

*W. G. R. K.*

NATIONAL RADIO ASTRONOMY OBSERVATORY  
Charlottesville, Virginia

Quarterly Report

April 1, 1983 - June 30, 1983

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

JUL 28 1983

RESEARCH PROGRAMS

<u>140-foot Telescope</u>	<u>Hours</u>
Scheduled observing	1646.00
Scheduled maintenance and equipment changes	296.25
Scheduled tests and calibration	152.50
Time lost due to: equipment failure	61.50
power	3.50
weather	31.50
interference	0.00

The following line programs were conducted during this quarter.

<u>No.</u>	<u>Observer</u>	<u>Program</u>
B-392	R. Brown	Observations at 6 cm of radio recombination line emission from a complete sample of QSOs.
B-396	M. Bell (Herzberg) H. Matthews (Herzberg) T. Sears (Herzberg)	Observations at 19.3, 22.1, and 24.8 GHz to attempt to detect the $N = 7 \rightarrow 6$ , $N = 8 \rightarrow 7$ , $N = 9 \rightarrow 8$ transitions of $C_6H$ .
B-403	M. Bell (Herzberg) H. Matthews (Herzberg) T. Sears (Herzberg)	Observations at 9.1 and 18.2 GHz of $HC_3N$ toward Cas A.
B-404	M. Bell (Herzberg) H. Matthews (Herzberg) T. Sears (Herzberg)	Attempt at 8.4 and 19.6 GHz to identify the carrier of a strong spectral line detected in TMCl.
C-212	G. Chin (Goddard) J. M. Hollis (Goddard) H. Payne	Search at 5 and 6 cm for excited OH in Comet IRAS-Araki-Alcock.
M-201	L. Avery (Herzberg) N. Broten (Herzberg) J. MacLeod (Herzberg) H. Matthews (Herzberg)	Studies at 24.33 GHz of the $J = 2 \rightarrow 1$ transition of OCS and an attempt at 19.79 GHz to detect the $J = 7 \rightarrow 6$ transition of $OC_3S$ .

<u>No.</u>	<u>Observer(s)</u>	<u>Program</u>
M203	M. Bell (Herzberg) H. Matthews (Herzberg) T. Sears (Herzberg)	Observations over a wide range of frequencies at K and X band in an attempt to ascertain the species responsible for an unusual feature in the direction of Sgr B2.
N-5	E. Churchwell (Wisconsin) A. Nash (Wisconsin)	Observations at 6 cm of the H <sub>2</sub> CO absorption toward dark clouds.
S-257	M. Bell (Herzberg) E. Seaquist (Toronto)	Extensive search at 6 cm for recombination lines in extragalactic sources.
S-264	F. Lovas (NBS) M. Schenewerk (Illinois) L. Snyder (Illinois)	Search at 6 cm for interstellar (NH <sub>2</sub> ) <sub>2</sub> CO.

The following continuum programs were conducted during this quarter.

<u>No.</u>	<u>Observer(s)</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.
V-45	S. Haarala (Turku, Finland) E. Salonen (Helsinki) W. Saslaw (Virginia) M. Valtonen (Turku, Finland)	Monitoring OJ 287 for variability at 19.5 GHz.
W-167	J. Uson (Princeton) D. Wilkinson (Princeton)	Observations at 19.5 GHz of the small-scale anisotropy of the cosmic microwave background.

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

B - Effelsberg MPIR 100 m	K - Haystack 120 ft
C - Algonquin 150-ft	N - NRL 85 ft
Dm - Goldstone 64 m	O - Owens Valley 130 ft
Ds - Madrid 64 m	R - Crimea 30 m
E - South Africa 25 m	Sn - Onsala 20 m
F - Fort Davis 85 ft	So - Onsala 25 m
G - Green Bank 140 ft	Wn - Westerbork n = 1 - 14x26 m
H - Hat Creek 85 ft	Yn - Socorro n = 1 - 27x25
I - Iowa 60 ft	

<u>No.</u>	<u>Observer(s)</u>	<u>Program</u>
B-32V	N. Bartel (MIT)	Observations at 3.6 and 13 cm of the black hole candidate Cyg X-1, with telescopes B, Dm, Ds, G, K, Sn, and So.

<u>No.</u>	<u>Observer(s)</u>	<u>Program</u>
B-37V	N. Bartel (MIT) N. Cohen (CFA) B. Corey (Haystack) M. Gorenstein (MIT) J. Marcaide (MIT) A. Rogers (Haystack) J. Romney (MPIR) I. Shapiro (CFA)	Observations at 3.6 and 13 cm of the compact source in M82, with telescopes B, Dm, F, G, K, O, and So.
B-40V	P. Barthel (Leiden) G. Miley (Leiden) E. Preuss (MPIR) R. Schilizzi (NFRA) T. Cornwell	Observations at 6 cm to search for superluminal motion in the cores of extended quasars, with telescopes B, G, O, So, and Yn.
B-43V	L. Baath (Chalmers) D. Graham (MPIR, Bonn) G. Nicolson (Hartebeesthoek, South Africa) G. Seielstad (Caltech) W. Cotton	Monitor at 6 cm the BL Lac objects AO 0235+164, 0735+178, MK 421, and 1749+701, with telescopes B, E, F, G, K, O, So, W, and Yn.
D-2V	G. de Waard (Leiden) G. Miley (Leiden) E. Preuss (MPIR, Bonn) R. Schilizzi (NFRA)	Study at 6 cm the nonthermal/thermal relationships in the nuclei of active galaxies, with telescopes of the European VLB network, G and O.
G-26V	D. Graham (MPIR, Bonn)	Observations of 3C 298 at 6 cm, with telescopes B, G, K, O, and Yn.
G-27V	N. Bartel (MIT) R. Bonometti (MIT) M. Gorenstein (MIT) J. Marcaide (MIT) R. Preston (JPL) I. Shapiro (CFA)	Observations at 3.6 and 13 cm of 0957+561A,B, with telescopes B, Dm, Ds, G, O, and So.
G-29V	B. Geldzahler (NRL) K. Johnston (NRL) J. Spencer (NRL) E. Waltman (NRL)	Observations at 2.8 cm of OJ 287, with telescopes B, C, F, G, H, K, and O.
G-30V	B. Geldzahler (NRL) K. Johnston (NRL) J. Spencer (NRL) E. Waltman (NRL)	Observations at 6 cm of OJ 287, with telescopes B, F, G, H, I, K, N, O, Wn, and Yn.
G-32V	M. Gorenstein (CFA) N. Cohen (CFA) E. Falco (CFA) R. Bonometti (CFA) I. Shapiro (CFA)	High sensitivity 6-cm observations of Q0957+516A,B,G, with telescopes B, G, O, and Yn.

