

WIGR DM
Berkeley

NATIONAL RADIO ASTRONOMY OBSERVATORY
Charlottesville, Virginia

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

JAN 18 1979

Quarterly Report

October 1, 1978 - December 31, 1978

RESEARCH PROGRAMS

<u>140-Foot Telescope</u>	<u>Hours</u>
Scheduled observing	1664.50
Scheduled maintenance and equipment changes	470.00
Scheduled tests and calibration	1.50
Time lost due to:	
equipment failure	8.00
power	0.00
weather	21.50
interference	0.00

The following line programs were conducted during this quarter.

<u>Observer</u>	<u>Program</u>
P. Bowers	Studies of 18-cm OH emission from unidentified Type II OH/IR stars.
W. B. Burton (Minnesota)	Study of the kinematics of the nuclear region of the galaxy by the examination of 21-cm hydrogen.
H. Liszt	
W. B. Burton (Minnesota)	Study of 21-cm hydrogen in the high-velocity stream.
A. Phillips (Minnesota)	
F. J. Lockman	Observations of 21-cm H166 α recombination-line emission to study the bulk motion in the ionized gas near the Rosette nebula.
C. Heiles (Berkeley)	Study of the 21-cm hydrogen distribution in regions showing possible Zeeman effects.
T. Troland (Berkeley)	
You-Hau Chu (Berkeley)	
J. M. van der Hulst	Observations of 21-cm hydrogen toward I0 and Irr II galaxies.
P. Crane	
R. Brown	Search at 732 MHz for highly redshifted HI in absorption in PKS 0528-25.
N. Evans (Texas)	Observations of 2-cm H ₂ CO to study the radial density variations in molecular clouds.
R. Loren (Texas)	
R. Snell (Texas)	
H. Wootten (Texas)	

<u>Observer</u>	<u>Program</u>
M. Allen (Caltech) N. Evans (Texas) M. Scholtes (Texas) H. Wootten (Texas)	Observations of 2-cm H ₂ CO in Bok globules and larger dust clouds.
C. Bernes (Stockholm Observatory) A. Sandqvist (Stockholm Observatory)	Mapping of 2-cm H ₂ CO in selected dark dust clouds.
E. Grayzeck (Nevada) P. Angerhofer (Maryland) G. Rossano (Maryland)	Observations at 4830 MHz of H ₂ CO toward the Cep IV star formation region.
G. Rossano (Maryland)	Observations at 6-cm of H110 _a and H ₂ CO toward HII regions that are embedded in dark cloud complexes, and of H109 _a in selected regions of the Rosette nebula.
K. Tucker (Fordham) W. Massano (Fordham) M. Kutner (Rensselaer) D. Machnik (Rensselaer)	Observations at 4388 MHz and 4593 MHz of H ₂ C ¹⁸ O and H ₂ ¹³ CO to obtain accurate isotope ratios for formaldehyde.
B. Burke (MIT) W. Baan (Inst. for Advanced Study) A. Haschick (Center for Astrophys.)	Search at 1665 MHz and 1667 MHz for OH absorption in selected radio galaxies and the QSO-galaxy pair 4C32.33/NGC 3067.
L. Brown (Goddard) R. Hobbs (Goddard) A. Michalitsianos (Goddard) M. Kafatos (George Mason)	Observations at 18-cm to search for OH maser radiation from Nova Cygni 1978.
R. Brown	Search for 18-cm OH scintillation in W-3.

The following continuum program was conducted.

<u>Observer</u>	<u>Program</u>
H. Johnson (Lockheed)	Attempt at 400 MHz to observe lunar occultations of selected Abell clusters of galaxies.

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

A - Algonquin, Canada 150-ft	K - Haystack 120-ft
B - MPIR Bonn, W. Germany 100-m	N - NRL 85-ft
F - Harvard, Fort Davis 85-ft	O - OVRO 130-ft
G - NRAO 140-ft	P - Arecibo 1000-ft
H - Hat Creek 85-ft	

Observer

B. Burke (MIT)
 A. Haschick (Center for Astrophys.)
 J. Moran (Center for Astrophys.)
 K. Johnston (NRL)
 R. Walker (Caltech)
 M. Reid

J. Bell (Center for Astrophys.)
 J. Moran (Center for Astrophys.)
 K. Johnston (NRL)
 M. Reid

D. Jones (Cornell)
 Y. Terzian (Cornell)
 R. Sramek

M. Cohen (Caltech)
 R. Linfield (Caltech)
 A. Moffet (Caltech)
 T. Pearson (Caltech)
 A. Readhead (Caltech)
 G. Seielstad (Caltech)
 R. Walker (Caltech)

R. Walker (Caltech)
 R. Preston (JPL)
 J. Romney (MPIR, Bonn)

R. Linfield (Caltech)

B. Geldzahler (Pennsylvania)
 K. Kellermann (MPIR, Bonn)

W. Cotton (MIT)
 I. Shapiro (MIT)
 J. Wittels (MIT)
 T. Clark (Goddard)
 C. Knight (Haystack)

M. Cohen (Caltech)
 A. Readhead (Caltech)
 T. Pearson (Caltech)
 G. Seielstad (Caltech)

Program

Observations at 2.8-cm of W3(OH) and W75 to produce full polarization maps of the OH maser complexes of these sources with telescopes at stations O, K, F, and G.

Observations at 18 cm to obtain absolute positions and to study the structure of OH masers using telescopes at stations N, F, and G.

Observations at 1667 MHz of the nuclei of normal galaxies with telescopes at stations P, O, and G.

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

Observations of 2.8-cm emission from 4 quasistellar sources having redshifts greater than 2.3, with telescopes at stations K, O, B, and G.

Observations at 2.8 cm of the nuclei of radio galaxies with telescopes at stations A, K, F, B, O, and G.

Observations at 2.8 cm of the nuclear components of Cyg A and 3C 154, using telescopes at stations B and G.

Observations at 3.6 cm and 13 cm to continue monitoring sources which show superluminal expansion and at 13 cm to examine the structure of steep spectrum compact sources, with telescopes at stations K, F, O, and G.

Observations at 6 cm of sources selected from the MPIR, Bonn, 6-cm catalog using telescopes at O, H, F, and G.

<u>300-Foot Telescope</u>	<u>Hours</u>
Scheduled observing	1986.50
Scheduled maintenance and equipment changes	138.25
Scheduled tests and calibration	3.00
Time lost due to: equipment failure	93.00
power	0.00
weather	11.25
interference	12.75

The following line programs were conducted during this quarter.

<u>Observer</u>	<u>Program</u>
B. Balick (Washington)	An attempt to detect HI emission from
T. Heckman (Washington)	the x-ray quasar 4U0241+61.
P. Usher (Penn State)	Observations of redshifted 21-cm hydrogen
K. Mitchell (Penn State)	in absorption toward quasistellar sources with featureless optical spectra.

The following continuum programs were conducted.

<u>Observer</u>	<u>Program</u>
G. Rossano (Maryland)	Study of diffuse envelopes surrounding dark cloud complexes at 9 cm.
J. Condon (VPI & SU) D. Jauncey (VPI & SU)	Deep 9-cm survey of faint extragalactic sources in the regions $19^{\text{h}} < \alpha < 7^{\text{h}}$, $+1^{\circ} < \delta < +2^{\circ}$, and $7^{\text{h}} < \alpha < 19^{\text{h}}$, $10^{\circ}30' < \delta < 11^{\circ}30'$.
B. Burke (MIT) P. Greenfield (MIT) C. Lawrence (MIT)	Study at 6 cm of sources found in the Arecibo 611-MHz survey.
D. Heeschen	Monitor selected extragalactic sources for short-term variability at 6 cm.
B. Burke (MIT) P. Greenfield (MIT) J. Jernigan (MIT) C. Lawrence (MIT)	Observations at 5006 MHz to survey a square of sky 12° on a side, centered at $13^{\text{h}}44^{\text{m}}$ R.A. and $21^{\circ}5$ Dec. for radio sources with x-ray emission.
R. M. Price (NSF) P. Crane	Observations of edge-on spiral galaxies at 6 cm.

