

NATIONAL RADIO ASTRONOMY OBSERVATORY
 Charlottesville, Virginia
 RADIO ASTRONOMY OBSERVATORY
 CHARLOTTESVILLE, VA.

APR 07 1984

Quarterly Report

April 1, 1984 - June 30, 1984

RESEARCH PROGRAMS

<u>140-foot Telescope</u>	<u>Hours</u>
Scheduled observing	1688.00
Scheduled maintenance and equipment changes	372.25
Scheduled tests and calibration	118.75
Time lost due to: equipment failure	30.00
power	4.75
weather	23.75
interference	0.75

The following continuum program was conducted during this quarter.

<u>No.</u>	<u>Observer</u>	<u>Program</u>
U15	J. Uson (Princeton) D. Wilkinson (Princeton)	Measurements at 19.5 GHz of the decrements in the cosmic microwave background toward several clusters of galaxies.

The following line programs were conducted during this quarter.

<u>No.</u>	<u>Observer</u>	<u>Program</u>
B405	R. Brown	Observations at 10 GHz to study the electron density in 3C 245.
B406	M. Bell (Herzberg) H. Matthews (Herzberg) T. Sears (Herzberg)	Observations at 8000 MHz in search of C ₆ H in TMCl.
B408	W. Batrla R. Gusten (MPIR, Bonn) C. Henkel (MPIR, Bonn)	Observations at 2 cm of H ₂ densities in condensations of the Taurus dark dust clouds and a search for CH ₃ C ₆ H and CH ₃ C ₅ N.
B417	R. Brown	Observations of Sgr A recombination lines at 5935 and 5990 MHz.

<u>No.</u>	<u>Observer</u>	<u>Program</u>
C217	F. Clark (Kentucky) S. Fulkerson (Centre College) S. Miller (Kentucky)	Observations of the 1.3 cm NH_3 transition to study the dynamics of clouds.
D137	L. DeNoyer (Colgate) J. Dodd (Colgate)	Observations of the galactic plane between $0^\circ < l < 90^\circ$ at 90 cm to determine rotation measures.
G270	R. Gusten (MPIR, Bonn) W. Batrla C. Henkel (MPIR, Bonn)	Observations at 13.7 and 14.5 GHz of the ratio of ^{12}C to ^{13}C and H_2 densities in the galactic center region.
H199	L. Higgs (DRAO, Canada) W. Batrla J. Vallee (Herzberg)	Recombination-line observations at 6 cm toward BG 2107+49.
L159	F. J. Lockman	A deep, systematic recombination-line survey at 3 cm of continuum sources in the galaxy.
L188	F. J. Lockman J. Dickey (Minnesota) L. Hobbs (Chicago) K. Jahoda (Wisconsin) D. McCammon (Wisconsin) C. Albert (Naval Academy)	Observations at 21 cm of high-latitude galactic HI.
M222	H. Matthews (Herzberg) P. Feldman (Herzberg) M. Bell (Herzberg)	Observations at 2.8 cm of CH_3CHO and HC_5N in the direction of Cas A.
P128	H. Payne Y. Terzian (Cornell)	Observations at 18 cm of OH in planetary nebulae.
R207	R. Rood (Virginia) T. Bania (Boston) T. Wilson (MPIR, Bonn)	Observations at 8700 MHz of the hyperfine transition of $^3\text{He}^+$ in several galactic HII regions and planetary nebulae.
T181	B. Turner	Observations at 1772 MHz to search for atomic sodium in dense molecular clouds.
W180	R. Willson (Tufts) B. Scheufele (Tufts) S. Federman (JPL)	Observations at 9 cm of CH in the direction of diffuse clouds.

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

A - Arecibo 1000 ft	N - NRL Maryland Point 85 ft
B - Effelsberg MPIR 100 m	O - Owens Valley 130 ft
F - Fort Davis 85 ft (HRAS)	P - Penticton, B.C. 85 ft
G - Green Bank 140 ft	Sn - Onsala 20 m
H - Hat Creek 85 ft	So - Onsala 25 m
Hr - Hartebeesthoek 26 m, S. Africa	Wn - Westerbork n = 1 - 14 x 26 m
I - Iowa 60 ft (North Liberty)	Yn - Socorro n = 1 - 27 x 25 m
Jb - Jodrell Bank MK II	X - Torun 15 m, Poland
Km - Haystack 120 ft	

