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NATIONAL RADIO ASTRONOMY OBSERVATORY  
Charlottesville, Virginia

Quarterly Report

October 1, 1982 - December 31, 1982

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RADIO ASTRONOMY OBSERVATORY  
CHARLOTTESVILLE, VA.

JAN 27 1983

RESEARCH PROGRAMS

<u>140-foot Telescope</u>	<u>Hours</u>
Scheduled observing	1755.00
Scheduled maintenance and equipment changes	129.00
Scheduled tests and calibration	252.00
Time lost due to: equipment failure	120.00
power	12.75
weather	48.25
interference	8.25

The following line programs were conducted during this quarter.

<u>No.</u>	<u>Observers</u>	<u>Program</u>
B-361	W. B. Burton (Leiden) P. Lintel (Leiden)	Sensitive broadband survey of HI at $ b  < 20^\circ$ .
B-387	M. Bell (Herzberg) H. Matthews (Herzberg) T. Sears (Herzberg)	Observations in an attempt to confirm spectral features attributed to previously undetected $C_nH$ and $C_mH$ carbon-chain found in the range 9.5-11.3 GHz.
B-390	M. Bell (Herzberg) H. Matthews (Herzberg) T. Sears (Herzberg)	Observations near 3-cm to measure accurate frequencies and relative intensities of hyperfine components of the $N = 1 \rightarrow 0$ transition of $C_4H$ in TMC1 and other sources.
C-204	P. Angerhofer (USNO) E. Churchwell (Wisconsin) R. Gusten (MPIR, Bonn) H. Ungerechts (Cologne) M. Walmsley (MPIR, Bonn)	Observations at 17.6, 18.1 and 18.2 GHz to study the $J = 2-1$ transition of $HC_3N$ in Sgr A and other selected clouds.
G-261	V. Bujarrabal (Madrid) J. Cernicharo (Meudon) M. Guelin (IRAM)	Observations in the range 18.2-23.7 GHz to search for $HC_3N$ , $HC_5N$ , $C_4H$ , and $NH_3$ in four dense fragments of Heiles Cloud 2.

<u>No.</u>	<u>Observers</u>	<u>Program</u>
G-262	V. Bujarrabal (Madrid) J. Cernicharo (Meudon) M. Guélin (IRAM)	Search at 1.3 cm for NH <sub>3</sub> absorption in the direction of Cas A.
H-175	R. Gusten (MPIR, Bonn) C. Henkel (Calif., Berkeley)	Observations of NH <sub>3</sub> (1,1) and (2,2) at 1.3 cm in a selected giant molecular cloud.
P-127	H. Payne	Observations of OH absorption by diffuse cold clouds in the direction of selected extragalactic clouds.
R-198	L. Rickard (Howard)	Search at 7720.5 MHz for C <sup>+</sup> 150 $\alpha$ .
R-199	L. Rickard (Howard)	Search at 13001.3 MHz for C <sup>+</sup> 126 $\alpha$ .
T-164	N. Rieu (Meudon) B. Turner	Observations at 18.067-18.155 GHz of SiS in the ground ( $v = 0$ ) and excited ( $v = 1$ ) states.
T-168	P. Myers (CFA) P. Thaddeus (NASA-Goddard)	Search over the frequency range 24896-25216 MHz for emission from two long-chain molecules, C <sub>5</sub> N and C <sub>6</sub> H.

The following continuum programs were conducted during this quarter.

<u>No.</u>	<u>Observers</u>	<u>Program</u>
U-15	J. Uson (Princeton) D. Wilkinson (Princeton)	Measurements at 19.5 GHz of the decrements in the cosmic microwave background toward several clusters of galaxies.
W-167	J. Uson (Princeton) D. Wilkinson (Princeton)	Measurements at 19.5 GHz of the small small-scale anisotropy of the cosmic microwave background.

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

A - Arecibo 1000-ft  
 B - Effelsberg MPIR, Bonn 100-m  
 C - Algonquin 150-ft  
 E - South Africa 25-m  
 F - Fort Davis 85-ft  
 G - Green Bank 140-ft  
 H - Hat Creek 85-ft  
 I - Iowa 60-ft  
 Jc - Jodrell Bank 25-m  
 Jm - Jodrell Bank 250-m  
 K - Haystack 120-ft

Kw - Westford 60-ft  
 N - Maryland Point 85-ft  
 O - Owens Valley 130-ft  
 P - Penticton, B.C. 85-ft  
 R - Crimea 30-m  
 So - Onsala 25-m  
 Sn - Onsala 20-m  
 Wd - Dwingeloo 25-m  
 Wn - Westerbork,  $n = 1-14 \times 26 \text{ m}$   
 Yn - VLA,  $n = 1-27 \times 25 \text{ m}$