ObserverProgram

P. Crane
J. van der Hulst

Survey of I0 and Irr II galaxies.

T. Balonek (Massachusetts)
W. Dent (Massachusetts)
M. Hartman (Massachusetts)

Study at 6, 11 and 21 cm of the polarization and flux density of known extragalactic radio sources, and an attempt to detect thermal emission from the Pleiades.

The following pulsar programs were conducted.

ObserverProgram

P. Backus (Massachusetts)
J. Taylor (Massachusetts)
M. Damashek

Observations at 610 MHz to determine periods, period derivatives, positions, and dispersion measures of known pulsars.

M. Ewing (Caltech)
A. Readhead (Caltech)

Pulsar observations at 4 discrete simultaneous frequencies between 100 and 200 MHz to (1) observe the drifting subpulses in PSR 0809+74, (2) check for clock error effects in PSR 0809+74 and PSR 1133+16, and (3) to look for narrow band scintillation features at low frequencies in moderate dispersion pulsars.

M. Damashek

Observations at 410 MHz to complete a northern hemisphere pulsar search.

Interferometer

Since October 1, 1978, the use of the 4-element interferometer has been under exclusive contract to the U.S. Naval Observatory for the purpose of precise measurements of universal time and polar motion.

36-Foot TelescopeHours

Scheduled observing	1980.75
Scheduled maintenance and equipment changes	132.75
Scheduled tests and calibration	46.50
Time lost due to: equipment failure	51.00
weather	330.50
power	0.00
interference	0.00

Observer

A. Barrett (MIT)
 M. Schneps (MIT)

G. Chin (Goddard)
 K. Fox (Tennessee)
 D. Jennings (Goddard)

F. Clark (Kentucky)
 R. Fleck (Kentucky)

E. Churchwell (Wisconsin)
 J. Walmsley (MPIR, Bonn)
 G. Winnewisser (MPIR, Bonn)

J. Davis (Texas)
 H. Pickett (Texas)

W. Dent (Massachusetts)
 R. Hobbs (Goddard)

E. Epstein (Aerospace)
 J. Rather (W. J. Schafer & Assoc.)

E. Epstein (Aerospace)
 J. Rather (W. J. Schafer & Assoc.)
 R. Landau (Minnesota)

K. Fox (Tennessee)
 D. Jennings (Goddard)

R. Hobbs (Goddard)
 F. Kerr (Maryland)
 R. Sinha

R. Hobbs (Goddard)
 S. Maran (Goddard)
 L. Brown (Goddard)
 M. Kafatos (George Mason)

D. Johnson (NBS)
 C. Heiles (California, Berkeley)
 T. Troland (California, Berkeley)
 F. Clark (Kentucky)

M. Kutner (Rensselaer)
 K. Tucker (Fordham)
 N. Evans (Texas)

Program

Study of the nebula NGC 2359.

Search for recombination lines of positronium.

Observational determination of the density law in dark clouds.

Observations of HCN chains in selected dark clouds.

Search for diatomic sulfur.

Study of variable sources at 3 mm and 9 mm.

Search for variability of extragalactic sources.

Study of intra-day variability of BL Lac.

Mapping of methane isotopes in Orion A and other sources.

Observations of the galactic center at 90 GHz.

Observations of Cygnus A at 150 GHz.

Study of flux and polarization of SiO maser sources.

Determination of isotope ratios via formaldehyde observations.

<u>Observer</u>	<u>Program</u>
M. Kutner (Rensselaer) K. Tucker (Fordham) N. Evans (Texas)	Study of interface between HII and molecules in NGC 1977.
M. Kutner (Rensselaer) K. Tucker (Fordham) R. Dickman (Aerospace)	Search for interstellar pyrrole and furan.
M. Kutner (Rensselaer) K. Tucker (Fordham) R. Dickman (Aerospace)	Study of unidentified lines at 89 and 98 GHz in Orion.
M. Kutner (Rensselaer) K. Tucker (Fordham)	Observations of broad CO lines in T-Tauri stars.
M. Morris (Columbia) P. Thaddeus (Inst. for Space Studies)	Verification of C ₅ N, C ₆ H radicals and search for C ₂ H ₃ radical.
J. Rahe (Erlanger-Nurnberg Univ.) W. Jackson (Howard) E. Churchwell (Wisconsin)	Search for C ₂ H, CN and CO in Comet Meier (1978f).
L. Rickard J. van der Hulst	Measurement of continuum emission from spiral galaxies at 3 mm.
L. Rickard B. Turner P. Palmer (Chicago)	Maps of CO in spiral galaxies.
L. Rickard B. Turner P. Palmer (Chicago)	Study of HCO ⁺ in external galaxies.
L. Rudnick F. Owen J. Puschell (Minnesota) W. Stein (Minnesota) J. Warner (Minnesota) T. Jones (Minnesota)	Study of polarization and emission from BL Lac objects.
R. Snell (Texas) R. Loren (Texas)	Study of self-reversed CO lines to test collapse models of stars.
L. Snyder (Illinois) J. Hollis J. Webber (Wisconsin)	Search for molecular lines in Comet Meier (1978f) and for glycine in galactic sources.

Observer

P. Wannier (Caltech)

R. Willson (Tufts)
K. Lang (Tufts)W. Wilson (Aerospace)
R. Kakar (JPL)
M. Klein (JPL)ProgramStudy of nucleosynthesis in stars and
in the galactic center.Search for CO emission from Wolf-Rayet
stars.Observations of CO in Venus and other
planets.Very Large Array

The array was scheduled for observations 57 percent of the time in the last quarter of 1978. Forty percent of the time was devoted to astronomical observing and the remaining 17 percent to instrumental development and tests. Approximately 11 percent of the observing time was lost to instrumental problems. The following research programs were conducted with the VLA during this quarter.

ObserverB. Balick (Washington)
E. Wollman (KPNO)
H. Smith (Arizona)G. Berge (Caltech)
D. Muhleman (Caltech)A. Bridle (Queens)
E. Fomalont
G. Miley (Leiden)
R. Perley
A. Willis (Brandeis)
J. Högbom (Stockholm)A. Bridle (Queens)
E. Fomalont
R. Perley
A. Willis (Brandeis)
W. van Breugel (Leiden)J. Broderick (VPI & SU)
R. Brown
J. Condon (VPI & SU)
J. Ledden (VPI & SU)Program

Attempt to detect the Becklin-Neugebauer object.

Six centimeter observations of Uranus.

Objects with both large- and small-scale structure: 3C 315, 3C 31 and NGC 1052.

Maps of the radio jet galaxies B2 0844+319 and 3C 310 at 6 and 2 cm.

Structure of faint sources selected at 6 cm.