<u>No.</u>	<u>Observer(s)</u>	<u>Program</u>
H-6V	D. Hough (Caltech) A. Readhead (Caltech)	Observations at 2.8 cm to map the central components of the double-lobed quasars 3C 207, 3C 212, 3C 245, 3C 249.1, and 3C 344, with telescopes B, F, G, K, and O.
J-23V	K. Johnston (NRL) T. Clark (Goddard) A. Rogers (Haystack) B. Ronnang (Chalmers) D. Shaffer (Interferometrics) J. Spencer (NRL)	Observations at 3.6 and 13 cm to establish a grid of precise radio source positions, with telescopes F, G, K, O, and Sn.
K-13V	I. Pauliny-Toth (MPIR, Bonn) J. Romney (MPIR, Bonn) J. Benson K. Kellermann R. C. Walker	High-resolution sensitivity and dynamic range 1.3-cm observations of 3C 273, with telescopes B, C, G, R, Sn, and Yn.
L-19V	R. Linfield (Calif., Berkeley) A. Readhead (Caltech)	Observations at 6 cm of the Cyg jet and a search for compact emission from within its lobes, with telescopes F, G, K, N, O, and Yn.
L-23V	D. Backer (Calif., Berkeley) M. Cohen (Caltech) K. Lo (Caltech)	Mapping at 1.3 and 3.6 cm of the galactic center source, with telescopes Dm, F, G, H, K, N, and O.
L-26V	D. Backer (Calif., Berkeley) M. Cohen (Caltech) K. Lo (Caltech) J. Moran (CFA) R. Ekers K. Kellermann	Mapping at 1.3 cm of the Sgr A compact radio source, with telescopes G, K, O, and Yn.
M-38V	R. Mutel (Iowa) R. Phillips (Haystack)	Observations at 6 cm to continue to monitor BL Lac, with telescopes B, F, G, H, K, and O.
M-41V	N. Bartel (MIT) M. Gorenstein (MIT) J. Marcaide (MIT) R. Preston (JPL) I. Shapiro (CFA)	Observations at 3.6 and 13 cm of the galactic center, with telescopes B, Dm, Ds, F, G, K, and O.
P-38V	R. Mutel (Iowa) R. Phillips (Haystack)	Observations at 6 cm to determine the component spectral indices and to search for a weak central source in "compact doubles," with telescopes F, G, K, O, and Yn.

<u>No.</u>	<u>Observer(s)</u>	<u>Program</u>
P-40V	R. Porcas (MPIR, Bonn)	Observations at 2.8 cm of 3C 179, with telescopes B, F, G, K, and O.
P-42V	M. Hodges (Iowa) R. Mutel (Iowa) R. Phillips (Haystack)	Continued observations at 6 cm of the expansion of BL Lac, with telescopes B, C, F, G, H, K, O, and Yn.
P-43V	R. Booth (Onsala) D. Graham (MPIR, Bonn) R. Porcas (MPIR, Bonn) P. Wilkinson (Jodrell)	Observations at 6 cm of the double quasar 0957+561A,B, with telescopes B, G, O, and So.
R-24V	R. Rusk (Toronto) E. Seaquist (Toronto) J. Yen (Toronto) R. Perley	Study at 6 cm highly polarized compact radio sources, with telescopes F, G, H, K, N, O, and Yn.
S-21V	D. Shaffer (Interferometrics) J. Marcaide (MPIR, Bonn) J. Romney (MPIR, Bonn) K. Kellermann	Observations at 6 cm of 4C 39.25, with telescopes B, F, G, H, I, K, and O.
S-28V	A. Eckart (MPIR, Bonn) H. Hirabayashi (Tokyo) I. Inoue (Tokyo) K. Johnston (NRL) J. Spencer (NRL) A. Witzel (MPIR, Bonn)	Observations at 6 cm to map 3C 395, with telescopes B, F, G, H, K, N, O, and Yn.
S-30V	P. Hill (Meudon) R. Hunstead (Sydney) H. Murdoch (Sydney) R. Schilizzi (NFRA) T. Cornwell	Observations at 1.3 cm of the BL Lac object PKS 0215+15, with telescopes B, G, K, O, and Yn.
W-18V	R. C. Walker S. Unwin (Caltech) J. Benson G. Seielstad (Caltech)	Observations at 6 cm of 3C 120, with telescopes A, B, F, G, H, K, N, O, So, and Yn.
W-21V	D. Weistrop (Goddard) P. Hintzen (Goddard) D. Shaffer (Interferometrics)	Observations at 6 cm to investigate the milliarcsecond radio structure of the BL Lac object 1400+162, with telescopes B, F, G, K, O, and Yn.
W-22V	A. Witzel (MPIR, Bonn) A. Eckart (MPIR, Bonn) K. Johnston (NRL) I. Pauliny-Toth (MPIR, Bonn)	Observations at 6 cm of four sources selected from a complete sample of extragalactic radio sources, with telescopes B, F, G, K, and O.