<u>No.</u>	<u>Observers</u>	<u>Program</u>
A-3V	W. Alef (MPIR, Bonn) L. Kogan (ISR, USSR) V. Kostenko (ISR, USSR) L. Matveyenko (ISR, USSR) I. Pauliny-Toth (MPIR, Bonn) J. Romney (MPIR, Bonn) K. Kellermann	Observations at 1.3 cm of NGC 1275, with telescopes B, G, K, O, Sn, O, and Yn.
B-26V	N. Bartel (MIT) B. Geldzahler (NRL) D. Shaffer (Interferometrics)	Observations at 1.3 cm of the nucleus of M81, with telescopes B, G, K, O, Sn, and Yn.
B-34V	L. Baath (Chalmers) R. Booth (Chalmers) D. Jones (Caltech)	Observations at 1.3 cm of the BL Lac objects AO 0235+164 and 0735+178, with telescopes B, C, G, K, N, O, R, Sn, and Yn.
B-36V	N. Bartel (MIT) B. Corey (Haystack) J. Marcaide (MIT) I. Pauliny-Toth (MPIR, Bonn) A. Rogers (Haystack) I. Shapiro (MIT)	Observations at 18 cm of the nucleus of M81, with telescopes B, F, G, K, O, and Yn.
B-38V	N. Bartel (MIT) B. Corey (Haystack) M. Gorenstein (MIT) J. Marcaide (MIT) I. Shapiro (MIT) K. Weiler (NSF)	Observations at 6 cm of SN 1979c in M100, with telescopes B, G, O, and Yn.
B-39V	J. Biretta (Caltech) M. Cohen (Caltech) K. Lind (Caltech) S. Unwin (Caltech)	Observations at 1.3 cm to measure the sub-milliarcsecond structure of 3C 273 and 3C 279, with telescopes C, G, K, N, Sn, O, and Yn.
E-3V	A. Eckart (MPIR, Bonn) A. Witzel (MPIR, Bonn)	Observations at 6 cm of selected high declination sources, with telescopes B, G, Jc, K, O, So, and Wn.

<u>No.</u>	<u>Observers</u>	<u>Program</u>
G-24V	B. Geldzahler (NRL)	Observations at 2.8 cm to monitor the position angle of the orientation of two objects in G127.11 + 0.54, with telescopes B, C, G, K, N, and O.
J-21V	M. Davis (Arecibo) D. Jones (Caltech) S. Unwin (Caltech)	Observations at 1.3 cm of the sub-milliarcsecond structure of AO 0235+164, with telescopes B, G, K, O, Sn and Yn.
K-11V	R. Ekers K. Kellermann	Observations at 1.3 cm of the Galactic Center, with telescopes G, K, O, and Yn.
K-12V	M. Reid (CFA) J. Romney (MPIR, Bonn) J. Schmitt (CFA) K. Kellermann	Observations at 6 cm of M87, with telescopes B, F, G, H, K, N, O, Wn, and Yn.
L-15V	R. Linfield (Calif., Berkeley) R. Simon (Caltech)	Observations at 18 cm of the structure of an object in 3C 380, with telescopes F, I, G, H, K, N, O, and Yn.
L-16V	R. Linfield (Calif., Berkeley)	Observations at 18 cm to determine the milliarcsecond structure of the jet 3C 390.3, with telescopes B, F, G, H, I, K, O, and Yn.
L-21V	D. Backer (Calif., Berkeley) M. Cohen (Caltech) K. Lo (Caltech) J. Moran (CFA)	Observations at 1.35 cm to map the Galactic Center compact source, with telescopes C, G, K, N, O, and Yn.
M-31V	G. Madejski (CFA) M. Reid (CFA) D. Schwartz (CFA)	Observations at 2.8 cm of X-ray emitting BL Lac objects, with telescopes F, G, H, K, and O.
M-33V	J. Broderick (VPI&SU) B. Geldzahler (NRL) A. Marscher (Boston)	Observations at 2.8 cm to monitor the superluminal structural change in NRAO 140, with telescopes B, F, G, H, K, O, and N.
N-4V	S. Neff (NFRA, Neth.) J. Benson R. Brown	Observations at 6 cm of two quasars with extremely wobbly jets, with telescopes B, G, Jc, K, O, Sn, Wn, and Yn.
P-33V	H. Aller (Michigan) R. Mutel (Iowa) R. Phillips (Haystack)	Observations at 2.8 cm of the apparent superluminal expansion of BL Lac, with telescopes B, C, F, G, K, and O.

<u>No.</u>	<u>Observers</u>	<u>Program</u>
P-34V	R. Porcas (MPIR, Bonn)	Observations of 3C 179 at 2.8 cm, with telescopes B, G, K, O, and Yn.
P-35V	T. Pearson (Caltech) A. Readhead (Caltech)	Second epoch observations at 6 cm of a complete sample of radio sources, with
P-36V	W. Alef (MPIR, Bonn) I. Pauliny-Toth (MPIR, Bonn) E. Preuss (MPIR, Bonn)	Observations at 6 cm of the core of 3C 147, with telescopes B, F, G, K, O, and Yn.
P-37V	I. Pauliny-Toth (MPIR, Bonn) R. Porcas (MPIR, Bonn) A. Zensus (MPIR, Bonn)	Observations at 18 cm of 3C 454.3, with telescopes B, F, G, Jm, O, So, and Wd. telescopes B, F, G, K, and O.
R-19V	B. Burke (MIT) R. Potash (Brandeis) D. Roberts (Brandeis) A. Rogers (Haystack) J. Wardle (Brandeis)	Measurements at 6 cm of strong extragalactic radio sources, with telescopes G, K, O, and Yn.
R-21V	N. Bartel (MIT) F. Fanti (Bologna) A. Ficarri (Bologna) L. Padrielli (Bologna) J. Romney (MPIR, Bonn). K. Weiler (NSF)	Observations at 18 cm of jets associated with low-frequency variables, with telescopes B, E, F, G, Jm, O, R, and So.
S-22V	P. Barthel (Leiden) G. Miley (Leiden) S. Neff (NFRA, Neth.) R. Schilizzi (NFRA, Neth.) P. Wilkinson (Manchester) T. Cornwell	Observations at 18 cm of the nucleus of the giant radio galaxy 3C 236, with telescopes B, G, Jm, K, O, So, Wn, and Yn.
S-23V	A. Readhead (Caltech) R. Simon (Caltech) P. Wilkinson (Manchester)	Observations at 18 cm to search for superluminal motion in 3C 147, with telescopes F, G, H, I, Jm, N, and Yn.
S-258V	J. Romney (MPIR, Bonn) R. Spencer (Manchester) R. Schilizzi (NFRA, Neth.)	Observations at 6 cm of the evolution of compact radio structure in SS443, with telescopes B, G, Jc, Sn, and Wn.
T-1V	J. Taylor (Princeton) J. Weisberg (Princeton)	Observations at 18 cm to measure the parallaxes and proper motions of pulsars with telescopes A, G, and O.
U-11V	R. Mutel (Iowa) S. Unwin (Caltech)	Observations at 18 cm to determine the spectral index of selected double sources, with telescopes B, F, G, H, I, O, and Yn.