<u>Observer</u>	<u>Program</u>
B. Burke (MIT)	Confirmation of x-ray radio identifications of high latitude objects suggested by SAS-3/300-ft observations. All bands.
B. Burke (MIT) P. Greenfield (MIT)	The x-ray galaxy NGC 2110, 2 and 1.3 cm observations.
E. Churchwell (Wisconsin) D. Abbott (Wisconsin) J. Bieging (Berkeley) J. Cassinelli (Wisconsin)	Observations of stars to study mass loss.
P. Crane R. M. Price (NSF)	Four-frequency fluxes of the compact nuclei of NGC 3031, NGC 3034, and NGC 4594.
W. Erickson (Maryland) J. Rickard (Clark Lake) W. Cronyn (Clark Lake) R. Perley	Six- and 20-centimeter observations of "Scintars"--low latitude strongly scintillating objects.
D. Florkowski (Florida) S. Gottesman (Florida)	Observations of the Wolf-Rayet binary HD193793 and of star Zeta Pupis at 2, 6, and 20 cm.
E. Fomalont G. Miley (Leiden)	Twenty-centimeter structure of 3C 318.1, an extremely steep spectrum source.
R. Hjellming N. Vandenberg (Goddard)	Observations of Nova Vulpecula 1976, at 2, 6, and 20 cm.
R. Hjellming R. Newell (NMIMT)	Six-centimeter observations of old novae--FH Serpentis 1970, HR Delphini 1967, and V1500 Cygni 1975.
K. Johnston (NRL) C. Wade F. Owen	Stellar astrometry at 6 cm.
P. Kronberg (Toronto) J. Clarke (Toronto) M. Burbidge (San Diego)	Maps of the high-z QSO's 3C 280.1 and 3C 205. Six and 20 cm.
K. Lang (Tufts)	Solar observations at 6 and 21 cm to study flare buildups.
F. Owen P. Hardee (Virginia)	Jet galaxy NGC 7385. Six-centimeter observations. Virgo A. Two-centimeter observations.

<u>Observer</u>	<u>Program</u>
F. Owen L. Rudnick J. Burns	Sources in clusters of galaxies.
R. Perley K. Johnston (NRL)	Weak halos of compact objects at 20 cm.
A. Readhead (Caltech) R. C. Bignell P. Napier	Observations of 3C 147 at 1.3 and 2 cm.
M. Reid D. Shaffer B. Rayhrer	Observations at 1.3 and 2 cm of the compact HII regions W3(OH) and W75.
L. Rickard S. Spangler P. Bowers	Six-centimeter narrow-band observations of the excited OH maser in W3.
L. Rudnick F. Owen W. Stein (Minnesota) J. Puschell (Minnesota) J. Warner (Marshall Sp. Fl. Ctr.) T. Jones (Minnesota)	Polarization of compact sources--spectral characteristics over radio, infrared and optical regimes.
W. Sanders (New Mexico State) B. Clark	Six-centimeter search for emission from Hyades stars.
M. Schneps (MIT) A. Haschick (Center for Astrophys.) J. Moran (Center for Astrophys.)	Observations of Wolf-Rayet shell stars--NGC 2359, MWC 297, GL 2104 and GL 2179 at 6 and 21 cm.
H. Schnopper (SAO) J. Moran (Center for Astrophys.) R. Hjellming	Search for radio emission from galaxies and clusters of galaxies near SAS-3 x-ray positions.
A. R. Thompson	Observation of planetary nebulae NGC 6543 and NGC 7662 at 2 and 6 cm.
B. Turner F. Owen	Observations in the OH lines to measure positions of maser sources.

ELECTRONICS DIVISION

Charlottesville

The Model IV autocorrelator hardware is now 80 percent complete and the software is 40 percent complete. Delivery to Green Bank in approximately six months is expected.

Completion of the first of two Mark III VLBI terminals will be on schedule, at the end of January. Construction of a second terminal will then commence.

FET amplifiers at \sim 1.5 GHz have been constructed using Plessey and Hewlett-Packard transistors, with noise temperatures of 40 K and 25 K, respectively, at a physical temperature of 77 K. A two-stage 1.5-GHz amplifier will be constructed and tested at 20 K. Design of 5- and 15-GHz amplifiers is proceeding.

Cooled mixer performance in the 80-120 GHz range has been greatly improved with the use of diodes provided by Bell Telephone Laboratory. At 90 GHz and 115 GHz, single-sideband receiver noise temperatures have been improved from 600 K and 700 K to 340 K and 480 K, respectively. One mixer has a mixer noise temperature of 86 K SSB at 90 GHz and a physical temperature of 12 K. This is the lowest value reported for a non-superconductor device.

Further work on varactor-mixers for 115 GHz has resulted in units with conversion gain. However, noise-temperature measurements with a maser I.F. amplifier gave high receiver noise-temperatures of \sim 400 K. Some of the noise may be due to a quasi-optical LO diplexer. This is being investigated, but work on varactor mixers will taper off due to their poor performance relative to the new cooled BTL diode mixers.

Green Bank

Work has been progressing well on the first channel of the 5-26 GHz up-converter/maser receiver for the 140-ft telescope. Tests on the 8.2-10.8 GHz upconverter indicate that we will be able to obtain our objective of a 50 K system temperature over most of this frequency range. AIL will soon deliver the 12-16 GHz upconverter and has started manufacturing the 5-8 GHz upconverter. This receiver should be operational by the end of 1979; the second channel will follow in 1980.

The 300-1000 MHz cooled upconverter/FET receiver is progressing. Cold testing of the prototype upconverter is currently taking place in the receiver dewar. Construction of the new traveling box track has started and it should be ready for testing and installation by mid-1979.

Development work on a circulator for a 40-50 GHz maser is continuing, with the main emphasis on the design of a circulator. A low pass filter has

been developed for insertion between the K-band maser ruby structure and circulator to eliminate pump power leakage which is a minor problem with the current 18-26 GHz maser.

The development of the IF section for the Model IV autocorrelator is progressing. Testing and installation of the complete system at the 140-ft telescope is likely late summer of 1979.

The digital group has completed the 14 video converters for the first VLB Mark III terminal. The construction of a further 14 for the second Mark III terminal is well underway. A new inductosyn readout system to replace the Baldwin strobe lamp encoders on the 300-ft telescope has been developed and is ready to be installed.

Tucson

During this quarter work has started on a high voltage power supply for the 180-230 GHz carcinotron. Work is progressing on a system for phase locking this device to permit its use for spectral-line observations.

The performance of our 80-120 GHz cooled mixer receiver has been improved by diodes donated by Bell Telephone Laboratories. The improvement factor at 90 GHz is approximately 1.5.

Work on the 2-mm room temperature receiver has continued, and we now have a receiver temperature of 2000 K SSB at 150 GHz. A cooled version of this receiver has been started.

The design of a 1-mm bolometer system operating at 0.3 K has been started. We expect to start construction of this receiver soon.

ENGINEERING DIVISION

Preparation of detail drawings for the 300-ft telescope traveling feed continued. Some parts of this system are now being built in the shop. Detail design of the drive system for the traveling feed progressed to the final stages. The 140-ft surface was measured on 72 radii, using the "stepping bar" method. Refinement and cross checking of the conceptual structure system for the 25-m millimeter-wave telescope was developed further. A contour map and conceptual site plan were developed for the proposed 25-m telescope. Studies and engineering assistance was provided the VLA project. Routine engineering assistance was provided operations and maintenance in Charlottesville, Green Bank, and Tucson.

COMPUTER DIVISION

Map Processing Development

Work is continuing on the map/image processing system. The software development projects at the VLA site and in Charlottesville are being coordinated so as to produce a single software system.

Spectral-Line Data Reduction

Single dish spectral-line data reduction may be done on a time available basis using the Charlottesville Mod Comp. The IBM 360 remains the primary data reduction path, in large part because of the use of the Calcomp.

IBM 360/65

The combination of VLA and VLBI data reduction programs has strained the input/output and the disc resources of the IBM 360/65. Replacement of this machine is not planned before 1981. We are investigating some channel configuration changes to relieve the difficulty.

VERY LARGE ARRAY PROGRAM

During the month of December the array operated for the first time with 15 antennas over approximately an 18-km baseline.

