearby Abell Clusters. 1980. ASTROPHYS. J. SUPPL. SER., 42, 83-101.
- 1077 Heeschen, D.S. and Hammond, S.E. A Radio Flare in SS 433. 1980. ASTROPHYS. J., 235, L129-L130.
- 1069 Heiles, C. and Chu, Y.-H. The Magnetic Field Strength in the H II Region S232. 1980. ASTROPHYS. J., 235, L105-L109.
- 1056 Johnston, K.J.; Brodrick, J.J.; Condon, J.J.; Wolfe, A.M.; Weiler, K.; Genzel, R.; Witzel, A.; and Booth, R. Further VLB Observations of the Redshifted H I Absorption in AO 0235+164. 1979. ASTROPHYS. J., 234, 466-470.
- 1063 Jones, T.W. and Owen, F.N. Hot Gas in Elliptical Galaxies and the Formation of Head-Tail Radio Sources. 1979. ASTROPHYS. J., 234, 818-824.
- 1064 Loren, R.B.; Evans, N.J. II; and Knapp, G.R. Properties of Molecular Clouds Containing Herbig-Haro Objects. 1979. ASTROPHYS. J., 234, 932-948.
- A 1057 Maloney, F.P. and Gottesman, S.T. Lunar Occultation Observations of the Crab Nebula. 1979. ASTROPHYS. J., 234, 485-492.
- A 1078 Moore, C.R. A K-band Ruby Maser with 500-MHz Bandwidth. 1980. IEEE TRANS. MICRO. THEORY TECH., MTT-28, 149-151.
- A 1075 Owen, F.N.; Wills, B.J.; and Wills, D. A Close Pair of Radio-Emitting Quasi-stellar Objects. 1980. ASTROPHYS. J., 235, L57-L60.
- A 1054 Perley, R.A.; Willis, A.G.; and Scott, J.S. The Structure of the Radio Jets in 3C449. 1979. NATURE, 281, 437-442.
- A 1066 Rood, R.T.; Sarazin, C.L.; Zeller, E.J.; and Parker, B.C. X- or γ-rays from Supernovae in Glacial Ice. 1979. NATURE, 282, 701-703.
- A 1059 Sarazin, C.L. Galactic Coronae, Quasar Absorption Lines, and the Origin of the Intracluster Medium. 1979. ASTROPHYS. LETT., 20, 93-99.
- A 1076 Saslaw, W.C. Galaxy Clustering and Thermodynamics. 1980. ASTROPHYS. J., 235, 299-306.
- A 1079 Saslaw, W.C. The Evolution of the Distribution of Galaxies. 1980. PHYS. SCR., 21, 725-731.
- A 1073 Seauquist, E.R.; Duric, N.; Israel, F.P.; Spoelstra, T.A.T.; Ulrich, B.L.; and Gregory, P.C. Radio Observations and Analysis of Nova V1500 Cygni. 1980. ASTRON. J., 85, 283-293.
- A 1058 Vanden Bout, P.A.; Steed, J.M.; Bernstein, L.S.; and Klemperer, W. Laboratory Measurements and a Search for Interstellar CO Dimer. 1979. ASTROPHYS. J., 234, 503-505.
- A 1062 von Hoerner, S. and Wong, W.Y. Improved Efficiency with a Mechanically Deformable Subreflector. 1979. IEEE TRANS. ANT. PROP., AP-27, 720-723.
- B 504 Weiler, K.W. and Johnston, K.J. A Study of BL Lacertae Objects. 1980. MON. NOT. ROY. ASTRON. SOC., 190, 269-285.
- A 1068 White, R.A. and Burns, J.O. Radio Emission in the Directions of cD and Related Galaxies in Poor Clusters. I. Pencil Beam Observations at 6 cm. 1980. ASTRON. J., 85, 117-120.
- A 1055 Wright, M.C.H. Maps of High-Velocity Hydrogen Clouds. 1979. ASTROPHYS. J., 234, 27-32.
- A TC Table of Contents. Reprint Series A 1001-1050. 1979. Bibliography - NRAO STAFF AND VISITOR PUBLICATIONS.