<u>No.</u>	<u>Observers</u>	<u>Program</u>
V-43V	T. Clark (NASA-Goddard) N. Vandenberg (Interferometrics) W. Boyer (NASA-Goddard) E. Himwich (Interferometrics) C. Knight (Interferometrics) D. Shaffer (Interferometrics)	Observations at 3.6 and 13.3 cm to measure polar motion, UT1, geodesy, and astrometry; to search for new compact reference sources; and to further evaluate the MK III VLB terminal with telescopes F, G, and Kw.
W-17V	P. Wilkinson (Manchester) T. Cornwell	Observations at 6 cm of QSO 3C 380, with telescopes B, G, Jc, K, O, So, Wn, and Yn.
W-18V	G. Seielstad (Caltech) S. Unwin (Caltech) J. Benson R. C. Walker	Observations at 6 cm to monitor 3C 120 with telescopes A, B, F, G, H, Jc, K, N, O, Sn, Wn, and Yn.
W-19V	G. Seielstad (Caltech) S. Unwin (Caltech) J. Benson R. C. Walker	Observations at 18 cm of the 3C 120 jet, with telescopes, A, B, C, F, G, H, I, Jm, K, N, O, P, So, Wn, and Yn.
W-20V	A. Kus (Copernicus) T. Pearson (Caltech) A. Readhead (Caltech) P. Wilkinson (Manchester)	Observations at 18 cm of 3C 309.1, with telescopes B, F, G, Jm, K, O, S, and Wn.
X-2V	R. Schilizzi (NFRA, Neth.) W. Van Breugel (KPNO)	Observations at 6 cm of MK501, with telescopes of the European network and G.
X-4V	D. Downes (IRAM) R. Genzel (CFA) J. Moran (CFA) M. Reid (CFA) M. Schneps (CFA)	Exploratory observations at 1.3 cm of water-vapor masers in the M33 galaxy, with telescopes B, G, K, O, and Yn.
X-5V	B. Geldzahler (NRL)	Observations at 18 cm of Sgr A, Cyg XI, and Cyg X3, with telescopes G, K, and N.
X-6V	L. Dressel (Rice) B. Geldzahler (NRL) L. Rickard (Howard)	Observations at 2.8 cm of the nucleus of UGC 09114, with telescopes G, K, and O.
X-7V	N. Bartel (MIT)	Observations at 6 cm in an attempt to detect Cyg XI, with telescopes K, G, and Yn.
Z-2V	R. Porcas (MPIR, Bonn) A. Zensus (MPIR, Bonn)	Observations at 2.8 cm of weak cores in galaxies, with telescopes B, G, K, and O.

The following occultation program was conducted during this quarter.

<u>No.</u>	<u>Observers</u>	<u>Program</u>
G-254	S. Gottesman (Florida) F. Maloney (Villanova) D. Speranzini (Villanova)	Observations at 114 MHz of the lunar occultation of the Crab Nebula.

<u>300-foot Telescope</u>	<u>Hours</u>
Scheduled observing	1990.25
Scheduled maintenance and equipment changes	123.25
Scheduled tests and calibration	38.50
Time lost due to: equipment failure	40.50
power	8.00
weather	1.50
interference	2.50

The following line programs were conducted during this quarter.

<u>No.</u>	<u>Observers</u>	<u>Program</u>
B-397	R. Brown	Observations in the range 690-1000 MHz to search for HI absorption in QSOs.
G-265	R. Giovanelli (Arecibo) M. Haynes	Continued observations of hydrogen in galaxies found in clusters and super-clusters.
R-195	M. Roberts	Observations of hydrogen toward radio quiet or radio weak quasistellar objects that may be imbedded in spiral or elliptical galaxies.
W-164	J. Dickel (Illinois) H. Rood (Inst. Adv. Studies) B. Williams	Hydrogen observations of "compact groups" of galaxies.

The following continuum programs were conducted during this quarter.

A-59	H. Aller (Michigan) M. Aller (Michigan) R. Fanti (Bologna) A. Ficarra (Bologna) F. Mantovani (Bologna) L. Padrielli (Bologna)	Observations at 1400 MHz of low-frequency variable sources selected from the Bologna-Michigan program.
B-389	J. Broderick (VPI&SU) B. Dennison (VPI&SU) K. Mitchell (VPI&SU) S. O'Dell (VPI&SU) J. Condon H. Payne	Observations at 611, 880, and 1400 MHz of low-frequency variable sources.

<u>No.</u>	<u>Observers</u>	<u>Program</u>
C-200	J. Broderick (VPI&SU) M. Condon (unaffiliated) J. Condon	Confusion limited map at 1400 MHz of the area $RA = 0^h < \alpha < 24^h$ , and Dec $-15^\circ < \delta < +85^\circ$ .
K-266	C. Aumann (Wisconsin) P. Chute (Wisconsin) J. Harlander (Wisconsin) G. Kojoian (Wisconsin) J. Muth (Wisconsin)	Observations at 4.7 GHz of those galaxies exhibiting strong ultraviolet continua and those of high surface brightness.

The following pulsar observations were conducted during this quarter.