<u>No.</u>	<u>Observer</u>	<u>Program</u>
B46V	J. Broderick (VPI & SU) A. Marscher (Boston)	Observations at 6 cm of the super-luminal, low-frequency, variable quasar NRAO 140, with telescopes B, F, G, H, Km, O, and Yn.
B52V	J. Biretta (Caltech) M. Cohen (Caltech) S. Unwin (Caltech)	Observations at 6 cm of the super-luminal radio sources 3C 273, 3C 279, and 3C 345, with telescopes A, B, F, G, H, I, Km, O, Sn, and Yn.
B54V	D. Backer (Berkeley) R. Sramek	Observations at 6 cm of compact sources near Sgr A, with telescopes F, G, H, and Yn.
B56V	N. Bartel (CFA)	Observations at 18 cm of SN 1979c, with telescopes B, G, O, and Yn.
D4V	P. Diamond (Chalmers) D. Robson (Manchester)	Observations at 6 cm of the "flip-flop" radio galaxy 3C 133, with telescopes B, G, Km, O, Wn, and Yn.
G41V	M. Gorenstein (CFA) C. Bennett (MIT) R. Bonometti (MIT) B. Burke (MIT) J. Hewitt (MIT) C. Lawrence (Caltech) J. Marcaide (MPIR, Bonn) I. Shapiro (CFA)	Observations at 18 cm of 2016+112A, B, C, with telescopes A, B, F, G, Km, O, and Yn.
K15V	H. Kuhr (Arizona) A. Eckart (MPIR, Bonn) P. Strittmatter (Arizona) A. Witzel (MPIR, Bonn)	Observations at 6 cm of 0014+81--a gravitations lens--with telescopes B, G, Jb, O, Sn, Wn, and X.
M53V	A. Marscher (Boston) N. Bartel (CFA) J. Broderick (VPI & SU) L. Padrielli (Bologna) J. Romney	Observations at 18 cm of the low-frequency variable NRAO 140, with telescopes B, F, G, H, I, Km, O, and Yn.

<u>No.</u>	<u>Observer</u>	<u>Program</u>
P48V	L. Padrielli (Bologna) R. Fanti (Bologna) A. Ficarra (Bologna) F. Mantovani (Bologna) I. Browne (Manchester) J. Romney	Observations at 18 cm of the steep spectrum source 1524-136, with telescopes B, F, G, Jb, Km, O, So, and Wn.
P54V	R. Porcas (MPIR, Bonn) I. Pauliny-Toth (MPIR, Bonn) G. Nicolson (Hartebeesthoek, Africa) K. Kellermann	Observations at 6 and 18 cm of PKS 2134+004, with telescopes B, F, G, H, Hr, Km, and O.
P55V	R. Porcas (MPIR, Bonn) F. Owen	Observations at 6 cm of very weak quasar cores, with telescopes B, G, and Yn.
P58V	T. Pearson (Caltech) A. Readhead (Caltech)	Second-epoch observations at 6 cm of a complete sample of 20 sources, with telescopes B, F, G, H, I, Km, O, and Yn.
R29V	R. Rusk (Toronto) E. Seaquist (Toronto) J. Yen (Toronto)	Observations at 2.8 and 18 cm of highly polarized, compact radio sources, with telescopes B, F, G, H, I, Km, O, P, and Yn.
S35V	R. Schilizzi (NFRA) G. Miley (Leiden) P. Barthel (Leiden)	Observations at 18 cm of 3C 236, with telescopes of the European Network, Merlin, A, F, G, H, I, Km, O, N, and Yn.
S36V	R. Spencer (Manchester) M. Reid (CFA)	Observations at 18 cm of 3C 274, with telescopes of the European Network, Merlin, A, F, G, H, I, Km, O, and Yn.
W23V	R. C. Walker J. Benson G. Seielstad S. Unwin (Caltech)	Monitor 3C 120 at 6 cm, with telescopes A, B, F, G, H, I, Km, O, Sn, and Yn.
W26V	P. Wilkinson A. Kus (Torun Obs., Poland) T. Pearson (Caltech) A. Readhead (Caltech) R. Simon (NRL) M. Chown (Caltech)	Detailed mapping at 6 cm of the interacting QSO system 3C 48, with telescopes A, B, F, G, I, Jb, Km, O, Sn, and Wn.

<u>No.</u>	<u>Observer</u>	<u>Program</u>
W30V	P. Wilkinson A. Readhead (Caltech) R. Simon (NRL) M. Chown (Caltech)	Observations at 18 cm of 3C 48, with telescopes of the European Network, Merlin, A, F, G, H, I, Km, O, and Yn.
W31	R. C. Walker S. Unwin (Caltech) J. Benson G. Seielstad R. Booth (Chalmers)	Observations at 18 cm of the 3C 120 jet with telescopes of the European Network, Merlin, A, F, G, H, I, Km, O, and Yn.
X24V	N. Bartel (CFA)	Observations at 6 cm of the supernova SN 1979c, with telescopes B, G, O, and Yn.

<u>300-foot Telescope</u>	<u>Hours</u>
Scheduled observing	1935.50
Scheduled maintenance and equipment changes	234.50
Scheduled tests and calibration	6.00
Time lost due to: equipment failure	26.50
power	3.75
weather	0.50
interference	0.00

The following continuum programs were conducted during this quarter.

<u>No.</u>	<u>Observer</u>	<u>Program</u>
A59	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.
B412	B. Burke (MIT) J. Hewitt (MIT) G. Langston (MIT) J. Mahoney (MIT)	Observations at 6 cm to continue the MIT-Green Bank survey at $\delta = 20^\circ < \delta < 45^\circ$.
B415	J. Broderick (VPI & SU) D. Altschuler (Puerto Rico) B. Dennison (VPI & SU) K. Mitchell (VPI & SU) S. O'Dell (VPI & SU) J. Condon H. Payne	Monitor of low-frequency variable sources at 611, 800 and 1400 MHz.