In addition to the above, and as a part of the 50th anniversary celebration of Carl Jansky's discovery, T. Clark (Goddard), D. Shaffer (Interferometrics), M. Balister, W. Brundage, H. Hvatum, and K. Kellermann (all NRAO) spent several hours using the 140-foot as the antenna for a 232 MHz ham band moon bounce.

<u>300-foot Telescope</u>	<u>Hours</u>
Scheduled observing	2061.25
Scheduled maintenance and equipment changes	118.25
Scheduled tests and calibration	0.00
Time lost due to: equipment failure	74.25
power	0.50
weather	1.25
interference	0.50

The following line programs were conducted during this quarter.

<u>No.</u>	<u>Observer(s)</u>	<u>Program</u>
B-401	R. Brown	Observations over the frequency range 500-1000 MHz to search for highly red-shifted 21-cm absorption and recombination lines in QSOs.
B-407	J. Broderick (VPI & SU) R. Brown	Survey at 9 cm of extragalactic ionized gas associated with uncondensed (very young) galaxies, radio quiet QSOs, and optically unidentified radio sources.
G-265	R. Giovanelli (NAIC) M. Haynes	Continued observations of hydrogen in galaxies found in clusters and superclusters.
H-186	T. Heckman (Maryland) W. van Breugel (Arizona) B. Balick (Washington) G. Miley (Leiden)	Search at discrete frequencies over the range 500-1300 MHz for HI absorption in quasars which have small-scale radio sources.
L-147	B. M. Lewis (NAIC) P. Crane	Observations to complete the detection of and to study Shapley Ames galaxies by the use of hydrogen-line observing techniques.
W-164	B. Williams H. Rood (Inst. Adv. Studies) J. Dickel (Illinois)	Hydrogen observations of "compact groups" of galaxies.

The following continuum programs were conducted during this quarter.

<u>No.</u>	<u>Observer(s)</u>	<u>Program</u>
A-59	H. Aller (Michigan) M. Aller (Michigan) R. Fanti (Bologna) A. Ficarra (Bologna) F. Mantovani (Bologna) L. Padrielli (Bologna)	Observations at 1400 and 2695 MHz of low-frequency variable sources selected from the Bologna-Michigan program.
B-335	T. Balonek (New Mexico) W. Dent (Massachusetts) W. Kinzel (Massachusetts) C. O'Dea (Massachusetts)	Polarization and flux density measurements of variable radio sources at 2695 MHz.
B-389	J. Broderick (VPI & SU) B. Dennison (VPI & SU) K. Mitchell (VPI & SU) S. O'Dell (VPI & SU) J. Condon H. Payne	Observations of low-frequency variable sources at 606, 880, and 1400 MHz.
C-200	J. Broderick (VPI & SU) J. Condon	Confusion limited map at 1400 MHz of the area $RA = 0^h < \alpha < 24^h$ and $Dec = -15^\circ < \delta < 85^\circ$ .
R-206	J. Romig (Radiophysics Inc.) C. Hayenga (NMIMT) I. de Pater (Arizona) C. Rhodes (NMIMT) D. Evans (Radiophysics Inc.) J. Warwick (Radiophysics Inc.) P. Crane M. Gordon	Observations at 390 MHz to attempt to detect electrostatic discharges from Saturn.

The following pulsar program was conducted during this quarter.

<u>No.</u>	<u>Observer(s)</u>	<u>Program</u>
T-166	J. Taylor (Princeton) R. Dewey (Princeton) J. Weisberg (Princeton) M. Damashek	Observations in the range 300-400 MHz for an improved Northern Hemisphere pulsar survey.

<u>12-meter Telescope</u>	<u>Hours</u>
Scheduled observing	2184.00
Scheduled maintenance and equipment changes	57.50
Scheduled tests and calibration	836.00
Time lost due to: equipment	73.00
weather	146.25
power	1.50
interference	0.00

The following line programs were conducted during this quarter.

<u>No.</u>	<u>Observer(s)</u>	<u>Program</u>
A-68	P. Ade (Queen Mary, UK) M. Smith (Royal Observatory) E. Robson (Preston Polytechnic, UK) I. Nolt (Oregon) J. Radostitz (Oregon) W. Gear (Queen Mary, UK)	Millimeter-wavelength narrow-band photometry of extragalactic objects.
B-402	D. Backer (Calif., Berkeley) A. Readhead (Caltech) A. Rogers (Haystack) C. Read (Massachusetts)	VLBI observations of extragalactic radio sources at 90 GHz.
C-210	L. Caroff (Ames) K. Villere (Ames)	One-millimeter continuum observation of Bok globules.
D-133	W. Dent (Massachusetts) T. Balonek (New Mexico) R. Hobbs (Goddard)	Evolution of extragalactic radio sources at millimeter wavelengths.
D-135	J. Dickel (Illinois) I. de Pater (Arizona) B. Ulich (Arizona) R. Brown (Arizona)	Observations of the Galilean satellites and asteroids.
E-42	R. Edelson (Caltech)	Search for 1-mm emission from an unbiased sample of X-ray sources.
F-85	B. Geldzahler (NRL)	Continuum observations of S5 survey objects.
H-177	J. M. Hollis (Goddard) P. Rhodes	Search for sodium hydroxide.
L-181	C. Lada (Arizona)	Study of the dynamical and spatial structure of energetic molecular outflows.
N-3	R. Newell (Scott Science & Technology) R. Hjellming	Observations of Alpha Orionis and Alpha Scorpii A at 3 and 1 mm.