<u>No.</u>	<u>Observers</u>	<u>Program</u>
C-193	V. Boriakoff (Cornell) J. Cordes (Cornell) J. Rankin (Vermont) J. Weisberg (Princeton) D. Stinebring	Simultaneous pulsar observation studies over the range 700-1000 MHz with observations conducted at Arecibo at 1420 and 1667 MHz.
T-166	R. Dewey (Princeton) J. Taylor (Princeton) J. Weisberg (Princeton) M. Damashek	Observations in the range 320-400 MHz for an improved Northern Hemisphere pulsar survey.

The following scintillation observation was conducted during this quarter.

<u>No.</u>	<u>Observers</u>	<u>Program</u>
C-195	J. Armstrong (JPL) V. Boriakoff (Princeton) J. Cordes (Princeton) J. Weisberg (Princeton) J. Dickey (Minnesota)	Interstellar scintillation measurements at 430 MHz in the direction of a large sample of pulsars.

### Very Large Array

The quarter was scheduled 97.2% of the time.

Astronomical observing	1,561.8 hours	(72.7%)
Test	587.4 hours	(27.3%)

The average downtime was 6.77%.

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



<u>No.</u>	<u>Observers</u>	<u>Program</u>
AA-15	C. Ambruster (NRL) K. Wood (NRL) K. Johnston (NRL) B. Geldzahler (NRL)	X-ray transient H0547-14. 6 and 20 cm.
AB-129	B. Burke (MIT) D. Roberts (Brandeis) P. Greenfield (MIT) J. Hewitt (MIT)	Monitoring double QSO 0957+561. 6 cm.
AB-165	J. Burns (New Mexico) T. Balonek (New Mexico) C. MacCallum (Sandia Labs)	Wide-angle tailed radio galaxy 1919+479. 6 and 20 cm.
AB-182	J. Burns (New Mexico) T. Balonek (New Mexico) E. Hummel (New Mexico)	Monitoring the cores of extended radio sources and spiral galaxies. 2, 6, and 20 cm.
AB-185	R. Brown	Quasar 3C 245. 6 and 18-cm line.
AB-186	J. Basart (Iowa State) M. Andrews (Iowa State) R. Lamb (Iowa State)	Center of W28. 2 cm.
AB-188	R. Becker (VPI&SU)	Distribution and polarization of the radio emission of two Crab-like SNRs. 2 cm.
AB-190	B. Burke (MIT) C. Lawrence (MIT) C. Bennett (MIT)	350 sources from the MIT 5 GHz survey. 6 cm.
AB-197	A. Barrett (MIT) J. Armstrong (MIT) J. Jackson (MIT) P. Ho (CFA)	Ammonia in Sgr A. 1.3-cm line.
AB-198	F. Bash (Texas) M. Kaufman (Ohio State)	Giant HII regions, spiral structure, and supernova remnants in M81. 6 cm.
AB-199	N. Broten (NRC, Canada) J. MacLeod (NRC, Canada) J. Vallee (NRC, Canada)	Gemini Ring - rotation measures of background sources seen through it. 2, 6, and 20 cm.
AB-204	T. Balonek (New Mexico) J. Burns (New Mexico) M. Zeilik (New Mexico) P. Smith (New Mexico) J. Puschell (Calif., San Diego) R. Barvainis (Massachusetts) J. Kenny (Massachusetts) C. Impey (Hawaii)	Simultaneous radio, infrared and optical polarimetry of quasi-stellar objects. 2, 6, and 20 cm.

<u>No.</u>	<u>Observers</u>	<u>Program</u>
AB-208	F. Briggs (Pittsburgh) P. Coleman (Pittsburgh)	Confirmation of radio emission from HII galaxies. 20 cm.
AB-210	R. Brown F. J. Lockman	The density structure of galactic HII regions. 6 cm.
AC-56	M. Claussen (Caltech) K. Lo (Caltech)	Molecular cloud cores. 21-cm line.
AC-57	D. Chernoff (Calif., Berkeley) C. Heiles (Calif., Berkeley) D. Hollenbach (Calif., Berkeley) C. McKee (Calif., Berkeley) M. Stevens (Calif., Berkeley)	Search for line radiation from HI in the BN-KL region of Orion. 21-cm line.
AC-58	M. Claussen (Caltech) C. Masson (Caltech) K. Lo (Caltech)	Ammonia maps of molecular cloud cores. 1.3 cm line.
AC-59	W. Christiansen (North Carolina) C. Foltz (Arizona) J. Stocke (Arizona) R. Weymann (Arizona)	Survey of broad absorption line QSOs. 6 cm.
AC-60	B. Clark R. Perley A. Bridle (Queen's) G. Grueff (Bologna)	Weak and extended objects from the B3 survey. 20 cm.
AC-61	M. Claussen (Caltech) K. Lo (Caltech)	Spectrum of the galactic nucleus. 1.3, 2 and 6 cm.
AC-62	P. Crane C. Kotanyi (ESO, FRG) E. Hummel (New Mexico) R. M. Price (New Mexico) J. van Gorkom J. van der Hulst (NFRA, Neth.)	Survey of the Virgo cluster. 6 cm.
AD-78	J. Dickey (Minnesota)	HI absorption in bright spiral galaxies. 21-cm line.
AD-83	L. Davis (KPNO)	Bright interacting galaxies. 6 and 20 cm.
AD-84	G. Dulk (Colorado) T. Bastian (Colorado)	Monitoring the solar transition region and corona, and major solar flares. 6 cm.