<u>No.</u>	<u>Observer</u>	<u>Program</u>
D138	G. Dulk (Colorado) T. Bastian (Colorado)	Observations of the quiet sun at 1415 MHz in conjunction with the VLA and an EUV rocket.
032	C. O'Dea T. Balonek (Williams College) W. Dent (Massachusetts) W. Kinzel (Massachusetts)	Polarization and flux-density measurements of variable sources at 2695 MHz.
033	S. Odenwald (NRL)	Observations at 5000 MHz to study a sample of 40 sources that have been identified by the Far Infrared Sky Survey experiment.

The following line programs were conducted during this quarter.

<u>No.</u>	<u>Observer</u>	<u>Program</u>
B409	W. Baan (Arecibo) A. Haschick (Haystack) J. Schmelz (Penn State)	Observations at 18 cm of OH absorption and anomalous emission in galaxies with strong continuum sources.
L188	F. J. Lockman C. Albert (Naval Academy) J. Dickey (Minnesota) L. Hobbs (Chicago) K. Jahoda (Wisconsin) D. McCammon (Wisconsin)	Observations at 21 cm of high-latitude galactic HI.
T180	B. Turner L. Ziurys (Berkeley)	Search over the range 700-725 MHz for the $\pi_{3/2}$, $J = 3/2$ multiplet of CH.
T183	W. Tifft (Arizona) W. Cocke (Arizona)	Observations at 21 cm of redshift periodicities in single and double galaxies.

The following pulsar program was conducted during this quarter.

<u>No.</u>	<u>Observer</u>	<u>Program</u>
T178	J. Taylor (Princeton) R. Dewey (Princeton) G. Stokes (Princeton) J. Weisberg (Princeton)	Continuation of the northern hemisphere pulsar survey at 390 MHz.

Very Large Array

The quarter was scheduled 100% of the time.

Astronomical	1,676.3 hours	(76.7%)
Scheduled Maintenance	261.7 hours	(12.0%)
Scheduled Test/Calibration	246.0 hours	(11.3%)

The average downtime was 5.88%.

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

<u>No.</u>	<u>Observer</u>	<u>Program</u>
AA29	D. Abbott (Colorado) J. Bieging (California) E. Churchwell (Wisconsin)	A distance-limited survey of a complete sample of OB stars. 6 cm.
AA30	H. Aller (Michigan) S. Reynolds	Mapping and polarimetry of 3C 58. 6 and 20 cm.
AA32	P. Alexander (Cambridge, UK) P. Scott (Cambridge, UK) G. Pooley (Cambridge, UK)	A search for evidence for possible re-acceleration in radio lobes. 6 cm.
AA33	R. Allen (Groningen) P. Atherton (Groningen) R. Tilanus (Groningen)	Star-formation regions in M83. 21-cm line.
AA34	D. Axon (Manchester) S. Unger (Manchester) A. Pedlar (Manchester)	The newly discovered Seyfert galaxy NGC 5252. 6 and 20 cm.
AB129	B. Burke (MIT) J. Hewitt (MIT) D. Roberts (Brandeis)	Monitoring time variations in 0957+561. 2 and 6 cm.
AB182	J. Burns (New Mexico) T. Balonek (Williams College) E. Hummel (MPIR, Bonn)	Monitoring the cores of extended radio sources and spiral galaxies. 2, 6, and 21 cm.
AB223	A. Bosma (Obs. Marseille) E. Athanassoula (Obs. Marseille)	The Sc galaxy NGC 2090. 21-cm line.
AB253	V. Boriakoff (NAIC) R. Buccheri (IFCI, Italy) F. Fauci (Palermo, Italy)	Structure search around the milli-second binary pulsar P1953+29. 18 and 20 cm.
AB255	M. Begelman (Colorado) J. Burns (New Mexico) F. Owen	Candidate magnetically confined jets. 6 cm.

<u>No.</u>	<u>Observer</u>	<u>Program</u>
AB257	J. Burns (New Mexico) D. Clarke (New Mexico) E. Feigelson (Penn State) E. Schreier (STSI)	The jet in Centaurus A. 2, 6, and 18 cm.
AB264	M. Bode (LANL) E. Seaquist (Toronto) W. Friedhorsky (LANL) A. Evans (Keele, UK)	Radio survey of classical novae. 6 cm.
AB271	R. Becker (VPI & SU) D. Helfand (Columbia) J. Pye (Leicester, UK) A. Smith (Leicester, UK)	Multi-frequency observations of galactic SNR. 20 cm.
AB275	C. Beichman (JPL) G. Wynn-Williams (Hawaii) E. Becklin (Hawaii) E. Neugebauer (Caltech) J. Houck (Cornell) C. Persson (JPL)	Observations of IRAS galaxies. 2, 6, and 20 cm.
AB276	C. Bennett (MIT) C. Lawrence (Caltech) J. Hewitt (MIT) B. Burke (MIT) E. Turner (Princeton)	Variability monitoring of the new gravitational lens 2016+112. 2 and 6 cm.
AB277	I. Browne (Caltech) D. Shone (Manchester) D. Walsh (Manchester) L. Rudnick (Minnesota)	Extended structure associated with the jet in 0800+608. 20 cm.
AB281	J. Basart (Iowa State) M. Andrews (Iowa State) R. Lamb (Iowa State)	Loop structure in W28. 6 cm.
AB282	C. Benn (Leiden) J. Wall (Royal Greenwich Obs.) G. Grueff (Bologna) M. Vigotti (Bologna)	Observations of further 5C 12 sources. 6 cm.
AB283	B. Burke (MIT) G. Langston (MIT)	A study of extended radio sources from the MG survey. 6 and 20 cm.
AB284	W. Baan (Arecibo) A. Haschick (Haystack) J. Jackson (MIT)	Water vapour in N3690. 1.3-cm line.