<u>No.</u>	<u>Observer(s)</u>	<u>Program</u>
N-4	I. Nolt (Oregon) G. Veeder (Caltech) J. Radostitz (Oregon) J. Caldwell (SUNY, Stony Brook)	Millimeter-wave observations of the Saturn system and asteroids.
R-164	L. Rickard (Howard) P. Bowers (NRL)	Study of neutral condensation in planetary nebulae at 1 mm.
R-201	L. Rickard (Howard)	CO mapping work on selected galaxies.
R-203	L. Rickard (Howard) L. Blitz (Maryland)	Variation of $^{12}\text{CO}/^{13}\text{CO}$ emission across disks of galaxies with bright molecular components.
S-241	S. Spangler (Iowa) W. Cotton	Continuum observations of low-frequency variables.
U-16	B. Ulich (Arizona)	Search for Sunyaev-Zel'dovitch effects at millimeter wavelengths.
W-160	B. Wilking (Texas) C. Lada (Arizona)	Millimeter dust emission in Rho Ophiuchus.
Z-38	B. Zuckerman (Maryland)	Observations of highly reddened evolved stars and SS443 at 1 mm.

#### Very Large Array

The quarter was scheduled 100 percent of the time.

Astronomical	1573.9 hours	(72.1 percent)
Test	610.1 hours	(27.9 percent)

The average downtime was 5.66 percent.

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

<u>No.</u>	<u>Observer(s)</u>	<u>Program</u>
AA-20	J. Albinson (NFRA) H. van Woerden (Groningen)	HI in dwarf irregular galaxies in the local group: NGC 6822. 21-cm line.
AA-22	H. Andernach (MPIR, Bonn) L. Feretti (Bologna) G. Giovannini (Bologna) U. Klein (MPIR, Bonn)	The extended source near Coma A. 6 and 20 cm.
AA-23	M. Andrews (Iowa State) J. Basart (Iowa State)	Hydrogen recombination line emission from the center of W28. 2-cm line.

<u>No.</u>	<u>Observer(s)</u>	<u>Program</u>
AB-129	B. Burke (MIT) J. Hewitt (MIT) D. Roberts (Brandeis)	Monitoring double quasar 0957+561. 6 cm.
AB-182	J. Burns (New Mexico) T. Balonek (New Mexico) E. Hummel (MPIR, Bonn)	Monitoring the cores of extended radio sources and spiral galaxies. 2, 6, and 20 cm.
AB-188	R. Becker (VPI & SU)	Distribution and polarization of two Crab-like SNRs. 6 cm.
AB-205	J. Bally (Bell Labs) R. Snell (Massachusetts)	Ionized gas associated with molecular jets and OH objects. 2, 6, and 20 cm.
AB-206	J. Bally (Bell Labs) D. Matsakis (USNO) R. Snell (Massachusetts) R. Predmore (Massachusetts)	H <sub>2</sub> CO and NH <sub>3</sub> in the disk associated with the bipolar HII region in S106. 1.3 and 6-cm line.
AB-209	F. Briggs (Pittsburgh) P. Coleman (Pittsburgh)	Radio properties of an optically selected sample of QSOs. 6 and 20 cm.
AB-216	M. Birkinshaw (Cambridge, UK) G. Gull (Cambridge, UK)	The Sunyaev-Zel'dovich effect in Abell 2218. 6 cm.
AB-224	J. Brodie (Calif., Berkeley) J. Clarke (Calif., Berkeley) S. Bowyer (Calif., Berkeley)	Search for Southern Hemisphere jets. 20 cm.
AB-230	R. Becker (VPI & SU) D. Helfand (Columbia)	Spectral index and polarization distribution over three small diameter SNRs. 6 cm.
AB-231	G. Berge (Caltech) D. Muhleman (Caltech) A. Niell (JPL)	Astrometric and physical observations of the Galilean satellites. 2 and 6 cm.
AB-232	B. Balick (Washington) R. Hjellming R. C. Bignell	Planetary nebulae NGC 40, NGC 6543, and IC 3568. 6 and 20 cm.
AC-42	D. Abbott (Colorado) J. Biegging (Calif., Berkeley) E. Churchwell (Wisconsin) R. C. Bignell	Monitor variability of flux densities of OB stars. 2, 6, and 20 cm.
AC-67	P. Coleman (Pittsburgh) D. Turnshek (Pittsburgh) F. Briggs (Pittsburgh)	Broad absorption line QSOs. 2, 6, and 20 cm.

<u>No.</u>	<u>Observer(s)</u>	<u>Program</u>
AC-70	M. Claussen (Caltech) K. Lo (Caltech)	HI in molecular cloud cores. 21-cm line.
AC-71	J. Condon K. Mitchell (VPI & SU)	Spectral index distributions of faint sources and QSOs. 6 cm.
AC-72	J. Cordes (Cornell) S. Beckwith (Cornell) J. Simonetti (Cornell) I. Wasserman (Cornell)	Pilot observations of extragalactic sources behind molecular clouds. 20 cm.
AC-73	W. Cotton F. Owen	Very steep spectrum sources. 6 cm.
AC-74	D. Chernoff (Calif., Berkeley) M. Stevens (Calif., Berkeley) D. Hollenbach (Calif., Berkeley) C. McKee (Calif., Berkeley) C. Heiles (Calif., Berkeley)	High velocity HI and magnetic fields in Orion A. 21-cm line.
AD-79	E. Salpeter (Cornell) J. Dickey (Minnesota)	HI synthesis of a rich cluster of galaxies. 21-cm line.
AD-84	G. Dulk (Colorado) T. Bastain (Colorado)	The solar transition region and corona, and major solar flares. 6 cm.
AD-85	I. de Pater (Arizona) D. Hunten (Arizona) J. Caldwell (SUNY, Stony Brook) J. Dickel (Illinois) T. Owen (SUNY, Stony Brook)	Planetary atmospheres: Jupiter. 1.3, 2, and 6 cm.
AD-91	A. Downes (Cambridge, UK) J. Peacock (Royal Obs.)	Diffuse structure in faint, high frequency extragalactic radio sources. 6 and 20 cm.
AD-92	H. Dickel (Illinois) A. Lubenow (Illinois) W. M. Goss (Groningen) A. Rots	H <sub>2</sub> CO absorption toward DR21. 2-cm line.
AD-94	I. de Pater (Arizona) K. Weiler (NSF) R. Fanti (Bologna) C. Fanti (Bologna)	Polarization characteristics in variable radio sources, 2, 6, and 20 cm.
AD-97	R. Davies (Manchester, UK) A. Lasenby (Manchester, UK)	Search for the Sunyaev-Zel'dovich decrement in A576. 6 cm.