<u>No.</u>	<u>Observers</u>	<u>Program</u>
AD-85	I. de Pater (Arizona) D. Hunten (Arizona) J. Caldwell (SUNY, Stony Brook) T. Owen (SUNY, Stony Brook) J. Dickel (Illinois)	Planetary atmospheres: Jupiter and Saturn. 1.3 and 2 cm.
AD-87	T. de Groot (Armagh Obs., Ireland) I. Skillen (Armagh Obs., Ireland)	Spectroscopic binaries. 6 cm.
AD-88	B. Dennison (VPI&SU) J. Condon	Interstellar scintillations in extragalactic sources. 20 cm.
AD-94	I. de Pater (Arizona) R. Fanti (Bologna) C. Fanti (Bologna)	Monitoring polarization of variable radio sources. 2 and 6 cm.
AF-52	S. Faber (Calif., Santa Cruz) E. Raimond (NFRA, Neth.) G. Knapp (Princeton) J. Gallagher (Illinois)	HI distribution in the elliptical galaxy NGC 1052. 21-cm line.
AF-54	A. Fabian (Cambridge, UK) S. Phinney (Cambridge, UK) J. Condon	Galaxies with emission-line filaments. 6 and 20 cm.
AG-102	D. Gibson (NMIMT)	M-dwarf flare stars. 6, 18, and 20 cm.
AH-89	A. Haschick (Haystack) P. Ho (CFA) J. Moran (CFA) L. Rodriguez (Mexico)	Proper motions of H <sub>2</sub> O masers associated with Herbig-Haro object HHI. 1.3 cm.
AH-92	G. Helou (Cornell) Y. Terzian (NAIC)	HI in binary galaxies. 21-cm line.
AH-97	C. Henkel (MPIR, Bonn) J. Bieging (Calif., Berkeley) T. Wilson (MPIR, Bonn) K. Johnston (NRL) R. Crutcher (Illinois)	H <sub>2</sub> CO absorption toward NGC 2024. 6-cm line.
AH-98	B. Hine (Texas) A. Rots	Neutral hydrogen in M81. 21-cm line.
AH-99	R. Hjellming R. Newell	$\alpha$ Sco radio sources. 2, 6, and 20 cm.
AH-104	D. Helfand (Columbia) R. Becker (VPI&SU)	Search for radio synchrotron nebulae surrounding radio pulsars. 6 and 20 cm.

<u>No.</u>	<u>Observers</u>	<u>Program</u>
AH-105	R. Hjellming M. Hjellming (Illinois)	Polarization mapping of M31 central radio source. 6, 18, 20, and 22 cm.
AH-106	R. Hjellming K. Johnston (NRL)	Calibrate Faraday rotation of SS433 and search for large structures and holes. 6, 18, 20, and 22 cm.
AH-107	C. Heiles (Calif., Berkeley) M. Stevens (Calif., Berkeley)	HI shells around novae. 21-cm line.
AH-108	P. Ho (CFA) A. Haschick (Haystack)	High-luminosity stellar objects without HII regions. 1.3-cm line.
AH-109	P. Ho (CFA) R. Martin (MPIR, Bonn)	NH <sub>3</sub> emission region in the spiral galaxy IC 342. 1.3-cm line.
AH-110	P. Ho (CFA) R. Martin (MPIR, Bonn)	Low mass proto stars -(1,1) ammonia lines. 1.3-cm line.
AH-111	D. Hogg A. Wilson (Maryland)	Crab nebula. 6 and 20 cm.
AI-14	M. Inoue (Tokyo) M. Ishiguro (Nobeyama Obs.) H. Tabara (Utsunomiya)	Small-scale bent beam in 4C 26.42. 1.3 and 2 cm.
AI-15	R. Isaacman (Leiden) H. Habing (Leiden) I. Gatley (UK Infrared Telescope, Hawaii)	A radio survey of compact planetary nebulae. 20 cm.
AJ-81	W. Jaffe	High redshift clusters. 6 and 20 cm.
AJ-83	D. Johnson (Battelle) S. Gottesman (Florida)	Dwarf elliptical NGC 147. 21-cm line.
AK-47	S. Kwok (NRC, Canada) R. C. Bignell	Monitoring AFGL 618. 1.3, 2, 6, and 20 cm.
AK-70	M. Kutner (Rensselaer) N. Evans (Texas)	Orion nebula. NGC 1977. 6 cm.
AK-71	K. Kellermann D. Shaffer (NASA-Goddard) R. Sramek	Search for Palomar bright quasars. 6 cm.
AK-72	A. Kembhavi (Tata Inst.) E. Feigelson (Penn State)	81 quasars with known X-ray properties. 6 cm.

<u>No.</u>	<u>Observers</u>	<u>Program</u>
AK-73	C. Kotanyi (ESO, FRG) C. Balkowski (Meudon) J. van Gorkom	HI survey of the Virgo cluster. 21-cm line.
AK-74	C. Kotanyi (ESO, FRG) P. Veron (ESO, FRG) J. van Gorkom	Nucleus of Seyfert NGC 5728. 6 cm.
AL-51	H. Liszt J. Dickey (Minnesota)	HI mapping of NGC 1068 and NGC 4151. 21-cm line.
AM-61	D. Doiron (Iowa) R. Mutel (Iowa)	Eclipse observations of the binary star AR Lacertae. 6 and 18 cm.
AM-69	P. Myers (CFA) P. Schwartz (NRL)	Stellar objects in Taurus cloud cores. 6 cm.
AM-71	I. Mirabel (Puerto Rico) A. Wilson (Maryland)	HI emission and absorption in highly inclined active galaxies. 21-cm line.
AM-72	L. Molnar (Harvard) M. Reid (CFA) R. C. Bignell	Polarization monitoring of BL Lac objects. 2, 6, and 20 cm.
AM-73	J. Moran (CFA) L. Rodriguez (Mexico)	Zeeman splitting of the 21-cm absorption feature in planetary nebula NGC 6302. 21-cm line.
AM-75	R. Mutel (Iowa) D. Doiron (Iowa) J. Lestrade (JPL) M. Slade (JPL) R. Preston (JPL) D. Gibson (NMIMT)	Coordinated VLA/VLBI observations of RS CVn binary star systems. 2, 6, and 18 cm.
AN-13	R. Newell	X Persei. 20 cm.
AN-14	S. Neff (NFRA, Neth.)	Quasars with very large bent jets. 2, 6, and 20 cm.
AN-15	S. Neff (NFRA, Neth.)	Quasars with end-on jets. 2, 6, and 18 cm.
AN-16	E. Nelson (New Mexico) J. Burns (New Mexico) R. White (NASA-Goddard)	PKS 0301-123: A coincident X-ray and radio tail source. 6 and 20 cm.