New suppliers have been found for the C- and L-band feeds and for the L-band circular polarizer. The need to find new suppliers for these feed components will delay the installation of the L-band circular polarizers until approximately April, 1979, but should not affect the schedule for the L- and C-band feeds. The new laboratory facility for the cryogenic and front end groups was completed and occupied during the quarter. A review of the reliability of the CTI cryogenics systems currently operational on antennas shows that in the 11300 compressor hours accumulated to date on 4 antennas, no cryogenic failures have occurred. This is a very significant improvement over the reliability obtained with the Air Products systems. The new spectral processor was brought into operation at the end of October.

In the waveguide area, the final-design couplers have now been installed at all stations on the west arm out to AW8 at 17.2 km where the completed waveguide ends. Tests of the newly installed waveguide on the east arm show a mean attenuation of 1.04 dB per km at 50 GHz for the 5.62 km from BE6 to AE5.

The PDP-11/70 mapping software works and is improving. A character generator for the Dicomed film writer has been designed and is nearly complete. We have completed our analysis of our need for a second graphics terminal and have recommended purchase of a H-P 2648 and a Versatec printer to serve as a hard copy unit.

Arizona Railroad Co. is continuing the take up of 4500 feet of railroad trackage at Fort Huachuca, Arizona, and shipments are being received at the site.

The procurement activity has centered around exercising a number of options on major subcontracts thus utilizing the \$3.5 million in advanced 1979 funding, initiating procurement actions for the early part of 1979 and completing the 1978 purchasing requirements. In all, some \$4.3 million in procurement activity has been commenced or completed this quarter. In a number of instances, it has been possible to place orders for quantities to complete the requirements for the program. This has allowed price advantages to be taken of larger quantities and elimination of potential inflation.

Bids were received on the second antenna transporter. Arrangements were made to meet with the bidders early in December in order to evaluate their capabilities and also to conduct price negotiations.

On November 30, 1978, the General Accounting Office denied the Burn Construction Company, Inc., Request for Reconsideration and affirmed their previous decision in favor of NSF-NRAO.

On October 26, 1978, two attorneys from the New Mexico Department of Taxation and Finance and experts from the U.S. Department of Justice visited the site to observe the movement of an antenna.

During the period November 28, 29, December 1, the Commission appointed by the U.S. District Court to consider the Ake-Taylor-Dunlap request for additional compensation for the land taken for the VLA held a final hearing in Las Cruces, New Mexico. It is expected that the Commission will visit the site before making their recommendations to the Judge.

Phase IV Site & Wye construction work went along on schedule and was 52 percent complete at the end of the quarter.

PERSONNEL

Appointments

Marian W. Pospieszalski	Electronics Engineer I	10/02/78
Simon D. M. White	Visiting Asst. Scientist	10/05/78
Stanislaw Gorgolewski	Visiting Scientist	10/05/78
Jack O. Burns, Jr.	Research Associate	11/01/78
John M. Benson	Research Associate	11/07/78

Changes in Status

Billy L. Meredith	Scientific Prog. Analyst I/ Assoc. Division Head, Computer Division	12/01/78
-------------------	---	----------

Changes in Status (cont'd)

Campbell M. Wade	Assistant Director, VLA Operations/Scientist	12/01/78
------------------	---	----------

Terminations

D. Richard Decker	Electronics Engineer I	10/31/78
Hernan Quintana	Research Associate	12/18/78
Jan M. van der Hulst	Research Associate	12/18/78
Simon D. M. White	Visiting Asst. Scientist	12/31/78

APPENDIX A

A list of Observatory reprints issued since January 1, 1978.

No.	Title	Author(s)	Journal
SERIES A			
751	Extragalactic Sources with Strong Millimeter-Wave Emission	F. N. Owen S. L. Mufson	<u>Astron. J.</u> , 82, 776, 1977.
752	Structure of Radio Sources with Remarkably Flat Spectra: PKS 0735+178	A. P. Marscher	<u>Astron. J.</u> , 82, 781, 1977
753	Search for Microarcsecond Structure in Low-Frequency Variable Radio Sources	J. W. Armstrong S. R. Spangler P. E. Hardee	<u>Astron. J.</u> , 82, 785, 1977
754	Precise Positions of Radio Sources. V. Positions of 36 Sources Measured on a Baseline of 35 km	C. M. Wade K. J. Johnston	<u>Astron. J.</u> , 82, 791, 1977
755	Orbit Segregation in Evolving Galaxies and Clusters of Galaxies	W. C. Saslaw	<u>Astrophys. J.</u> , 216, 690, 1977.
756	Possible Jovian Methane Emission at 76 GHz in Coincidence with Decameter Activity	K. Fox D. E. Jennings	<u>Astrophys. J.</u> , 216, L83, 1977
757	A Statistical Investigation of Radio Sources in the Directions of Zwicky Clusters of Galaxies	J. O. Burns F. N. Owen	<u>Astrophys. J.</u> , 217, 34, 1977
758	Extended Rotation Curves of High-Luminosity Spiral Galaxies. I. The Angle Between the Rotation Axis of the Nucleus and the Outer Disk of NGC 3672	V. C. Rubin N. Thonnard W. K. Ford, Jr.	<u>Astrophys. J.</u> , 217, L1, 1977
759	Observations with the VLA of the Radio Binary Star AR Lacertae	F. N. Owen S. R. Spangler	<u>Astrophys. J.</u> , 217, L41, 1977

No.	Title	Author(s)	Journal
760	^{30}SiO in the Interstellar Medium	F. O. Clark F. J. Lovas	<u>Astrophys. J.</u> , 217, L47, 1977
761	Radio Detection of Nitroxyl (HNO): The First Interstellar NO Bond	B. L. Ulich J. M. Hollis L. E. Snyder	<u>Astrophys. J.</u> , 217, L105, 1977
762	Detection and Significance of Carbon Recombination Lines in Diffuse Interstellar Clouds	R. M. Crutcher	<u>Astrophys. J.</u> , 217, L109, 1977
763	The Detailed Structure of CO in Molecular Cloud Complexes. I. NGC 6334	H. R. Dickey J. R. Dickey W. J. Wilson	<u>Astrophys. J.</u> , 217, 56, 1977
764	Production and Beaming of Pulsar γ -ray Emission	P. E. Hardee	<u>Astrophys. J.</u> , 216, 873, 1977
765	A Search for Neutral Hydrogen Clouds in Radio Galaxies and in Intergalactic Space	M. S. Roberts D. G. Steigerwald	<u>Astrophys. J.</u> , 217, 883, 1977
766	Compact Blueshifted Galaxy RMB 56 (1216+141)	T. D. Kinman V. C. Rubin N. Thonnard W. K. Ford, Jr. C. J. Peterson	<u>Astron. J.</u> , 82, 879 and 932, 1977.
767	Radio and Optical Observations of the N Galaxy 4C 39.11	M. T. Adams L. Rudnick	<u>Astron. J.</u> , 82, 857 and 931, 1977.
768	The Dressed Slingshot and the Symmetry of Double Radio Galaxies	D.N.C. Lin W. C. Saslaw	<u>Astrophys. J.</u> , 217, 958, 1977
769	Observations of the SiO and H_2O Masers in Orion A	J. M. Moran K. J. Johnston J. H. Spencer P. R. Schwartz	<u>Astrophys. J.</u> , 217, 434, 1977
770	On the Nature of Radio Sources Near Flare Stars	W. S. Gilmore R. L. Brown B. Zuckerman	<u>Astrophys. J.</u> , 217, 716, 1977