<u>No.</u>	<u>Observer(s)</u>	<u>Program</u>
AE-20	R. Ekers C. Fanti (Bologna) R. Fanti (Bologna) P. Parma (Bologna)	Peculiar low-luminosity radio galaxy B2 1637+29. 6 and 20 cm.
AE-21	R. Ekers R. Laing (Royal Greenwich Obs.)	Microwave decrement in the direction of the galaxy cluster 0016+16. 2 and 20 cm.
AF-64	D. Florkowski (USNO) K. Johnston (NRL)	Search for radio emission from massive early-type stars. 6 cm.
AG-106	S. Gottesman (Florida) J. Ball (Florida) J. Hunter (Florida) J. Huntley (Bell Labs)	Barred spiral galaxy: NGC 1073. 21-cm line.
AG-110	S. Gottesman (Florida) J. Ball (Florida) J. Hunter (Florida) J. Huntley (Bell Labs)	HI in barred spirals NGC 1073 and NGC 3359. 21-cm line.
AH-115	P. Ho (CFA) A. Barrett (MIT) T. Armstrong (MIT) J. Jackson (MIT)	Continuum observations of the Sgr A molecular cloud. 2 and 6 cm.
AH-117	D. Helfand (Columbia) R. Becker (VPI & SU) T. Hamilton (Columbia)	A search for millisecond pulsar candidates in globular clusters. 6 and 20 cm.
AH-118	D. Hogg	Wolf-Rayet stars. 1.3, 2, and 6 cm.
AH-121	M. Haynes R. Giovanelli (NAIC)	HI in NGC 4388. 21-cm line.
AH-122	D. Hunter (KPNO) J. van Gorkom	HI observations of non-interacting irregular galaxies. 21-cm line.
AH-123	D. Hunter (KPNO) J. van Gorkom	Non-interacting irregulars. 6 cm.
AI-17	C. Impey (Hawaii)	Survey of a quasar supercluster. 6 and 20 cm.
AJ-82	D. Johnson (Battelle) S. Gottesman (Florida)	Formaldehyde observations of M31 and M33. 6-cm line.
AJ-87	D. Johnson (Battelle) S. Gottesman (Florida)	HI in NGC 205. 21-cm line.

<u>No.</u>	<u>Observer(s)</u>	<u>Program</u>
AJ-89	N. Jeske (Calif., Berkeley) M. Davis (Calif., Berkeley) M. Stevens (Calif., Berkeley)	HI velocity mapping of dwarf irregular galaxies; DDO 125. 21-cm line.
AJ-90	K. Johnston (NRL) P. Seidelmann (USNO) C. Wade G. Kaplan (USNO)	Minor planet 10 Hygiea. 6 cm.
AJ-91	N. Jeske (Calif., Berkeley) M. Davis (Calif., Berkeley) M. Stevens (Calif., Berkeley)	Ring galaxies. 6 cm.
AJ-92	D. Jaffe (Calif., Berkeley) P. Ho (CFA) R. Genzel (Calif., Berkeley) D. Downes (IRAM)	Ammonia observations of warm molecular condensations around "protostars." 1.3-cm line.
AK-76	P. Kronberg (Toronto) S. Button (Toronto) E. Zukowski (Toronto) K. Kim (Toronto) A. Boksenberg (Royal Greenwich Obs.)	Rotation measure survey. 2, 6, 17, 19, and 22 cm.
AK-79	K. Kellermann R. Sramek D. Shaffer (Interferometrics)	Deep search for Palomar quasars. 6 cm.
AK-80	G. Kriss (Michigan) C. Canizares (MIT) R. Sramek	Survey of X-ray and optically selected quasars. 20 cm.
AK-81	M. Kundu (Maryland) R. Shevgaonkar (Maryland) E. Schmahl (Maryland)	Solar flares and active regions. 2 and 6 cm.
AK-82	M. Kutner (Rensselaer) K. Mead (Rensselaer) N. Evans (Texas)	Search for HII in outer galaxy molecular clouds. 6 cm.
AK-83	C. Kotanyi C. Balkowski (Meudon) J. van Gorkom	HI survey of the Virgo cluster. 21-cm line.
AL-25	R. Landau (Minnesota) E. Epstein (Aerospace) L. Rudnick (Minnesota) T. Jones (Minnesota)	Spectra of extragalactic variable sources. 1.3, 2, 6, and 20 cm.

<u>No.</u>	<u>Observer(s)</u>	<u>Program</u>
AL-43	R. Laing (Royal Greenwich Obs.)	Hot spots in luminous extragalactic radio sources. 2 cm.
AL-47	R. Laing (Royal Greenwich Obs.) G. Pooley (Cambridge, UK) J. Riley (Cambridge, UK)	Rotation measure variations in the radio galaxy 3C 452. 6, 17, and 22 cm.
AL-57	J. Linsky (Colorado) S. Drake (Colorado)	Mass loss rates from late-type giant and supergiant stars. 2 and 6 cm.
AL-62	H. Liszt	HI synthesis of three Seyfert galaxies. 21-cm line.
AL-63	L. Little (Kent, UK) G. White (Queen Mary, UK)	Continuum emission from the molecular cloud G35.2-0.74. 6 cm.
AL-64	J. Lestrade (Paris Obs./JPL) R. Mutel (Iowa) D. Doiron (Iowa)	RS CVn binary systems. 6 and 20 cm.
AL-65	G. Lake (Bell Labs) R. Schommer (Rutgers) J. van Gorkom	HI observations of faint elliptical galaxies. 21-cm line.
AM-72	L. Molnar (CFA) M. Reid (CFA) R. C. Bignell	Polarization monitoring of BL Lac objects. 2, 6, and 20 cm.
AM-76	D. Muhleman (Caltech) G. Berge (Caltech)	Saturn's rings: scattering phase functions and polarization. 2 and 6 cm.
AM-81	T. Montmerle (CEN-Saclay, France) E. Feigelson (MIT) E. Falgarone (Meudon) L. Koch-Miramond (CEN-Saclay, France)	Nonthermal radio emission from X-ray detected stars in the Rho Oph dark cloud. 20 cm.
AM-83	N. Mandolesi (TESR-CNR, Italy) R. B. Partridge (Haverford) R. Perley	Search for the Sunyaev-Zel'dovich effect in Abell 2218. 6 cm.
AM-84	T. Menon (British Columbia)	Radio sources in compact groups of galaxies. 6 and 20 cm.
AM-86	M. Morris (Columbia/UCLA) F. Y.-Zadeh (Columbia) D. Chance (Columbia)	The continuum arc in the galactic center region. 6 and 20 cm.