AUGUST - 1980

List No. 26

REPRINTS AVAILABLE ON REQUEST

- 1086 Angerhofer, P.E.; Wilson, A.S.; and Mould, J.R. The Central Radio Source in the Peculiar Supernova Remnant CTB 80. 1980. *ASTROPHYS. J.*, 236, 143-152.
- 507 Brown, R.L. Carbon Radio Recombination Line Emission from Dark Clouds. 1980. *RADIO RECOMBINATION LINES*, 127-140.
- 506 Brown, R.L. The Importance of Non-LTE Effects to the Interpretation of Radio Recombination Lines. 1980. *RADIO RECOMBINATION LINES*, 53-61.
- 1089 Cioffi, D.F. and Jones, T.W. Internal Faraday Rotation Effects in Transparent Synchrotron Sources. 1980. *ASTRON. J.*, 85, 368-375.
- 1094 Cram, T.R.; Roberts, M.S.; and Whitehurst, R.N. A Complete, High-Sensitivity 21-cm Hydrogen Line Survey of M31. 1980. *ASTRON. ASTROPHYS. SUPPL. SER.*, 40, 215-248.
- 1093 Dickinson, D.F.; Kuiper, E.N.R.; Dinger, A.S.C.; and Kuiper, T.B.H. Shock Enhancement of HCO⁺. 1980. *ASTROPHYS. J.*, 237, L43-L45.
- 1087 Eilek, J.A. Pair Production and Gamma-Ray Luminosities in Hot Accretion Disks. 1980. *ASTROPHYS. J.*, 236, 664-673.
- 1097 Fomalont, E.B.; Bridle, A.H.; Willis, A.G.; and Perley, R.A. Structure of the Magnetic Field in the Radio Jets in 3C 31 and NGC 315. 1980. *ASTROPHYS. J.*, 237, 418-423.
- 1096 Greenfield, P.E.; Roberts, D.H.; and Burke, B.F. The Double Quasar 0957+561: Examination of the Gravitational Lens Hypothesis Using the Very Large Array. 1980. *SCIENCE*, 208, 495-497.
- 1091 Haschick, A.D.; Moran, J.M.; Rodriguez, L.F.; Burke, B.F.; Greenfield, P.; and Garcia-Barreto, J.A. Observations of a Compact H II Region and Water Vapor Maser Sources in the Vicinity of the Herbig-Haro Objects 7-11. 1980. *ASTROPHYS. J.*, 237, 26-37.
- 1092 Helfand, D.J.; Taylor, J.H.; Backus, P.R.; and Cordes, J.M. Pulsar Timing. I. Observations from 1970 to 1978. 1980. *ASTROPHYS. J.*, 237, 206-215.
- 1100 Johnson, H.M. Observations of R Aquarii. 1980. *ASTROPHYS. J.*, 237, 840-844.
- 509 Kellermann, K.I. Radio Galaxies and Quasars. 1980. *ANN. N.Y. ACAD. SCI.*, 336, 1-11.
- 1106 Kennicutt, R.; Balick, B.; and Heckman, T. A Remarkable H II Region Complex in NOC 2366. 1980. *PUBL. ASTRON. SOC. PACIFIC*, 92, 134-144.
- 1099 Kutner, M.L.; Machnik, D.E.; Tucker, K.D.; and Dickman, R.L. Molecular Clouds Associated with Reflection Nebulae. I. A Survey of Carbon Monoxide Emission. 1980. *ASTROPHYS. J.*, 237, 734-748.
- 1090 Liszt, H.S. and Burton, W.B. The Gas Distribution in the Central Region of the Galaxy. III. A Barlike Model of the Inner-Galaxy Gas Based on Improved H I Data. 1980. *ASTROPHYS. J.*, 236, 779-797.