No.	Title	Author(s)	Journal
771	Carbon Monoxide in Maffei 2	L. J. Rickard B. E. Turner P. Palmer	<u>Astrophys. J.</u> , 218, L51, 1977
772	21-cm Observations of Non-planar HI Associated with the Perseus Spiral Arm	E. J. Grayzeck	<u>Astron. J.</u> , 82, 886, 1977
773	The Energetics of Molecular Clouds. I. Methods of Analysis and Application to the S255 Molecular Cloud	N. J. Evans II G. N. Blair S. Beckwith	<u>Astrophys. J.</u> , 217, 448, 1977
774	Real-Time, Very-Long Baseline Interferometry Based on the Use of a Communications Satellite	J. L. Yen K. I. Kellermann B. Rayhrer N. W. Brotan D. N. Fort S. H. Knowles W. B. Waltman G. W. Swenson, Jr.	<u>Science</u> , 198, 289, 1977
775	2.8 and 6 cm Wavelength Observations of NGC 7822	P. E. Angerhofer M. R. Kundu R. H. Becker T. Velusamy	<u>Astron. Astrophys.</u> , 61, 285, 1977
776	The Radio Structure and Optical Field of 3C 303	P. P. Kronberg E. M. Burbidge H. E. Smith R. G. Strom	<u>Astrophys. J.</u> , 218, 8, 1977
777	The H ₂ CO Absorption Toward IC 1318 b-c in Cygnus	H. R. DickeI A. W. Seacord II S. T. Gottesman	<u>Astrophys. J.</u> , 218, 133, 1977
778	Variable 2.6 mm CO Emission from x Cygni and Mira	K. Y. Lo K. P. Bechis	<u>Astrophys. J.</u> , 218, L27, 1977
779	Radio Detection of Interstellar N ₂ D ⁺	L. E. Snyder J. M. Hollis D. Buhl W. D. Watson	<u>Astrophys. J.</u> , 218, L61, 1977

No.	Title	Author(s)	Journal
780	The Hydroxyl Masers in the Orion Nebula	S. S. Hansen J. M. Moran M. J. Reid K. J. Johnston J. H. Spencer R. C. Walker	<u>Astrophys. J.</u> , 218, L65, 1977
781	Physical Conditions in Polarized Compact Radio Sources	T. W. Jones S. L. O'Dell	<u>Astron. Astrophys.</u> , 61, 291, 1977
782	Bispectral Analysis of Meter Wavelength Interplanetary Scintillation	J. W. Armstrong	<u>Astron. Astrophys.</u> , 61, 313, 1977
783	Radio Sources with Superluminal Velocities	M. H. Cohen K. I. Kellermann D. B. Shaffer R. P. Linfield A. T. Moffet J. D. Romney G. A. Seilestad I.I.K. Pauliny-Toth E. Preuss A. Witzel R. T. Schilizzi B. J. Geldzahler	<u>Nature</u> , 268, 405, 1977
784	Radio Sources Near the Globular Clusters M13 and M53	S. J. Goldstein Jr. C. M. Wade	<u>Astron. J.</u> , 82, 972, 1977
785	Gravitational and Acoustic Waves in an Elastic Medium	B. Carter H. Quintana	<u>Phys. Rev. D.</u> , 16 2928, 1977
786	Radio Survey of Close Binary Stars	S. R. Spangler F. N. Owen R. A. Hulse	<u>Astron. J.</u> , 82, 989, 1977
787	The Compact Radio Sources in 4C 39.25 and 3C 345	D. B. Shaffer K. I. Kellermann G. H. Purcell I.I.K. Pauliny-Toth E. Preuss A. Witzel D. Graham R. T. Schilizzi M. H. Cohen A. T. Moffet J. D. Romney A.E. Niell	<u>Astrophys. J.</u> , 218, 353, 1977

No.	Title	Author(s)	Journal
788	Detection of Interstellar Ethyl Cyanide	D. R. Johnson F. J. Lovas C. A. Gottlieb E. W. Gottlieb M. M. Litvak M. Guelin P. Thaddeus	<u>Astrophys. J.</u> , 218, 370, 1977
789	Radiation Transport and Non-LTE Analysis of Interstellar Molecular Lines. II. Carbon Monosulfide	H. S. Liszt C. M. Leung	<u>Astrophys. J.</u> , 218, 396, 1977
790	Observations of High-Frequency Carbon Recombination-Line Emission in NGC 2024 and IC 1795	L. J Rickard B. Zuckerman P. Palmer B. E. Turner	<u>Astrophys. J.</u> , 218, 659, 1977
791	The Structure of Quasars from the Region of the 5C2 Survey	R. E. Spencer J.F.C. Wardle	<u>Astrophys. J.</u> , 218, 599, 1977
792	The Star-Formation Process in Molecular Clouds Associated with Herbig Be/Ae Stars. I. LkH α 198, BD +40° 4124, and NGC 7129	R. B. Loren	<u>Astrophys. J.</u> , 218, 716, 1977
793	New Silicon Monoxide Masers	D. F. Dickinson L. E. Snyder L. W. Brown D. Buhl	<u>Astron. J.</u> , 83, 36, 1978
794	Neutral Hydrogen in the Elliptical Galaxy NGC 4636	G. R. Knapp S. M. Faber J. S. Gallagher	<u>Astron. J.</u> , 83, 11, 1978
795	A Comparison of Neutral Hydrogen 21 cm Observations with UV and Optical Absorption Line Measurements	R. Giovanelli M. P. Haynes D. G. York J. M. Shull	<u>Astrophys. J.</u> , 219, 60, 1978
796	A Radio Search for Interstellar CO $^+$, HCN $^+$, HNC $^+$ and CN $^+$ Ions	J. M. Hollis B. L. Ulrich L. E. Snyder D. Buhl F. J. Lovas	<u>Astrophys. J.</u> , 219, 74, 1978

No.	Title	Author(s)	Journal
797	Observations of Interstellar Sulfur Monoxide	C. A. Gottlieb E. W. Gottlieb M. M. Litvak J. A. Ball H. Penfield	<u>Astrophys. J.</u> , 219, 77, 1978.
798	Spectral Line Shapes in Spherically Symmetric Radially Moving Clouds	T.B.H. Kuiper E.N.R. Kuiper B. Zuckerman	<u>Astrophys. J.</u> , 219, 129, 1978
799	Wave Production in an Ultra-relativistic Electron-Positron Plasma	P. E. Hardee W. K. Rose	<u>Astrophys. J.</u> , 219, 274, 1978
800	Relativistic Blast-Wave Model for Superlight Motion in Compact Double Radio Sources	A. P. Marscher	<u>Astrophys. J.</u> , 219, 392, 1978
801	Upper Limits on the Abundance of the Sulfur Dimer in Molecular Clouds	H. S. Liszt	<u>Astrophys. J.</u> , 219, 454, 1978
802	Microwave Detection of Interstellar Deuterated Ammonia	B. E. Turner B. Zuckerman M. Morris P. Palmer	<u>Astrophys. J.</u> , 219, L43, 1978
803	Deuterated Ammonia Toward the Orion Nebula	E.N.R. Kuiper B. Zuckerman T.B.H. Kuiper	<u>Astrophys. J.</u> , 219, L49, 1978
804	Atomic Hydrogen in Galactic Molecular Clouds	W. B. Burton H. S. Liszt P. L. Baker	<u>Astrophys. J.</u> , 219, L67, 1978
805	The Energetics of Molecular Clouds. II. The S140 Molecular Cloud	G. N. Blair N. J. Evans II P. A. Vanden Bout W. L. Peters III	<u>Astrophys. J.</u> , 219, 896, 1978
806	The Velocity Field of the Barred Spiral Galaxy NGC 5383	C. J. Peterson V. C. Rubin W. K. Ford Jr. N. Thonnard	<u>Astrophys. J.</u> , 219, 31, 1978