<u>No.</u>	<u>Observer(s)</u>	<u>Program</u>
AN-18	L. Noreau (Toronto) P. Kronberg (Toronto) F. Bertola (Pavoda, Italy) G. Galetta (Pavoda, Italy) D. Bettoni (Pavoda, Italy)	Arp 205 and 206. 17 and 22 cm.
AN-20	J. Neff (Iowa)	Planetary nebulae. 6 cm.
AO-35	F. Owen J. Biretta (Caltech) P. Hardee (Alabama)	M87. 2 and 6 cm.
AO-37	F. Owen C. O'Dea M. Inoue (Tokyo Astron. Obs.) J. Eilek (NMIMT) J. Burns (New Mexico)	3C 75 and 3C 465. 20 cm.
AP-64	J. Peacock (Royal Obs.) R. Prestage (Edinburgh, UK) J. Wall (Royal Greenwich Obs.)	The structure and environment of bright radio sources. 6 and 20 cm.
AP-66	R. Perley A. Bridle	Low brightness features of NGC 6251. 6 and 20 cm.
AP-68	G. Pettengill (MIT) B. Chapman (MIT)	Search for radio occultations by rings of Saturn and Uranus. 20 cm.
AQ-2	P. Quinn (Caltech) K. Lo (Caltech) D. Carter (ANU, Australia)	Shell elliptical NGC 2865. 21-cm line.
AR-73	L. Rickard (Howard) J. van der Hulst (NFRA)	High-frequency fluxes of central radio sources in spiral galaxies. 1.3 and 2 cm.
AR-81	A. Rots W. van Driel (Groningen) H. van Woerden (Groningen)	HI in SO galaxies: NGC 1291. 21-cm line.
AR-84	G. Fazio (CFA) M. Reid (CFA)	Compact far-infrared sources. 6 cm.
AR-88	S. Reynolds	The remnant of SN 1006. 18 and 20 cm.
AR-89	S. Reynolds R. Chevalier (Virginia)	Detection of old nova GK Per (1901) 6 and 20 cm.
AS-79	S. Spangler (Iowa) W. Cotton	Monitoring of low-frequency variables. 1.4, 5, 15, and 21 cm.

<u>No.</u>	<u>Observer(s)</u>	<u>Program</u>
AS-80	R. Sramek J. van der Hulst (NFRA) K. Weiler (NSF)	Monitoring supernovae SN 1980k in NGC 6946 and SN 1979c in M100. 6 and 20 cm.
AS-134	O. Slee (CSIRO) R. Perley	Steep spectrum sources in clusters of galaxies. 6 and 20 cm.
AS-140	E. Skillman (Washington)	The refractory period and cell size in irregular galaxies: NGC 6872 and IC 1613. 21-cm line.
AS-148	S. Spangler (Iowa) J. Pogge (Iowa)	Double sources with extended lobes or bridges. 2 and 6 cm.
AS-149	S. Simkin (Wisconsin) H. Su (Purple Mountain Obs.) J. van Gorkom	HI observations of Seyferts. 21-cm line.
AS-152	D. Schwartz (CFA) H. Bradt (MIT) E. Feigelson (Penn State)	Search for radio emission from unidentified, bright X-ray sources. 20 cm.
AS-155	P. Schwartz (NRL) H. Smith (NRL) K. Shivanandan (NRL)	Compact HI regions in dark clouds discovered in the far infrared by FIRSSE. 6 and 20 cm.
AS-157	R. Simon (NRC/NRL) J. Spencer (NRL) K. Johnston (NRL)	Large-scale structure in compact radio sources. 20 cm.
AS-158	C. Subrahmanya (Tata Inst.) A. Patnaik (Tata Inst.) G. Swarup (Tata Inst.)	Extended sources studied at 327 MHz. 6 and 20 cm.
AS-159	M. Sitko (Minnesota) G. Schmidt (Arizona) R. Moore (Aerospace) L. Rudnick (Minnesota)	The eruptive QSO 0846+513. 2, 6 and 20 cm.
AT-25	J. Turner (Calif., Berkeley) P. Ho (CFA)	Star formation regions in nearby spiral nuclei. 2 cm.
AT-26	Y. Terzian (Cornell) R. C. Bignell J. van Gorkom	Angular expansion of planetary nebulae. 6 cm.
AT-33	J. Turner (Calif., Berkeley) P. Ho (CFA)	Star formation in the nuclear regions of M31 and M33. 6 cm.
AT-38	K. Turner (Arecibo) Y. Terzian (Cornell)	Four bright cometary nebulae. 20 cm.