<u>No.</u>	<u>Observer</u>	<u>Program</u>
AB285	A. Bosma (Marseille Obs.) E. Athanassoula (Marseille Obs.) J. Boulesteix (Marseille Obs.) M. Duval (Marseille Obs.) Y. Georgelin (Marseille Obs.) M. Marcelin (Marseille Obs.) G. Monnet (Marseille Obs.)	A 21-cm line study of the barred spiral galaxy NGC 3351. 21-cm line.
AB286	A. Brown (Colorado) R. Mundt (MPI, Heidelberg) S. Drake (Colorado) F. Walter (Colorado)	Jets in star-formation regions. 6 cm.
AB287	S. Baum (Maryland) R. Elston (Arizona) R. Hjellming B. Jannuzi (Harvard) E. Nelson (New Mexico) H. Greidanus (Leiden)	Spectral index and depolarization information on selected filaments in W50. 20 cm.
AB288	J. Bookbinder (Harvard) J. Schmitt (Harvard) L. Golub (CFA)	Search for quiescent radio emission from M dwarfs with detected X-ray emission. 6 cm.
AC99	C. Carignan (Groningen) K. Freeman (Mt. Stromlo)	Mass distribution in the dwarf irregular DDO 155. 20-cm line.
AC102	S. Catalano (Catania U., Italy) M. Rodono (Catania U., Italy) D. Gibson (Colorado/NMIMT)	The coronae of active late-type giants. 2 cm.
AC103	W. Christiansen (North Carolina) C. Foltz (Illinois) R. Williams (ESO, FRG)	Search for radio emission from elliptical galaxies with shells. 6 and 20 cm.
AC104	T. Cornwell W. van Breugel (Berkeley) R. Ekers L. Smarr (Illinois)	Radio emission from the dB system NGC 4782/NGC 4783. 6 cm.
AC105	R. Cameron (Mt. Stromlo) G. Bicknell (Mt. Stromlo) R. Ekers	Jet radio sources in southern clusters; 0449-17. 6, 18, and 20 cm.
AD94	I. de Pater (Berkeley) K. Weiler (NSF) R. Fanti (Bologna) C. Fanti (Bologna)	Polarization characteristics in variable radio sources. 2, 6, and 20 cm.

<u>No.</u>	<u>Observer</u>	<u>Program</u>
AD114	G. Dulk (Colorado) T. Bastian (Colorado) O. Slee (CSIRO)	Flare stars in stellar clusters. 6 and 20 cm.
AD122	R. Davies (Jodrell Bank) A. Rots P. Appleton (Manchester) T. Kinman (KPNO)	Neutral hydrogen in dwarf galaxies. 21-cm line.
AD129	J. Dreher (MIT) K. Johnston (NRL) W. Welch (Berkeley)	W49. 6 and 20 cm.
AD133	H. Dickel (Illinois) W. M. Goss A. Rots	Two centimeter formaldehyde toward W49A. 2-cm line.
AD135	S. Drake (Colorado) T. Simon (Hawaii) J. Linsky (Colorado)	Survey of barium stars and related systems. 6 cm.
AD136	G. Dulk (Colorado) T. Bastian (Colorado) G. Rottman (Colorado) F. Orrall (Hawaii)	Solar transition region and corona. 6 and 20 cm.
AD137	A. Dupree (CFA) B. Burke (MIT) J. Hewitt (MIT)	Vela X-1. 6 and 18 cm.
AD138	V. Dhawan (MIT) B. Burke (MIT) J. Hewitt (MIT)	Wide separation double sources. 6 cm.
AE30	R. Elston (Arizona)	Three interacting galaxies with extended radio emission. 20 cm.
AE32	R. Ekers W. M. Goss J. van Gorkom U. Schwarz (Groningen)	Sgr A. 20 cm.
AF74	L. Feretti (Bologna) G. Giovannini (Bologna) L. Gregorini (Bologna)	The new, wide angle, tail galaxy in A115. 20 cm.
AF78	C. Fanti (Bologna) R. Fanti (Bologna) P. Parma (Bologna) H. de Ruiter (Bologna)	Extended low luminosity B2 radio galaxies. 20 cm.