No.	Title	Author(s)	Journal
807	Absorption Lines in the Optical Spectrum of Quasar A0 0827+24	M. H. Ulrich F. N. Owen	<u>Nature</u> , 269, 673, 1977
808	Microwave Spectral Lines in Galactic Dust Globules	R. N. Martin A. H. Barrett	<u>Astrophys. J. Suppl.</u> <u>Ser.</u> , 36, 1, 1978
809	Investigation of 410-MHz Fine Structure in Candidate Low-Frequency Variable Sources	S. R. Spangler K. A. Meyers	<u>Astron. J.</u> , 83, 147, 1978
810	A Large-Scale OH Sky Survey at 1612 MHz. Part I. The Observations	P. F. Bowers	<u>Astron. Astrophys.</u> <u>Suppl. Ser.</u> , 31, 127, 1978
811	87.2-GHz Continuum Observations of M82, NGC 253 and NGC 1068	M. Jura R. W. Hobbs S. P. Maran	<u>Astron. J.</u> , 83, 153, 1978
812	Velocity Dispersion and Global Parameters of the Southern Cluster of Galaxies CA 0340-538 (\equiv 3U 0328-52?)	R. J. Havlen H. Quintana	<u>Astrophys. J.</u> , 220, 14, 1978
813	VLBI Observations of 3C 345 and NRAO 512 in Right and Left Circular Polarization	C. R. Menyuk I. I. Shapiro J. J. Wittels H. F. Hinteregger C. A. Knight A.E.E. Rogers A. R. Whitney T. A. Clark L. K. Hutton	<u>Astrophys. J.</u> , 220, L27, 1978
814	Molecular Envelopes Around Evolved Stars and the Origin of Planetary Nebulae	B. Zuckerman P. Palmer D. P. Gilra B. E. Turner M. Morris	<u>Astrophys. J.</u> , 220, L53, 1978
815	Vibrationally Excited Carbon Monoxide in IRC+10216	N. Z. Scoville P. M. Solomon	<u>Astrophys. J.</u> , 220, L103, 1978
816	The Radio Source Associated with the G-type Supergiant HR 8752	L. A. Higgs P. A. Feldman J. Smolinski	<u>Astrophys. J.</u> , 220, L109, 1978

No.	Title	Author(s)	Journal
817	Long-Period Variables: Stellar and Expansion Velocities	D. F. Dickinson M. J. Reid M. Morris R. Redman	<u>Astrophys. J.</u> , 220, L113, 1978
818	Very Long Baseline Interferometric Observations of the Hydroxyl Masers in VY Canis Majoris	M. J. Reid D. O. Muhleman	<u>Astrophys. J.</u> , 220, 229, 1978
819	Are Supernovae Radio Sources? A Search for Radio Emission from Young Supernova Remnants	R. L. Brown A. P. Marscher	<u>Astrophys. J.</u> , 220, 467, 1978
820	Origin and Evolution of the Radio Emission from Immediate Post-outburst Supernovae	A. P. Marscher R. L. Brown	<u>Astrophys. J.</u> , 220, 474, 1978
821	Rotation and Velocity Structure in the Core of the Optical Condensation B213 NW and its Relation to the Parent Gas	F. O. Clark D. R. Johnson	<u>Astrophys. J.</u> , 220, 500, 1978
822	Carbon Monoxide in the Galaxy III. The Overall Nature of its Distribution in the Equatorial Plane	W. B. Burton M. A. Gordon	<u>Astron. Astrophys.</u> , 63, 7, 1978
823	Gas Distribution, Motions and Dynamics for Some Dwarf Irregular Galaxies	R. B. Tully L. Bottinelli J. R. Fisher L. Gouguenheim R. Sancisi H. van Woerden	<u>Astron. Astrophys.</u> , 63, 37, 1978
824	Detection of a Long HI Plume Emerging from NGC 3628	A. H. Rots	<u>Astron. J.</u> , 83, 219, 1978
825	Tidal Fields in General Relativity: D'Alembert's Principle and the Test Rigid Rod	J. Faulkner B. P. Flannery	<u>Astrophys. J.</u> , 220, 1125, 1978
826	Atomic and Molecular Observations of the ρ Ophiuchi Dark Cloud	P. C. Myers P.T.P. Ho M. H. Schneps G. Chin V. Pankonin A. Winnberg	<u>Astrophys. J.</u> , 220, 864, 1978

No.	Title	Author(s)	Journal
827	Optical Identifications of Radio Sources in the NRAO 5-GHz Survey: The "S2" and "Intermediate" Surveys	D. B. Shaffer	<u>Astron. J.</u> , 83, 209, 1978
828	The Effects of Rotation on Microwave Spectral Line Profiles: A Study of CRL 437	M. H. Schneps R. N. Martin P.T.P. Ho A. H. Barrett	<u>Astrophys. J.</u> , 221, 124, 1978
829	Compact Radio Sources in and Near Bright Galaxies	J. J. Condon L. L. Dressel	<u>Astrophys. J.</u> , 221, 456, 1978
830	PKS 0528-250: A Neutral Stellar Object at $z = 2.812$, with No Emission Lines and a Rich Absorption-Line Spectrum	D. L. Jauncey A. E. Wright B. A. Peterson J. J. Condon	<u>Astrophys. J.</u> , 221, 1109, 1978
831	Upper Limits to the HI Content of the Dwarf Spheroidal Galaxies	G. R. Knapp F. J. Kerr P. F. Bowers	<u>Astron. J.</u> , 83, 360, 1978
832	Radio and Optical Identification of the X-ray Source GX 17+2	R. M. Hjellming	<u>Astrophys. J.</u> , 221, 225, 1978
833	A Search for Atomic Hydrogen in Clusters of Galaxies	M. P. Haynes R. L. Brown M. S. Roberts	<u>Astrophys. J.</u> , 221, 414, 1978
834	Energetic Secondary Electrons and the Nonthermal Galactic Radio Background: A Probe of the Magnetic Field in Interstellar Clouds	A. P. Marscher R. L. Brown	<u>Astrophys. J.</u> , 221, 588, 1978
835	Classical Double Sources in the Directions of Rich Clusters of Galaxies	J. O. Burns F. N. Owen L. Rudnick	<u>Astron. J.</u> , 83, 312, 1978
836	Excess Radio Emission from Close Pairs of Galaxies	J. T. Stocke	<u>Astron. J.</u> , 83, 348, 1978
837	A Radio Continuum Survey of Isolated Pairs of Galaxies	J. T. Stocke W. G. Tifft M.A. Kaftan-Kassim	<u>Astron. J.</u> , 83, 322, 1978

No.	Title	Author(s)	Journal
838	Measuring the Gravitational Astigmatism of a Radio Telescope	S. von Hoerner	<u>IEEE Trans. Ant. Prop.</u> , AP-26, 315, 1978
839	The Helium Problem in Sagittarius B2	E. J. Chaisson S. M. Lichten L. F. Rodriguez	<u>Astrophys. J.</u> , 221, 810, 1978
840	Constraints on the Properties of Circumstellar Shells from Observations of Thermal CO and SiO Millimeter Line Emission	D. L. Lambert P. A. Vanden Bout	<u>Astrophys. J.</u> , 221, 854, 1978
841	A Jet in the Nucleus of NG6251	A.C.S. Readhead M. H. Cohen R. D. Blandford	<u>Nature</u> , 272, 131, 1978
842	Evaluation of Intensity Calibration Errors of Millimeter-Wave Spectrometers	B. L. Ulich	<u>Astrophys. Lett.</u> , 19, 93, 1978
843	Centimetric Radio Emission from Bright Optical Quasars	D. B. Shaffer R. F. Green	<u>Publ. Astron. Soc. Pacific</u> , 90, 22, 1978
844	Minimum-Noise Maximum-Gain Telescopes and Relaxation Method for Shaped Asymmetric Surfaces	S. von Hoerner	<u>IEEE Trans. Ant. Prop.</u> , AP-26, 464, 1978
845	A Large-Scale OH Sky Survey at 1612 MHz. Part II. The Galactic Distribution and Kinematics of the Unidentified Type II OH/IR Stars	P. F. Bowers	<u>Astron. Astrophys.</u> , 64, 307, 1978
846	The 5 GHz Strong Source Surveys. IV. Survey of the Area Between Declination 35 and 70 Degrees and Summary of Source Counts, Spectra and Optical Identifications	I.I.K. Pauliny-Toth A. Witzel E. Preuss H. Kühr K. I. Kellermann E. B. Fomalont M. M. Davis	<u>Astron. J.</u> , 83, 451, 1978
847	9.5 mm Flux Density Measurements of a Sample of Sources from the 5-GHz S4 Survey	A. Witzel I.I.K. Pauliny-Toth B. J. Geldzahler K. I. Kellermann	<u>Astron. J.</u> , 83, 475, 1978