<u>No.</u>	<u>Observer(s)</u>	<u>Program</u>
AT-39	A. Taylor (Toronto) E. Seaquist (Toronto) P. Gregory (British Columbia)	New radio stars. 6 cm.
AT-40	C. Townes (Calif., Berkeley) A. Harris (Calif., Berkeley) P. Palmer (Chicago) D. Matsakis (USNO)	Ammonia observations north of Orion-KL and of B335. 1.3-cm line.
AV-80	T. Velusamy (Tata Inst.)	Search for a Crab nebula shell. 20 cm.
AV-82	J. van der Hulst (NFRA) R. Kennicutt (Minnesota)	HI in the Virgo core galaxies NGC 4571, 4689, and 4237. 21-cm line.
AV-84	W. van Breugel (Arizona) R. Strom (NFRA) J. Dickel (Illinois)	Radio polarimetry of Tycho A. 6, 18, and 20 cm.
AV-86	W. van Breugel (Arizona) T. Heckman (Maryland) G. Miley (Leiden) M-H. Ulrich (ESO, FRG)	Optical-line emission along the radio axes of two classical doubles, PKS 0349-278 and 3C 445. 6 and 20 cm.
AW-48	C. Wade P. Seidelman (USNO) G. Kaplan (USNO) K. Johnston (NRL)	Astrometric observations of minor planets. 2 and 6 cm.
AW-78	J. Wardle (Brandeis) R. Laing (Royal Greenwich Obs.)	Variability of the central components of extended radio sources. 2 and 6 cm.
AW-83	J. Whiteoak (CSIRO) F. Gardner (CSIRO)	H <sub>2</sub> CO observations of Sgr A West. 2-cm line.
AW-86	G. Wynn-Williams (Hawaii) E. Becklin (Hawaii)	Dwarf HII region galaxies. 6 and 20 cm.
AW-87	G. de Waard (Leiden) G. Miley (Leiden) R. Perley	Monitoring of IRAS active galaxies. 1.3, 2, 6, and 20 cm.
AW-89	D. Wells	HI in NGC 6503. 21-cm line.
AZ-22	H. Zirin (Caltech) G. Hurford (Caltech)	Solar spicules: the limb brightness profile. 1.3, 2, and 6 cm.

## Comet Tests:

I. de Pater (Arizona)	Comet IRAS-Araki-Alcock. 2 and 6 cm.
C. Wade	
R. Hjellming	
B. Clark	

## COMPUTER DIVISION

CharlottesvilleAIPS

Miscellaneous - New documentation in the form of Explain files should aid in the use and understanding of the more complicated tasks in AIPS. This documentation will be available interactively and in hard-copy format. Some re-evaluation of the role of the AIPS Cookbook will be made so that it complements the Explain files.

Other new software additions include: new template tasks to make programming in AIPS more accessible; new routines to handle several nonlinear coordinate systems and the frequency/velocity conversion; revision of the FITS reading and writing routines for greater speed and generality in handling UV data; a complete set of operators for handling strings; and new tasks for summing, smoothing, and deconvolving the frequency axis.

IBM - We do not plan to support AIPS on the IBM under the old OS-MFT operating system. An old version of AIPS currently runs under this system, but several factors, including the lack of an array processor, make it too slow to be attractive. It is felt that the updating of the code to a more recent version of AIPS would not be worth the effort because of the slowness and the past difficulties experienced with the OS system.

UNIX - The effort to develop a supported version of AIPS that runs under UNIX is progressing. This work is being done on the IBM because it is currently the only machine we have running UNIX. We hope to run a UNIX emulator on the VAX eventually, which should make some things easier. However, the IBM work is necessary because a non-VAX architecture is important if the code is going to be transferred to non-VAX systems. A number of 68000-based systems have been proposed. It is expected that the current UNIX work will aid in the development of these.

Socorro

The software necessary to add the B and D IF channels to the array was completed on June 8. The data from this IF pair is filled into a separate database on which the existing calibration and editing programs can be used.

The number of baseline-channels available for observations in the spectral line mode was increased from 7168 to 10,240. The number of antennas that can be used in this mode with the maximum number of channels (256) has thereby been increased to 9. The modifications to allow this also represent the first step towards eliminating gain codes for all observing modes.

The coordinate system for epoch 2000 observations using the IAU standard convention has been implemented on the on-line computers. The VLA standard calibrator list has also been updated, so observations are now fully supported using this system.

The graphical displays to be used on the pipeline have been interfaced and a basic set of functions are now available.

#### ENGINEERING DIVISION

An alternate installation for the elevation inductosyn mounting on the 12-meter telescope was studied and the design started.

Drawings for the azimuth inductosyn mounting on the 12-meter telescope were completed and sent to the shop for fabrication of the components.

Research and studies for a new elevation drive on the 12-meter telescope were started.

Painting of the 14.2-meter antenna structure was completed, thereby completing the antenna contract.

Installation of the enclosure on the alidade platform of the 14.2-meter antenna was completed.

Lifting arm structures for the 12-meter and 45-foot antennas to be used in installing receivers were designed and fabricated in the shop.

Reflectors were specified and a purchase order issued for a new feed system on the 140-foot. Studies and design were started for the installation of these reflectors and the associated feeds and receivers on the 140-foot Cassegrain building.

A special cart to transport the new hydrogen maser system was designed and fabricated in the shop.

Design studies and research continued for the VLBA sites and antennas.

#### ELECTRONICS

##### Charlottesville

All 15-GHz and 1.5-GHz cooled FET amplifiers for the VLA, sixty of each, have been completed. Work will now begin on design of 0.327 and 8.3 GHz systems. The development of 22-25 GHz amplifiers has been suspended while waiting for better FET devices.

The development of mixers and multipliers for 200-360 GHz continues. Millimeter-wave development plans for the next year are as follows:

1. Finish 240-280 mixers for telescope.
2. Construct 90-115 GHz Schottky diode receiver.
3. Construct 115 GHz superconducting junction receiver.
4. Construct 330-360 GHz mixers.

The construction of a 12 Mb/s VLBI tape recording system and the VLA tape archives system continues. The image storage system is complete, and integration with the AIPS system has begun.