<u>No.</u>	<u>Observer</u>	<u>Program</u>
AF79	L. Feretti (LBologna) G. Giovannini (Bologna) L. Gregorini (Bologna) L. Padrielli (Bologna)	3C 28. 6 cm.
AF80	J. Forster (CSIRO) J. Caswell (DRAO/CSIRO)	Positions of H ₂ O masers (for comparison with OH). 1.3-cm line.
AF82	M. Fich (Washington)	Galactic plane continuum sources. 2 and 6 cm.
AF83	M. Fich (Washington) D. van Buren (Colorado)	HI shells around HII regions. 21-cm line.
AG116	D. Gibson (Colorado) W. Friedhorsky (LANL)	A search for 300-day periodicity in Cyg X-1. 2, 6, and 20 cm.
AG141	S. Gottesman (Florida) J. Ball (Florida) J. Hunter (Florida) J. Huntley (Bell Labs)	HI observations of the barred spiral NGC 1073. 21-cm line.
AG142	I. Gioia (CFA) T. Maccacaro (CFA) D. Maccagni (IFC Milan) J. Stocke (Arizona)	A complete sample of X-ray selected BL Lacs. 1.3, 2, 6, and 20 cm.
AG145	B. Geldzahler (NRL) P. Schwartz (NRL)	Simultaneous multifrequency observations of blazars. 1.3, 2, 6, and 20 cm.
AG146	D. Green (MRAO, UK) S. Gull (MRAO, UK)	A search for young galactic supernova remnants. 6 cm.
AG148	D. Gary (Caltech) G. Hurford (Caltech) H. Zirin (Caltech)	Solar observations during the partial eclipse of 30 May 1984. 1.3, 2, 6, and 20 cm.
AG151	A. Gower (Victoria) J. Hutchings (DAO)	Low redshift quasars. 20 cm.
AG154	R. Gaume (Iowa) R. Mutel (Iowa)	An investigation of OH emission toward star-formation regions. 2 cm.
AG155	R. Gaume (Iowa) R. Mutel (Iowa)	An investigation of the 1720 MHz hydroxyl emission toward four supernova remnants. 18 and 2-cm line.
AH134	L. Higgs (DRAO) T. Landecker (DRAO)	Spectral-index mapping of gamma-Cygni nebula. 6 cm.

<u>No.</u>	<u>Observer</u>	<u>Program</u>
AH151	P. Ho (Harvard) A. Haschick (Haystack) R. Klein (Berkeley)	Low-level continuum emission associated with OB clusters. 6 and 20 cm.
AH152	E. Hummel (MPIR, Bonn) W. Keel (KPNO)	The active central region of the spiral galaxy NGC 2655. 6 and 20 cm.
AH153	E. Hummel (MPIR, Bonn) C. Kotanyi	The central radio sources in NGC 4636 and NGC 4710. 6 cm.
AH156	A. Haschick (Haystack) W. Baan (Arecibo)	HI absorption in quasar/galaxy pairs. 21-cm line.
AH157	J. Hewitt (MIT) B. Burke (MIT)	Radio emission associated with optically discovered gravitational lens systems. 6 cm.
AH158	P. Ho (CFA) L. Rodriguez (Mexico) J. Canto (Mexico) J. Torrelles (Mexico)	Ammonia study of the small, dense condensations associated with the outflow in Cepheus A. 1.3 line and 1.3, 2.6.
AH159	P. Ho (Harvard) J. Turner (Berkeley)	Possible jets in the nucleus of M81 (NGC 3031). 2 cm.
AH161	G. Helou (Caltech) E. Salpeter (Cornell) G. Hoffman (Lafayette College)	HI mapping of a dwarf irregular galaxy. 21-cm line.
AJ87	D. Johnson (Battelle) S. Gottesman (Florida)	Neutral-hydrogen observations of dwarf elliptical NGC 205. 21-cm line.
AJ101	W. Jaffe (STSI) T. Owen (SUNY) J. Caldwell (SUNY)	Thermal radiation from Titan. 2 cm.
AJ102	W. Jaegers (Leiden) H. van der Laan (Leiden) R. Sanders (Groningen) A. Bridle E. Fomalont	The 3C 120 sources. 6 cm.
AJ104	K. Johnston (NRL) D. Florkowski (USNO) C. Wade G. Gatewood (Pittsburgh) C. de Vegt (Hamburger Stern., FRG) M. Shao (NRL)	Precise optical/radio positions of the stars Algol, HR1099, and UX Ari.
AJ105	N. Jeske (Berkeley) M. Davis (Berkeley) M. Stevens (Berkeley)	Mapping ring galaxies. 2 cm.