- B 508 Lockman, F.J. Low Frequency Recombination Line Surveys of the Galactic Plane 1980. *RADIO RECOMBINATION LINES*, 185-204.
- A 1104 Marsh, K.A.; Hurford, G.J.; and Zirin, H. VLA Observations of Spatial Structure in the Quiet Sun at 6 Centimeters, During the 1977 October Eclipse. 1980. *ASTROPHYS. J.*, 236, 1017-1025.
- A 1088 Owen, F.N.; Spangler, S.R.; and Cotton, W.D. Simultaneous Radio Spectra of Sources with Strong Millimeter Components. 1980. *ASTRON. J.*, 85, 351-362.
- A 1080 Partridge, R.B. New Limits on Small-Scale Angular Fluctuations in the Cosmic Microwave Background. 1980. *ASTROPHYS. J.*, 235, 681-687.
- A 1095 Perley, R.A.; Bridle, A.H.; Willis, A.G.; and Fomalont, E.B. High-Resolution Observations of 3C219 at 1.48 and 4.89 GHz. 1980. *ASTRON. J.*, 85, 499-506.
- A 1101 Readhead, A.C.S.; Napier, P.J.; and Bignell, R.C. Hybrid Mapping of 3C 147 on the VLA. 1980. *ASTROPHYS. J.*, 237, L55-L60.
- A 1083 Roberts, M.S. and Havlen, R.J. National Radio Astronomy Observatory (Annual Report). 1980. *BULL. AM. ASTRON. SOC.*, 12, 288-311.
- A 1082 Rodriguez, L.F.; Moran, J.M.; Ho, P.T.P.; and Gottlieb, E.W. Radio Observations of Water Vapor, Hydroxyl, Silicon Monoxide, Ammonia, Carbon Monoxide, and Compact H II Regions in the Vicinities of Suspected Herbig-Haro Objects. 1980. *ASTROPHYS. J.*, 235, 845-865.
- A 1098 Rots, A.H. A Companion for IC 342. 1979. *ASTRON. ASTROPHYS.*, 80, 255-259.
- A 1085 Sarazin, C.L. A Maximum Likelihood Method for Determining the Distribution of Galaxies in Clusters. 1980. *ASTROPHYS. J.*, 236, 75-83.
- A 1084 Spangler, S.R. Interpretation of Radio Spectra of Compact Extragalactic Sources. 1980. *ASTROPHYS. LETT.*, 20, 123-129.
- A 1103 Ulrich, B.L.; Davis, J.H.; Rhodes, P.J.; and Hollis, J.M. Absolute Brightness Temperature Measurements at 3.5-mm Wavelength. 1980. *IEEE TRANS. ANT. PROP.*, AP-28, 367-377.
- A 1105 Ulmer, M.P.; Crane, P.C.; Brown, R.L.; and van der Hulst, J.M. Search for Radio Emission from the Young Supernova Remnant in NGC6946. 1980. *NATURE*, 285, 151-152.
- A 1102 Wilson, A.S.; Pooley, G.G.; Willis, A.G.; and Clements, E.D. Markarian 3: Double Radio Source in a Seyfert Galaxy. 1980. *ASTROPHYS. J.*, 237, L61-L64.
- A 1081 Zuckerman, B. and Kuiper, T.B.H. On Ultracold Molecular Gas Toward the Galactic Center. 1980. *ASTROPHYS. J.*, 235, 840-844.
- A TC Table of Contents. Reprint Series A 1051-1100.
- Rots, A.H. An Atlas of 21 cm H I Line Profiles of 61 Galaxies of Large Angular Size. 1979.