<u>No.</u>	<u>Observers</u>	<u>Program</u>
AO-36	F. Owen C. O'Dea M. Inoue (Tokyo) H. Tabara (Utsunomiya) M. Ishiguro (Nobeyama Obs.)	Cluster source 3C 75. 20 cm.
AO-37	F. Owen J. Eilek (NMIMT) C. O'Dea J. Burns (New Mexico) M. Inoue (Tokyo)	3C 75 and 3C 465. 6 cm.
AR-66	J. Romig (Radiophysics Inc.) D. Evans (Radiophysics Inc.) J. Warwick (Radiophysics Inc.)	Saturn electrostatic discharges. 20-cm phased array.
AR-70	M. Reid (CFA) P. Myers (MIT/CFA) J. Bieging (Calif., Berkeley)	Ammonia absorption toward W3 (OH). 1.3-cm line.
AR-71	A. Readhead (Caltech) W. Sargent (Caltech) A. Moffet (Caltech) D. Wilkinson (Princeton) J. Uson (Princeton)	North celestial pole region. 20 cm.
AR-72	L. Rickard (Howard) T. Stecher (NASA-Goddard) R. Bohlin (NASA-Goddard) J. Hill (Sys. & Appl. Sci. Corp.) R. Cornell (Sys. & Appl. Sci. Corp.)	M83 -- Studies of HII. 2 and 6 cm.
AR-74	L. Rickard (Howard) P. Palmer (Chicago)	HI maps of CO galaxies. 21-cm line.
AR-75	L. Rodriguez (Mexico) J. Canto (Mexico) J. Torrelles (Mexico) P. Ho (CFA) J. Moran (Calif., Berkeley)	Ammonia clumps in regions with bipolar mass outflow. 1.3-cm line.
AR-79	L. Rudnick (Minnesota) W. Stein (Minnesota) M. Sitko (Minnesota)	The spectra of low radio luminosity OSOs. 2 cm.
AS-79	S. Spangler (Iowa) W. Cotton	Monitoring of low-frequency variables. 1.4, 5, 15, and 20 cm.
AS-80	R. Sramek J. van der Hulst (Minnesota) K. Weiler (NSF)	Supernovae: SN1980 in NGC 6946 and SN1979c in M100. 6 and 20 cm.

<u>No.</u>	<u>Observers</u>	<u>Program</u>
AS-138	N. Scoville (Massachusetts) J. van Gorkom D. Hall (STSI) S. Kleinmann (MIT) U. Schwarz (Groningen)	Search for broad hydrogen and helium recombination lines in the galactic center. 6-cm line.
AS-139	M. Simon (SUNY, Stony Brook) M. Felli (Arcetri)	Circumstellar ionized regions. 1.3 cm.
AS-141	L. Smarr (Illinois) R. Ekers W. van Breugel (KPNO) T. Cornwell	High-resolution studies of jet structures in Dumbell galaxies. 6 and 20 cm.
AT-25	J. Turner (Calif., Berkeley) P. Ho (CFA)	Massive star formation regions in nearby spiral nuclei. 6 cm.
AT-26	Y. Terzian (Cornell) R. C. Bignell J. van Gorkom	Angular expansion of planetary nebulae. 6 cm.
AT-27	N. Thonnard (DTM) V. Rubin (DTM)	Neutral hydrogen distribution in SC galaxies. 21-cm line.
AT-28	C. Townes (Calif., Berkeley) P. Palmer (Chicago) D. Matsakis (USNO) A. Harris (Calif., Berkeley)	Continuum emission from small, rotating NH <sub>3</sub> clumps and an NH <sub>3</sub> region. 2 and 6 cm.
AT-29	C. Townes (Calif., Berkeley) P. Palmer (Chicago) D. Matsakis (USNO) A. Harris (Calif., Berkeley)	NH <sub>3</sub> observations of B335, OMC2 and Orion north of KL. 1.3-cm line.
AT-30	A. Turtle (Sydney) M. Calabretta (Sydney) M. Phillips (CTIO, Chile)	Seyfert 2-galaxy M4-1. 20 cm.
AU-14	J. Ulvestad K. Johnston (NRL)	Diffuse emission around BL Lac objects. 6 and 20 cm.
AV-52	J. van der Hulst (NFRA, Neth.) R. Sramek K. Weiler (NSF)	Monitoring extragalactic supernovae; the next four. 6 and 20 cm.
AV-77	J. van Gorkom D. Hunter (Illinois)	Interacting irregulars. 6 and 20 cm.
AV-79	J. van der Hulst (NFRA, Neth.) P. Crane R. Kennicutt (Minnesota) R. Allen (Groningen)	Extended radio emission in M51 and NGC 6946. 20 cm.