<u>No.</u>	<u>Observer</u>	<u>Program</u>
AJ106	N. Jeske (Berkeley) M. Davis (Berkeley) M. Stevens (Berkeley)	A survey of ring galaxies. 20 cm.
AJ108	W. Jaffe (STSI) G. Gavazzi (Milan) E. Valentijn (ESO, FRG)	Coma supercluster survey. 20 cm.
AJ110	N. Jeske (Berkeley) C. Heiles (Berkeley)	HI mapping of supershells in NGC 7741. 21-cm line.
AJ111	K. Johnston (NRL) S. Odenwald (NRL) H. Kuhr (Arizona)	Extended emission in 58 extragalactic radio sources. 6 cm.
AK101	U. Klein (MPIR, Bonn)	Radio morphology of blue compact dwarf galaxies. 6 and 20 cm.
AK102	M. Kundu (Maryland) E. Schmahl (Maryland) R. Shevgaonkar (Maryland)	Solar filaments. 2, 6, and 20 cm.
AK104	M. Kutner (RPI) K. Mead (RPI) N. Evans (Texas)	HII regions in outer galaxy molecular clouds. 20 cm.
AL80	K. Lang (Tufts) R. Willson (Tufts)	High-energy solar jets. 2 cm.
AL83	H. Liszt W. B. Burton (Leiden)	Survey of the galactic center outside Sgr A. 20 cm.
AM117	H. Marshall (STSI)	A complete sample of optically selected quasars. 6 and 20 cm.
AM118	K. Mitchell (VPI & SU) L. Takalo (Penn State)	Variability of faint radio quasars. 20 cm.
AM119	L. Molnar (Harvard) M. Reid (CFA) J. Grindlay (CFA)	Radio period of Cygnus X-3. 1.3, 2, 6, and 20 cm.
AM120	K. Mitchell (VPI & SU) J. Condon	A second deep survey at 1465 MHz. 20 cm.
AN25	L. Noreau (Toronto) P. Kronberg (Toronto) F. Bertola (Padua, Italy) G. Galletta (Padua, Italy) D. Bettoni (Padua, Italy)	HI observations of NGC 3432. 20-cm line.

<u>No.</u>	<u>Observer</u>	<u>Program</u>
AN26	A. Nash (Wisconsin) E. Churchwell (Wisconsin)	Absorption of OH (H_2CO and NH_3) toward extragalactic sources. 1.3, 6, and 18-cm line.
A033	M. Ondrechen (Minnesota) J. van der Hulst (NFRA)	Barred spiral galaxy NGC 1097. 6 cm.
A044	S. Odenwald (NRL) K. Johnston (NRL) H. Smith (NRL) P. Schwartz (NRL)	Survey of far infrared sources near the galactic center. 6 and 20 cm.
A047	C. O'Dea F. Owen	Constraints on the properties of bent beams. 6 cm.
AO-48	F. Owen J. Burns (New Mexico) R. White (Computer Sci. Corp.)	Abell clusters of galaxies. 20 cm.
AP71	R. Perley J. Dreher (MIT)	Cygnus A. 6 cm.
AP73	A. Pedlar (Manchester) R. Davies (Manchester) R. Perley P. Crane	Extended structure in NGC 1275. 20 cm.
AP76	S. Pottasch (Groningen) R. C. Bignell	Identification of IRAS sources in two selected regions close to the galactic plane. 6 cm.
AP77	A. Patnaik (TIFR) C. Subrahmanya (TIFR) D. Banhatti (TIFR)	Further observations of seven extragalactic radio sources. 6 cm.
AP79	L. Padrielli (Bologna) A. Rogora (Bologna) H. de Ruiter (Bologna)	A complete sample of quasars selected from the B2 catalogue. 6 cm.
AP80	P. Palmer (Chicago) R. Rubin (NASA Ames/UCLA)	He and H-line observations of K3-50A. 2-cm line.
AP81	P. Palmer (Chicago) F. Gardner (CSIRO) J. Whiteoak (CSIRO)	Excited state OH. 6-cm line.

<u>No.</u>	<u>Observer</u>	<u>Program</u>
AP82	P. Palmer (Chicago) D. Matsakis (USNO) C. Townes (Berkeley) A. Hjalmarson (Onsala) A. Cheung (Calif., Davis) J. van Gorkom	OH absorption in DR21. 18-cm line.
AP83	P. Palmer (Chicago) R. Rubin (NASA Ames)	Formamide in the galactic center. 19-cm line.
AR97	L. Rodriguez (Mexico) J. Garcia-Barreto (Mexico) N. Calvet (CIDA, Venezuela) G. Garay (Chile)	The optically obscured cores of the young planetary nebulae NGC 6302 and NGC 7027. 2-cm line.
AR104	T. Rengarajan (CFA/TIFR, India) P. Ho (CFA)	OB clusters in luminous far-IR complexes. 2 and 6 cm.
AR105	D. Retallack W. M. Goss	HI absorption in the direction of Orion A. 21-cm line.
AR106	P. Roelfsema (Groningen) W. M. Goss D. Retallack	Radio recombination-line observations of W3. 2-cm line.
AR107	P. Roelfsema (Groningen) W. M. Goss R. C. Bignell	Recombination lines in planetary NGC 7027. 2-cm line.
AR108	L. Rudnick (Minnesota) J. Pedelty (Minnesota)	Search for electron scattering around 3C 295. 6 cm.
AR109	L. Rudnick (Minnesota)	The double axis (?) in 4C 39.11. 6 cm.
AS79	S. Spangler (Iowa) W. Cotton S. Allendorf (Iowa)	Monitoring low-frequency variables. 1.3, 2, 6, and 20 cm.
AS80	R. Sramek J. van der Hulst (NFRA) K. Weiler (NSF)	Monitoring SN 1980k in NGC 6946 and 1979c in M100. 6 and 20 cm.
AS188	M. Simon (SUNY, Stony Brook) J. Fischer (NRL)	Star formation in galaxies with high IR emission. 6 cm.
AS189	R. Strom (NFRA)	The flat spectrum component in CTB 80. 2 and 6 cm.
AS191	S. Spangler (Iowa) S. Myers (Iowa) J. Pogge (Iowa)	Radio galaxies 3C 166 and 3C 411. 2 cm.