OCTOBER - 1980

List No. 27

REPRINTS AVAILABLE ON REQUEST

- A 1112 Abbott, D.C.; Bieging, J.H.; Churchwell, E.; and Cassinelli, J.P. VLA Radio Continuum Measurements of Mass Loss from Early-Type Stars. 1980. *ASTROPHYS. J.*, 238, 196-202.
- A 1132 Adams, M.T.; Jensen, E.B.; and Stocke, J.T. A Continuum Radio Survey of Isolated Galaxies. 1980. *ASTRON. J.*, 85, 1010-1026.
- B 510 Archer, J.W. Solar Observations with the Very Large Array. 1980. *IAU SYMP.*, 86, 135-140.
- A 1125 Burns, J.O. and Ulmer, M.P. On the Distribution of Radio Emission in the X-ray Cluster of Galaxies Abell 401. 1980. *ASTRON. J.*, 85, 773-779.
- A 1122 Cotton, W.D.; Whittels, J.J.; Shapiro, I.I.; Marcaide, J.; Owen, F.N.; Spangler, S.R.; Rius, A.; Angulo, C.; Clark, T.A.; and Knight, C.A. The Very Flat Radio Spectrum of 0735+178: A Cosmic Conspiracy? 1980. *ASTROPHYS. J.*, 238, L123-L128.
- A 1110 Dickel, H.R.; Dickel, J.R.; Wilson, W.J.; and Werner, M.W. The H II Region-Molecular Cloud Complex W3: Observations of CO, CS, and HCN. 1980. *ASTROPHYS. J.*, 237, 711-733.
- A 1113 Dickel, H.R.; Habing, H.J.; and Isaacman, R. Radio Emission from the Wolf-Rayet Star HD 192163 in NGC 6888. 1980. *ASTROPHYS. J.*, 238, L39-L41.
- A 1124 Erkes, J.W.; Philip, A.G.D.; and Turner, K.C. Fine Structure in the Northern Extension of the Magellanic Stream. 1980. *ASTROPHYS. J.*, 238, 546-553.
- A 1130 Fomalont, E.B.; Palimaka, J.J.; and Bridle, A.H. Extended Radio Sources and Elliptical Galaxies. IV. Structures of 40 Resolved Sources. 1980. *ASTRON. J.*, 85, 981-994.
- A 1114 Gisler, G.R. On the Morphology of Galaxies in Clusters. 1980. *ASTRON. J.*, 85, 623-625.
- A 1121 Gottesman, S.T. High-Resolution Observations of the Neutral Hydrogen in the Galaxy NGC 925. 1980. *ASTRON. J.*, 85, 824-835.
- B 511 Hjellming, R.M. and Gibson, D.M. Nonthermal Microwave Phenomena in Other Stars. 1980. *IAU SYMP.*, 86, 209-220.
- A 1109 Lake, G. and Partridge, R.B. Microwave Search for Ionized Gas in Clusters of Galaxies. 1980. *ASTROPHYS. J.*, 237, 378-389.
- A 1120 Ledden, J.E.; Broderick, J.J.; Condon, J.J.; and Brown, R.L. A Confusion-Limited Extragalactic Source Survey at 4.755 GHz. I. Source List and Areal Distributions. 1980. *ASTRON. J.*, 85, 780-788.
- A 1117 Marscher, A.P. and Shaffer, D.B. VLBI Observations at 18 and 2.8 cm: 0133+47, 0735+178, OH 471, OQ 172, 1633+38, and NRAO 667 (2147+145). 1980. *ASTRON. J.*, 85, 668-672.
- A 1119 Morris, M. and Bowers, P.F. A Study of Broad-Line OH Emission Sources: OH231.8+4.2, VY CMa, and M1-92. 1980. *ASTRON. J.*, 85, 724-737.
- B 512 Neff, S.G. and Rudnick, L. The Behaviour of Hot Spots in Classical Double Radio Sources. 1980. *MON. NOT. ROY. ASTRON. SOC.*, 192, 531-544.
- A 1126 Owen, F.N.; Hardee, P.E.; and Bignell, R.C. VLA Observations of the M87 Jet at 6 and 2 Centimeters. 1980. *ASTROPHYS. J.*, 239, L11-L15.
- A 1131 Palimaka, J.J.; Bridle, A.H.; and Fomalont, E.B. Extended Radio Sources and Elliptical Galaxies. V. Optical Positions for 40 Identified Sources. 1980. *ASTRON. J.*, 85, 995-1002.
- A 1108 Pearson, T.J.; Readhead, A.C.S.; and Wilkinson, P.N. Maps of the Quasars 3C 119, 3C 286, 3C 345, 3C 454.3, and CTA 102 with a Resolution of 5 Milli-arcseconds at 1.67 GHz. 1980. *ASTROPHYS. J.*, 236, 714-723.
- A 1115 Perley, R.A.; Fomalont, E.B.; and Johnston, K.J. Compact Radio Sources with Faint Components. 1980. *ASTRON. J.*, 85, 649-658.
- A 1128 Potash, R.I. and Wardle, J.F.C. 4C 32.69: A Quasar with a Radio Jet. 1980. *ASTROPHYS. J.*, 239, 42-49.
- A 1129 Reid, M.J.; Haschick, A.D.; Burke, B.F.; Moran, J.M.; Johnston, K.J.; and Swenson, G.W., Jr. The Structure of Interstellar Hydroxyl Masers: VLBI Synthesis Observations of W3(OH). 1980. *ASTROPHYS. J.*, 239, 89-111.
- A 1111 Rodriguez, L.F. and Chaisson, E.J. On the Radio and Near-Infrared Hydrogen Recombination-Line Emission from M82. 1980. *ASTROPHYS. J.*, 238, 41-44.
- A 1118 Rossano, G.A.; Angerhofer, P.E.; and Grayzeck, E.J. A Continuum and Recombination Line Study of the CEP IV Star Formation Region. 1980. *ASTRON. J.*, 85, 716-723.
- A 1123 Sarazin, C.L.; Begelman, M.C.; and Hatchett, S.P. Disk-Driven Precession in SS 433. 1980. *ASTROPHYS. J.*, 238, L129-L132.
- A 1107 Simon, R.S.; Readhead, A.C.S.; Moffet, A.T.; Wilkinson, P.N.; and Anderson, B. Very Long Baseline Interferometry Observations of 3C 147 and 3C 286 at 329 Megahertz. 1980. *ASTROPHYS. J.*, 236, 707-713.
- A 1127 Snell, R.L.; Loren, R.B.; and Plambeck, R.L. Observations of CO in L1551: Evidence for Stellar Wind Driven Shocks. 1980. *ASTROPHYS. J.*, 239, L17-L22.
- A 1116 Spangler, S.R. and Cook, D.B. VLA Observations of Steep-Spectrum, Variable Radio Sources. 1980. *ASTRON. J.*, 85, 659-667.
- A 1133 Ulich, B.L. Improved Correction for Millimeter-Wavelength Atmospheric Attenuation. 1980. *ASTROPHYS. LETT.*, 21, 21-28.