No.	Title	Author(s)	Journal
848	Southern Search for OH from M Supergiants	P. F. Bowers F. J. Kerr	<u>Astron. J.</u> , 83, 487, 1978
849	Structure and Time Variations of Compact Radio Sources in Galaxies and Quasars	K. I. Kellermann	<u>Physica Scripta</u> , 17, 257, 1978
850	National Radio Astronomy Observatory (Annual Report)	D. S. Heeschen D. E. Hogg	<u>Bull. Am. Astron. Soc.</u> , 10, 279, 1978
851	The Differential Radio Source Counts at 1400 MHz from the GB2 Sky Survey	J. Machalski	<u>Astron. Astrophys.</u> , 65, 157, 1978
852	Determination of the Spiral Pattern Speed of the Galaxy	M. A. Gordon	<u>Astrophys. J.</u> , 222, 100, 1978
853	Observations of OH and H ₂ O Micro-wave Maser Emission from VY Canis Majoris	B. R. Rosen J. M. Moran M. J. Reid R. C. Walker B. F. Burke K. J. Johnston J. H. Spencer	<u>Astrophys. J.</u> , 222, 132, 1978
854	Infrared Radiation from Dark Globules	R. G. Spencer C. M. Leung	<u>Astrophys. J.</u> , 222, 140, 1978
855	The Analysis of Radio Emission from HII Regions: Consequences of Improper Analytic Methods	F. J. Lockman R. L. Brown	<u>Astrophys. J.</u> , 222, 153, 1978
856	Time-Dependent CO Formation and Fractionation	H. S. Liszt	<u>Astrophys. J.</u> , 222, 484, 1978
857	Carbon Recombination Lines and the Neutral Hydrogen Clouds Near the Orion Nebula	W. L. Boughton	<u>Astrophys. J.</u> , 222, 517, 1978
858	Searches for Correlated X-ray and Radio Emission from X-ray Burst Sources	H. M. Johnson R. C. Catura P. A. Lamb N. E. White P. W. Sanford J. A. Hoffman W.H.G. Lewin J. G. Jernigan	<u>Astrophys. J.</u> , 222, 664, 1978

No.	Title	Author(s)	Journal
859	A Comprehensive Radio Study of the $z = 0.524$ Absorption System in AO 0235+164	A. M. Wolfe J. J. Broderick J. J. Condon K. J. Johnston	<u>Astrophys. J.</u> , 222, 752, 1978
860	The Abundance and Distribution of Interstellar C ₂ H	K. D. Tucker M. L. Kutner	<u>Astrophys. J.</u> , 222, 859, 1978
861	PKS 1402+044: A Red Object with a Redshift of 3.20	B. A. Peterson D. L. Jauncey A. E. Wright J. J. Condon	<u>Astrophys. J.</u> , 222, L81, 1978
862	The DCO ⁺ /HCO ⁺ Abundance Ratio and the Electron Density in Cool Interstellar Clouds	W. D. Watson L. E. Snyder J. M. Hollis	<u>Astrophys. J.</u> , 222, L145, 1978
863	PKS 2126-15: A Bright Quasi-stellar Object with Neutral Color and a Redshift of 3.27	D. L. Jauncey A. E. Wright B. A. Peterson J. J. Condon	<u>Astrophys. J.</u> , 223, L1, 1978
864	The Radio Source 0915+320: A "Wide-Angle-Tail" Source in a Group of Galaxies	E. B. Fomalont A. H. Bridle	<u>Astrophys. J.</u> , 223, L9, 1978
865	Optical Emission in the Radio Lobes of Radio Galaxies	W. C. Saslaw J. A. Tyson P. Crane	<u>Astrophys. J.</u> , 222, 435, 1978
866	Carbon Monoxide in the Galactic Disk and Nucleus	W. B. Burton H. S. Liszt M. A. Gordon	<u>J. Physique</u> , 39, C1-103, 1978
867	Statistical Counts of Faint Sources at 2380 MHz	J. J. Condon L. L. Dressel	<u>Astrophys. J.</u> , 222, 745, 1978
868	New Highly Variable Radio Source, Possible Counterpart of γ -ray Source CG135+1	P. C. Gregory A. R. Taylor	<u>Nature</u> , 272, 704, 1978
869	The Dynamics of Relativistic Plasmoids and Rapidly Varying Radio Sources	W. A. Christiansen J. S. Scott W. T. Vestrand	<u>Astrophys. J.</u> , 223, T3, 1978

No.	Title	Author(s)	Journal
870	Ionized Gas in X-ray Clusters of Galaxies: Radio Limits	L. Rudnick	<u>Astrophys. J.</u> , 223, 37, 1978
871	Frequency Dependence of Compact Structure in Extended Extra-galactic Radio Sources	S. R. Spangler K. A. Meyers	<u>Astron. J.</u> , 83, 547, 1978
872	A 5 GHz Survey of Infrared Sources	J. W. Warner J. H. Black	<u>Astron. J.</u> , 83, 586, 1978
873	Extended Radio Sources and Elliptical Galaxies. I. Small-Diameter Components in Extended Structures	A. H. Bridle E. B. Fomalont	<u>Astron. J.</u> , 83, 704, 1978
874	Extended Radio Sources and Elliptical Galaxies. II. A Search for Radio Cores Using the VLA	E. B. Fomalont A. H. Bridle	<u>Astron. J.</u> , 83, 725, 1978
875	Observations of Radio Sources with Flat Spectra	F. N. Owen R. W. Porcas S. L. Mufson T. J. Moffett	<u>Astron. J.</u> , 83, 685, 1978
876	On the Origin and Evolution of Iron-Enriched Gas in Clusters of Galaxies	D. S. De Young	<u>Astrophys. J.</u> , 223, 47, 1978
877	Integrated Masses of Galaxies	J. R. Dickel H. J. Rood	<u>Astrophys. J.</u> , 223, 391, 1978
878	An Application of Walsh Functions in Radio Astronomy Instrumentation	J. Granlund A. R. Thompson B. G. Clark	<u>IEEE Trans. Electro-magn. Compat.</u> , EMC-20, 451, 1978
879	Characteristics of the Radio Source near the Supergiant Star HD 18391	L. A. Higgs P. A. Feldman J. Smolinski	<u>Astron. Astrophys.</u> , 67, 431, 1978
880	Neutral Hydrogen Absorption in the Spectra of Quasi-stellar Objects: A Search for Absorption Due to Clusters of Galaxies	B. M. Peterson	<u>Astrophys. J.</u> , 223, 740
881	A Study of CO Emission from Two Scd Galaxies: IC 342 and NGC 6946	M. Morris K. Y. Lo	<u>Astrophys. J.</u> , 223, 803, 1978