### Green Bank

Work is continuing on the development of several new receivers. The OMT-FET L-band front-end has been tested. System temperature, measured from the dewar input window to the IF output, is about 16 K across most of the band. Front-end box integration is well underway and telescope tests are scheduled in August. Construction and testing of the second channel of the 5-25 GHz upconverter-maser receiver is continuing. Vacuum integrity tests of an L, C, X band VLB receiver for Fort Davis are complete. Construction of the front-end is complete and wiring of the backend is 75% complete.

Design and construction of the interferometer RF and digital links continue. Preliminary tests of the signal from Green Bank to Monteville were in reasonably close agreement with the calculations. There should be sufficient signal-to-noise to operate in all conditions except very heavy rain.

Design and prototyping of a front-end data link is complete. Two complete systems are presently being integrated.

The RF and IF sections of the holographic surface measuring receiver have been completed and shipped to Tucson. The digital section prototyping is complete, and chassis wiring is nearing completion.

Design of the curved reflectors for the 140-foot 7.5-25 GHz beam splitter is complete, and the contract for manufacture has been let.

The hardware for the second digital continuum receiver is complete. Software for the device will be ready in August.

### Tucson

The  $\text{He}^3$  bolometer system has been used for routine observing during this quarter. The sensitivity, under good weather conditions, at 1.3 mm is 3-5 Jy in one second. We have some changes planned that should increase the sensitivity and these will be implemented during the shutdown period.

We were unable to use the 200-240 GHz cooled mixer receiver for astronomy during this quarter due to a very strong interfering signal leaking into the intermediate amplifiers. This signal apparently originates from a high-powered classified military radar. We have carefully shielded the vital components on the receiver, and initial tests on the telescope indicate that the problem is solved.

We are planning to measure the 12-meter surface using a satellite transmitter as the source for a holographic measurement. We have successfully tracked the satellite in preliminary observations, and we hope to measure the surface using this technique in the next month or so.

Socorro

Installation of the cryogenically cooled GaAsFET amplifiers for the 21-cm and 2-cm observing bands is continuing, with twenty-two antennas being completed by the end of the quarter.

The two unused B and D IF bands were successfully brought into operation doubling the instantaneous bandwidth of the VLA. This effectively halves the observing time needed to obtain a given sensitivity.

Support for several VLBI experiments was provided. A final local oscillator synthesizer was provided in the VLBI equipment rack so that future VLBI observations can be made without being affected by the observations of the rest of the VLA. The hydrogen maser clock and the Mark III recorder terminal were taken to the 12-meter telescope at Kitt Peak for a millimeter frequency VLBI experiment.

Tests with the prototype 327-MHz receivers on three antennas show that radio frequency interference generated by the digital and local oscillator systems on the VLA antennas themselves is a serious problem at this new observing frequency. The solution to the problem will probably require modifications to the antenna vertex room to improve its electrical screening.

## PERSONNEL

Rehires

Willem A. Baan	Visiting Assistant Scientist	06/01/83
Robert H. Sanders	Visiting Scientist	06/13/83

Retirement

Sebastian von Hoerner	Senior Scientist	06/30/83
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Terminations

Robert A. Laing	Research Associate	04/01/83
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## STUDENT PROGRAM

Announcement of the summer student program was sent to over 100 colleges and universities in November, 1982. From the applications received, 23 students were chosen to participate in the program as research assistants to the scientific staff and in the electronics and computer divisions in Charlottesville, Green Bank, and Socorro. A series of lectures is being given by the staff on various topics in radio astronomy and instrumentation. Students also attend the regular NRAO colloquia and seminars, and those from Charlottesville and Green Bank will each spend one week assisting in the Public Education Program of the Observatory.

APPENDIX A  
Colloquium Speakers - July 1982 - June 1983

<u>Name</u>	<u>Institution</u>
Aller, H.	Michigan
Baan, W.	Penn State
Baath, L.	Onsala
Backer, D.	Calif., Berkeley
Bally, J.	Bell Labs
<sup>1</sup> Bates, R.	Canterbury, New Zealand
<sup>1</sup> Begelman, M.	Colorado
Blitz, L.	Maryland
Burns, J.	New Mexico
Burke, B. F.	MIT
*Christiansen, W.	North Carolina
Cordes, J.	Cornell
Dennison, B.	VPI & SU
<sup>1</sup> Dressler, A.	Mt. Wilson & Las Campanas
Eilek, J.	NMIMT
<sup>1</sup> Elbert, J.	Utah
<sup>1</sup> Fienup, J.	ERIM
Fukui, Y.	Nagoya
<sup>1</sup> Gull, S.	Cambridge, U.K.
Hanbury-Brown, R.	Sydney
Hazard, C.	Pittsburgh
Heckman, T.	Maryland
<sup>1</sup> Kriss, G.	Michigan
Lovelace, R.	Cornell
Morrison, P.	MIT
McCammon, D.	Wisconsin
Puschell, J.	Calif., La Jolla
Quinn, P.	Caltech
Reif, K.	Bonn (Univ. of)
<sup>1</sup> Rodriguez, L.	UNAM, Mexico
Romney, J.	MPI, Bonn
Schwartz, P.	NRL
Scoville, N.	Massachusetts
Simon, R.	NRL
<sup>1</sup> Smith, H.	Texas
*Stembridge, C.	JPL
<sup>1</sup> Tarter, J.	NASA/Ames
Turner, E.	Princeton
Ulmer, M.	Northwestern
Valtonen, M.	Turku, Finland
Weisberg, J.	Princeton
<sup>1</sup> Welch, W. J.	Calif., Berkeley
White, R.	STSI
Wilson, T.	MPI, Bonn
*Winnberg, A.	Onsala
Wohlleben, R.	MPI, Bonn
Zuckerman, B.	Maryland

<sup>1</sup> NRAO Socorro

\* NRAO Charlottesville and Socorro