<u>No.</u>	<u>Observer</u>	<u>Program</u>
AS192	P. Schwartz (NRL) K. Shivanandan (NRL) C. Albert (USNA)	FIRSSE and IRAS galactic sources. 6 and 20 cm.
AS193	W. Sanders (New Mexico State) R. Sramek E. Fomalont	Search for radio emission from Hyades cluster members. 6 cm.
AS195	E. Skillman (Washington) B. Balick (Leiden)	Hubble V. 6 cm.
AS196	E. Skillman (Washington) S. Anderson (Washington) B. Margon (Washington)	The trivariate luminosity function for faint optically selected QSOs. 6 cm.
AS197	E. Skillman (Washington) P. Hodge (Washington)	NGC 3239. The genesis of a spiral arm? 21-cm line.
AS198	D. Stinebring R. Ekers D. Retallack	Search for galactic variables. 20 cm.
AS200	S. Simkin (Michigan State) H. Su (Purple Mountain) J. van Gorkom	HI observations of Seyferts of different morphological type: MK 348. 21-cm line.
AT47	A. Taylor (Toronto) E. Seaquist (Toronto)	Neutral-hydrogen mapping of the peculiar edge-on galaxy NGC 3079. 21-cm line.
AT49	T. Thuan (Virginia) H. Loose (Göttingen)	HI distribution and kinematics of blue, compact dwarf galaxies: MK 71. 21-cm line.
AT51	A. Taylor (Toronto) E. Seaquist (Toronto)	A deep radio survey in the galactic plane. 21-cm line.
AT52	A. Taylor (Toronto) E. Seaquist (Toronto)	HI absorption distances for galactic plane radio variables. 21-cm line.
AU17	S. Unger (NRAL, UK) A. Pedlar (NRAL, UK)	The SO galaxy NGC 1218 (3C 78). 20 cm.
AV88	W. van Breugel (Berkeley) T. Foley (Leiden) G. Miley (STSI/Leiden) T. Heckman (Maryland) M. Ulrich (ESO, FRG)	Equatorial survey of radio galaxies. 20 cm.

<u>No.</u>	<u>Observer</u>	<u>Program</u>
AV91	W. van Breugel (Berkeley) P. Barthel (Leiden) W. Jagers (Leiden)	The giant quasar 4C 34.47. 20 cm.
AV95	P. Vanden Bout (Texas)	Formaldehyde observations of the S88 molecular cloud. 6-cm line.
AV96	J. van der Hulst (NFRA) R. Sramek K. Weiler (NSF)	Monitoring radio supernova in NGC 4258. 6 and 20 cm.
AV99	J. Vallee (Herzberg) L. Higgs (DRAO)	Sharpless 121. 6 and 20 cm.
AV102	W. van Breugel (Berkeley) T. Heckman (Maryland) G. Miley (Leiden) M. Ulrich (ESO, FRG)	Minkowski's object (working surface of a jet?). 6 and 20 cm.
AV103	J. van Gorkom G. Miley (Leiden) T. Heckman (Maryland) B. Balick (Leiden) W. van Breugel (Berkeley)	Search for redshifted CO absorption in 2000-330. 1.3-cm line.
AV104	T. Velusamy (TIFR)	The "jet" in the Crab nebula. 6 cm.
AV105	J. van Gorkom G. Hunt A. Patnaik (TIFR) C. Salter P. Shaver (ESO, FRG)	Six nonthermal galactic radio sources. 2, 6, and 20 cm.
AV106	G. van Moorsel	HI in galaxy pairs: NGC 3718. 20-cm line.
AV108	W. van Breugel (Berkeley) J. Dickel (Illinois) R. Strom (NFRA)	Tycho's SNR. 6, 18, and 20 cm.
AV109	T. Velusamy (TIFR)	Small diameter sources within CTB 80. 6 and 20 cm.
AW78	J. Wardle (Brandeis) R. Laing (Royal Greenwich Obs.)	Monitoring the central components of extended radio sources. 2 and 6 cm.
AW92	R. C. Walker J. Benson	The jet in 3C 120. 2 and 6 cm.