No.	Title	Author(s)	Journal
882	The Detailed Structure of CO in Molecular Cloud Complexes. II. The W75-DR 21 Region	J. R. Dickel H. R. Dickel W. J. Wilson	<u>Astrophys. J.</u> , 223, 840, 1978
883	Detection of the C ₄ H Radical Toward IRC + 10216	M. Guelin S. Green P. Thaddeus	<u>Astrophys. J.</u> , 224, L27, 1978
884	Extended Neutral Hydrogen in the M51 System	M. P. Haynes R. Giovanelli M. S. Burkhead	<u>Astron. J.</u> , 83, 938, 1978
885	High-Sensitivity Search for OH Emission from Mira Variables	P. F. Bowers R. P. Sinha	<u>Astron. J.</u> , 83, 955, 1978
886	Coordinated Photometric and Spectroscopic Observations of Strong Extragalactic 90 GHz Sources	S. L. O'Dell J. J. Puschell W. A. Stein F. Owen R. W. Porcas S. Mufson T. J. Moffett M.-H. Ulrich	<u>Astrophys. J.</u> , 224, 22, 1978
887	The Spatial Distribution of the OH and H ₂ O Masers Associated with W3(OH), W49N, and W51	G. L. Mader K. J. Johnston J. M. Moran	<u>Astrophys. J.</u> , 224, 115, 1978
888	A Comparison of Optical and Radio Wavelength Observations of CH in the Diffuse Interstellar Medium	K. R. Lang R. F. Willson	<u>Astrophys. J.</u> , 224, 125, 1978
889	Virial Properties of Groups of Galaxies	H. J. Rood J. R. Dickel	<u>Astrophys. J.</u> , 224, 724, 1978
890	Interstellar Scintillation Evidence for Relativistic Expansion in Low-Frequency Variable Sources	J. J. Condon B. Dennison	<u>Astrophys. J.</u> , 224, 835, 1978
891	What is the Compact Radio Source in the Nucleus of M82?	P. P. Kronberg J. N. Clarke	<u>Astrophys. J.</u> , 224, L51, 1978

No.	Title	Author(s)	Journal
892	Evidence for the Zeeman Effect in the OH Maser Emission from W3 (OH)	J. M. Moran M. J. Reid C. J. Lada J. L. Yen K. J. Johnston J. H. Spencer	<u>Astrophys. J.</u> , 224, L67, 1978
893	Microwave Detection of Interstellar NO	H. S. Liszt B. E. Turner	<u>Astrophys. J.</u> , 224, L73, 1978
894	Integral Properties of Late-Type Galaxies Derived from HI Observations	G. S. Shostak	<u>Astron. Astrophys.</u> , 68, 321, 1978
895	Interferometer Observations of Quasars from the Jodrell Bank 966-MHz Survey	F. N. Owen R. W. Porcas S. G. Neff	<u>Astron. J.</u> , 83, 1009, 1978
896	X-ray Emission from BL-Lacertae Objects. II. The Nature of Markarian 421	B. Margon T. W. Jones J.F.C. Wardle	<u>Astron. J.</u> , 83, 1021, 1978
897	Twenty-one Centimeter Line Widths of Galaxies	M. S. Roberts	<u>Astron. J.</u> , 83, 1026, 1978
898	Optical Identifications of a Complete Sample of Flat-Spectrum Radio Sources	J. J. Condon D. L. Jauncey A. E. Wright	<u>Astron. J.</u> , 83, 1036, 1978
899	Observations of the Central Region of Fornax A at 4.9 GHz	B. J. Geldzahler E. B. Fomalont	<u>Astron. J.</u> , 83, 1047, 1978
900	Dynamical Interactions and Astrophysical Effects of Stable Heavy Neutrinos	G. Steigman C. L. Sarazin H. Quintana J. Faulkner	<u>Astron. J.</u> , 83, 1050, 1978
901	Radio Sources in Zwicky Clusters of Galaxies. I. Pencil Beam and Preliminary Interferometer Observations	J. O. Burns	<u>Astron. J.</u> , 83, 1143, 1978
902	H109 α Recombination Line Observations of S187 and of S298	G. S. Rossano	<u>Astron. J.</u> , 83, 1214, 1978

No.	Title	Author(s)	Journal
903	A Survey of HI in Seyfert Galaxies	T. M. Heckman	<u>Astrophys. J.</u> , 224, 745, 1978
904	Coordinated Centimeter, Millimeter, Infrared, and Visual Polarimetry of Compact Nonthermal Sources	L. Rudnick F. N. Owen T. W. Jones J. J. Puschell W. A. Stein	<u>Astrophys. J.</u> , 225, L5, 1978
905	Parameters of 17 Newly Discovered Pulsars in the Northern Sky	M. Damashek J. H. Taylor R. A. Hulse	<u>Astrophys. J.</u> , 225, L31, 1978
906	4U0241+61: A Luminous Low-Redshift QSO	K.M.V. Apparao G. F. Bignami L. Maraschi H. Helmken B. Margon R. Hjellming H. V. Bradt R. G. Dower	<u>Nature</u> , 273, 450, 1978
<u>SERIES B</u>			
479	Cosmological Information from New Types of Radio Observations	W. C. Saslaw	<u>IAU Symp.</u> , 74, 379, 1977
480	The Deflection of Radio Waves by the Sun	E. B. Fomalont R. A. Sramek	<u>Comments in Astrophys.</u> , 7, 19, 1977
481	Observations of the Flux Density and Linear Polarization of Compact Extragalactic Radio Sources at 3.7 and 11.1 cm Wavelengths--II	D. R. Altschuler J.F.C. Wardle	<u>Mon. Not. Roy. Astron. Soc.</u> , 179, 153, 1977
482	Comparative Morphology of Galactic Carbon Monoxide and Hydrogen	W. B. Burton M. A. Gordon	van Woerden, H. (ed.), 1977, <u>Topics in Interstellar Matter</u> (Dordrecht: D. Reidel), 165.
483	The Large-Scale Distribution of Interstellar Matter in the Context of the Density-Wave Theory	W. W. Roberts, Jr. W. B. Burton	van Woerden, H. (ed.), 1977, <u>Topics in Interstellar Matter</u> (Dordrecht: D. Reidel), 195.

No.	Title	Author(s)	Journal
484	HI Profile Distances and the Hubble Constant	J. R. Fisher R. B. Tully	<u>Comments in Astrophys.</u> , 7, 85, 1977
485	The Radio Source Near NGC 2823	E. B. Fomalont A. H. Bridle	<u>Mon. Not. Roy. Astron. Soc.</u> , 182, 1P, 1978
486	The Angular Size of Quasars	J.F.C. Wardle R. Potash	<u>Ann. N.Y. Acad. Sci.</u> , 302, 605, 1977
487	The Interaction of Radio Galaxies with the Intergalactic Medium	D. S. De Young	<u>Ann. N.Y. Acad. Sci.</u> , 302, 669, 1977
488	HD 193793, a Radio-Emitting Wolf-Rayet Binary Star	D. R. Florkowski S. T. Gottesman	<u>Mon. Not. Roy. Astron. Soc.</u> , 179, 105, 1977
489	A Relation Between the Homogeneity of the Universe and the Dimensionality of Space	W. C. Saslaw	<u>Mon. Not. Roy. Astron. Soc.</u> , 179, 659, 1977
490	The Distance to the Pulsar 1858+03	A. W. Seacord S. T. Gottesman	<u>Mon. Not. Roy. Astron. Soc.</u> , 179, 671, 1977
491	The Kinematics Within M31	M. S. Roberts R. N. Whitehurst T. R. Cram	<u>IAU Symp.</u> , 77, 169, 1978
492	The Three-Dimensional Distribution of Neutral Hydrogen in M31	R. N. Whitehurst M. S. Roberts T. R. Cram	<u>IAU Symp.</u> , 77, 175, 1978
493	Radio Recombination Lines	R. L. Brown F. J. Lockman G. R. Knapp	<u>Ann. Rev. Astron. Astrophys.</u> , 16, 445, 1978