<u>No.</u>	<u>Observers</u>	<u>Program</u>
AW-66	B. Wills (Texas) D. Wills (Texas)	Radio structure and radio optical emission lines. 6 cm.
AW-76	G. Wynn-Williams (Hawaii) E. Becklin (Hawaii) N. Scoville (Massachusetts)	The 3-kpc disk of NGC 1068. 2 and 6 cm.
AW-79	B. Williams J. Dickel (Illinois) H. Rood (Inst. Adv. Study)	Neutral hydrogen in Seyfert's sextet, a compact group of galaxies. 21-cm line.
AY-2	J. Young (Massachusetts) N. Scoville (Massachusetts)	Extended radio continuum emission in M82. 2, 6, and 20 cm.
AY-3	K. Young (Caltech) K. Lo (Caltech) W. Sargent (Caltech)	Five faint dwarf galaxies mapped in the HI line. 21-cm line.
AZ-21	H. Zirin (Caltech) G. Hurford (Caltech) A. Kattenberg (Caltech)	Solar observations. 1.3, 2 and 6 cm.

## ELECTRONICS

### Charlottesville

During this quarter sixteen 15 GHz and twelve 1.5-GHz low-noise FET amplifiers were shipped to the VLA for use in the sensitivity improvement program. Several amplifiers for use in VLBI experiments have been shipped to the University of Iowa and to two Canadian observatories. Assistance in the construction and testing of the 1.5-GHz amplifiers has been provided to NAIC (Arecibo) and Nobeyama and Nagoya observatories (Japan). Work is continuing on the development of a low-noise 23-GHz amplifier.

A 200-350 GHz receiver has been shipped to the 12-meter telescope on Kitt Peak. The receiver can accommodate eight mixer modules; at present two modules covering 200-235 GHz with < 600 K single-sideband receiver noise temperature are complete. Work is continuing on mixers and LO multipliers for the higher frequencies. An 115 GHz mixer giving < 200 K SSB receiver-noise temperature has been completed.

The construction of a 12 MB/s VLBI tape recording system based upon video-cassette recorders and a design of the University of Toronto has commenced. Construction of a high-density tape archives system for the VLA continues.

During this quarter eight visitors, including five from foreign countries, visited the laboratory to discuss our work.



### Green Bank

The digital hardware for the second digital continuum receiver is complete. Development of the software and construction of the IF hardware are in progress. We expect that this system will be on the air in the spring.

Detailed design of the orthomode junction for the new L-band receiver is complete and fabrication in the shop will begin very soon. The dewar for this receiver is nearing completion in the shop.

Work on constructing a second channel for the L, C, and X band Ft. Davis VLBI receiver has begun.

About 95% of the IR/RF parts for the holographic receiver are in-house. Construction of the IF sections, breadboarding of the LO system, and design of the digital system are in progress.

Design, breadboarding, and construction of the link for the additional baseline to the interferometer are in progress. A small amount of detailed design remains undone. Much breadboarding is yet to be done to verify that the stringent phase requirements of the microwave link are met. Construction is proceeding, but is perhaps a little behind schedule at this point.

Construction and testing of the second channel of the 5 to 25 GHz upconverter-maser receiver continues. Modifications to the cryogenics to improve the cooling rate and capacity are being studied.

A dialogue between scientists and engineers to pin down specifications for the pulsar processor and to study the possibility of using the pulsar processor as a new spectrometer for the 300-ft telescope was quite successful. It was agreed to pursue an FFT implementation with up to 50-ns time sampling rate, four 256-frequency channels for pulsar applications and two 1024-channel spectrometers for line applications. Interference rejection in both time and frequency were endorsed with the proviso that they be optional to the user. A 10-day interference survey in the band from 370 to 410 MHz was conducted to establish the required dynamic range for this backend. Basically, this study concluded that if the backend could handle an interfering line signal equal in strength to  $S_{\text{sys}}$ , we could collect useful data more than 98% of the time with only a few bad channels. Despite the limited nature of the survey, it agrees with the gut feeling of many observers, and it will be used as a basis for determining the processor's dynamic range. Further details are documented in the pulsar processor memo series.

Construction and testing of the interferometer inductosyn interfaces continues. Design and construction of the front-end data links is also continuing.

Further improvements to the Model III autocorrelator IF section have improved the electronics dependent baseline variations by up to a factor of two.

The 3-feed, 11-cm receiver has been retrofitted with FET amplifiers.

Tucson

During this period the electronics group has continued to support the surface and RF measurements of the resurfaced antenna.

The cooled 200-300 GHz receiver dewar and local oscillator assembly that was developed in Charlottesville was shipped to Tucson during this period. This has been installed in the receiver frame and the mounting, wiring and testing of the rest of the electronics for this receiver is continuing.

The He<sup>3</sup> bolometer has been delivered and is currently being readied for initial tests on the resurfaced antenna.

Very Large Array

The new design subreflector control system installed on antenna 12 is working well and will continue to be evaluated. The second 327 MHz system is in process of fabrication and will be installed on antenna 15 next quarter. The 2-cm and 21-cm GASFET front-end retrofit program is continuing, with 11 antenna systems completed. The excess attenuation in the west and north arm waveguide systems was traced to 7 previously damaged sections, which have now been replaced. The master local oscillator subsystem is now powered by an uninterruptable power supply that will operate the master local oscillator system for 30 minutes, which is more than that required for the emergency power system to come on line. Five DCS timing analyzer modules have been completed and installed in the central electronics equipment racks.

## COMPUTER DIVISION

CharlottesvilleIBM

UNIX - The trial use of UNIX on the IBM system appears successful, and it will now be supported as a standard operating mode. There are some problems with the FORTRAN 77 compiler, but they are slowly being solved.

Screen Editor - A screen editor will be available for use in February. The editor can be used with either UNIX or CMS.

AIPS

The new AIPS updating and installation process, along with a reorganization of the software files, appear to be successful. The AIPS cookbook has been transcribed into a more readable format using the TEX package on the VAX Versatec. Further problems with running AIPS under OS on the IBM 4341 have been solved. The implementation of AIPS on the new generation micro-computers costing less than \$40,000 is being investigated. The major software push in the next several months will be to implement the spectral-line package.

Socorro

The number of baseline-channels available for observations in the spectral-line mode was increased from 5000 to 7168. The number of antennas that can be used in this mode with the maximum number of channels (256) has thereby been increased from 6 to 8.

For ease of maintenance and operation, the spectral-line and continuum modes of observing have now been included in a single version of the synchronous computer operating system. The integration, which was previously handled by the array processor and CORA, is now performed in the integrator hardware of the correlator.

For the first time an integration time of less than 10 seconds has been made available for continuum observations; the integration period may now be a minimum of 3.125 seconds. The only restriction is that for integration periods of less than 10 seconds the FILLER program cannot be run on this data in real-time.

## ENGINEERING DIVISION

Assistance was provided Tucson in the setting, measuring and interpreting the measured data of the new 12-meter surface.

Design and drawings for three inductosyns for the 12-meter telescope were completed and turned over to the shop for fabrication. Design of the interface to the telescope for these inductosyns was started.

The 14.2-meter antenna structure for the interferometer addition was received, assembled and tested at the site on Point Mountain.

Preliminary studies and investigations were started for the VLBA antenna and sites.

## PERSONNEL

New Hires

Robert J. Antonucci	Research Associate	12/06
Henry A. Wootten	Assistant Scientist	12/20

Terminations

Jerzy Machalski	Visiting Scientist	09/10
Patrick E. Palmer	Visiting Scientist	09/30
Edsko Hummel	Research Associate	10/08
Walter Jaffe	Systems Scientist	10/29
Eric Graham	Sci. Prog. Analyst	12/31
Robert T. Newell	Research Associate	12/31

Retirement

Forrest H. Wells	Head/Plant Maintenance--VLA	12/31
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Leave of Absence

William D. Cotton	Systems Scientist	11/01
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Return from Leave of Absence

William D. Cotton	Systems Scientist	12/01
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Change of Status

Harry E. Payne	Sci. Associate I to Systems Scientist	11/01
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## APPENDIX A

A-1

## NRAO REPRINTS

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List No. 34

- A 1333 Blitz, L.; Israel, F.P.; Neugebauer, G.; Catley, I.; Lee, T.J.; and Beattie, D.H. The Largest H II Regions in M101.  
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- A 1330 Bowers, P.F.; Johnston, K.J.; and Spencer, J.H. Microwave OH Maser Emission in the Circumstellar Envelopes of Late-Type Stars.  
1981. *NATURE*, 291, 382-385.
- A 1327 Bridle, A.H.; Fomalont, E.B.; and Cornwell, T.J. The Large- and Small-Scale Structures of 3C 293.  
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- A 1324 Bridle, A.H. and Vallée, J.P. High-Resolution Radio Observations of the X-ray Galaxy NGC 3862 (3C 264) in Abell 1367.  
1981. *ASTRON. J.*, 86, 1165-1174.
- A 1340 Brown, R.L.; Johnston, K.J.; and Lo, K.Y. High Resolution VLA Observations of the Galactic Center.  
1981. *ASTROPHYS. J.*, 250, 155-159.
- A 1322 Burns, J.O.; White, R.A.; and Haynes, M.P. A Search for Neutral Hydrogen in D and cD Galaxies.  
1981. *ASTRON. J.*, 86, 1120-1125.
- A 1344 Dickel, H.R.; Dickel, J.R.; and Wilson, W.J. The Molecular Cloud Associated with NGC 7538.  
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- A 1341 Evans, N.J. II; Blair, G.N.; Harvey, P.; Israel, F.; Peters, W.L. III; Scholtes, M.; de Graau, T.; and Vanden Bout, P. The Energetics of Molecular Clouds. IV. The S88 Molecular Cloud.  
1981. *ASTROPHYS. J.*, 250, 200-212.
- A 1338 Fisher, J.R. and Tully, R.B. Neutral Hydrogen Observations of a Large Sample of Galaxies.  
1981. *ASTROPHYS. J. SUPPL. SER.*, 47, 139-200.
- A 1328 Geldzahler, B.J. and Witzel, A. 31.4- and 89.6-GHz Flux Density Measurements of Extragalactic Radio Sources.  
1981. *ASTRON. J.*, 86, 1306-1311.
- A 1332 Henriksen, R.N.; Vallée, J.P.; and Bridle, A.H. Radio Jet Refraction in Galactic Atmospheres with Static Pressure Gradients.  
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- A 1346 Kazès, I. and Crovisier, J. Observations of CO in HI Clouds: Correlations with HI and OH.  
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- A 1335 Kutner, M.L. and Mead, K.N. Molecular Clouds Outside the Solar Circle in the First Quadrant of Our Galaxy.  
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- A 1343 Kutner, M.L. and Ulich, B.L. Recommendations for Calibration of Millimeter-Wavelength Spectral Line Data.  
1981. *ASTROPHYS. J.*, 250, 341-348.
- A 1348 Kwok, S.; Purton, C.R.; and Keenan, D.W. Radio Observations of Compact Planetary Nebulae.  
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- A 1336 Marscher, A.P. and Broderick, J.J. X-ray and VLBI Radio Observations of the Quasars NRAO 140 and NRAO 530.  
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- A 1371 Altschuler, D.R. Evidence for Rotation in Compact Extragalactic Radio Sources. 1980. *ASTRON. J.*, 85, 1559-1564.
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