<u>No.</u>	<u>Observer</u>	<u>Program</u>
AW101	P. Wilkinson T. Cornwell	Polarization and spectral study of the peculiar radio structure in QSO 1828+48 (3C 380). 2 and 6 cm.
AW104	D. Weedman (Penn State) C. Lonsdale (Penn State) R. Sramek	Quasar survey fields. 20 cm.
AW105	R. Warwick (Leicester, UK) V. Stanger (Leicester, UK) J. Schwarz (CFA)	Early-type galaxies NGC 4636 and NGC 4649. 6 and 20 cm.
AW106	B. Williams R. Brown	HI observations of the double galaxy UGC 6081. 21-cm line.
AW107	A. Wootten F. Bruhweiler (Catholic U.) R. Clegg (University College)	Neutral circum-nebular gas in planetaries. 21-cm line.
AW109	R. Willson (Tufts)	X-ray clusters of galaxies. 2 and 6 cm.
AW110	A. Wilkinson C. Kotanyi I. Browne (Caltech)	Elliptical galaxies with shells. 20 cm.
AW111	W. Webster (Goddard) R. Hobbs (CTA, Inc.) P. Lowman (Goddard)	Asteroid 704 Interamnia. 2 cm.
AW112	C. Wynn-Williams (Hawaii) C. Impey (Caltech) E. Becklin (Hawaii)	Survey of ellipticals with nonstellar infrared emission. 6 cm.
VAH27	N. Bartel (MIT)	SN 1979c. 6 cm.

12-Meter TelescopeHours

Scheduled observing	1824.35
Scheduled maintenance and equipment changes	98.50
Scheduled tests and calibration	261.25
Time lost due to: equipment	81.00
weather	166.50
power	0.00
interference	0.00

The following line programs were conducted during this quarter.

<u>No.</u>	<u>Observer</u>	<u>Program</u>
A70	L. Avery (Herzberg) G. White (Queen Mary)	Study of high-velocity outflows in dark clouds at 1 mm.
B399	L. Blitz (Maryland) R. Mathieu (Calif., Berkeley)	Study of CO in 2-1 emission from sources in M31 and M33.
B400	T. Bania (Boston) K. Janes (Boston)	Study of CO associated with distant star clusters.
B411	A. Barrett (MIT) J. Jackson (MIT) P. Ho (Harvard)	A survey of CO in star-burst galaxies.
B414	W. Baan (Arecibo) R. Freund A. Haschick (Haystack)	Search for CO in IC 4553, NGC 2623, NGC 3810, and NGC 6240 at 1.2 mm.
D133	W. Dent (Massachusetts) T. Balonek (Williams College) R. Hobbs (Computer Technology)	Evolution of extragalactic radio sources at millimeter wavelengths.
E44	R. Edelson (Caltech)	Flux measurements of Seyfert galaxies at 1.2 mm.
F87	Y. Fukui (Nagoyua) E. Churchwell (Wisconsin)	Mapping negative velocity molecular emission in CO and CN.
G273	J. Gallagher (KPNO) D. Hunter (KPNO)	CO observations of irregular galaxies.
H194	P. Ho (Harvard) R. Martin (IRAM) T. Armstrong (MIT)	Observations at 1 mm of nearby spiral galaxies.
H0L0	J. Payne E. Stobie A. Lasenby	Holographic measurement of the 12-m antenna surface.
J106	J. Jackson (MIT) A. Barrett (MIT)	Study of HNC0 in molecular clouds.
J108	M. Jura (UCLA) B. Zuckerman (UCLA)	Measurement of mass loss rates in late-type stars.
K285	M. Kutner (Rensselaer) K. Mead (Rensselaer)	High-resolution measurements of selected clouds in the galaxy.

<u>No.</u>	<u>Observer</u>	<u>Program</u>
K288	G. Knapp (Princeton)	Measurement of C^{12} - C^{13} ratios in atmospheres of α CETI and α ORI.
L181	C. Lada (Arizona)	Study of dynamical and spatial structure of energetic molecular outflows.
M194	I. Mirabel (Puerto Rico)	Search for CO in galaxies with strong compact radio sources.
M215	P. Myers (MIT) M. Reid (CFA) J. Moran (CFA)	Measurement of 1-mm flux from Vega.
M226	L. Molnar (CFA) M. Reid (CFA) J. Moran (CFA)	Coordinated observations of Cygnus X-3.
S241	S. Allendorf (Iowa) W. Cotton S. Spangler (Iowa)	Multi-frequency observations of low-frequency variable sources.
S268	P. Schwartz (NRL)	Measurement of the ratio of CO column density to 1-mm opacity.
S272	T. Seimle (Rice) B. Turner	Search for interstellar magnesium oxide.
T170	H. Smith (NRL) H. Thronson (Wyoming)	Structure and excitation of the star-forming regions W3A, AFGL 2591, and S209.
T173	B. Turner	Search for vibrationally excited diacetylene at 3 mm.
T184	H. Thronson (Wyoming)	Chemical and thermal structure at HII/H ₂ boundaries.
U17	B. Ulich (Arizona) I. de Pater (Arizona) J. Payne J. Davis (unaffiliated)	Study of molecular absorbers in the planetary atmosphere.
W176	H. A. Wootten	Study of gas outflows near star-forming regions.
W178	H. A. Wootten	Observations of the 3-2 HCO ⁺ line in molecular outflow regions.
W181	P. Wannier (Caltech) R. Sahai (Caltech)	Study of mass-loss from M-type stars.

<u>No.</u>	<u>Observer</u>	<u>Program</u>
W183	H. A. Wootten R. Clegg (Texas)	Accurate temperature profiles and mass loss rates in evolved stars.

ELECTRONICS DIVISION

Charlottesville

The prototype 8.4-GHz, VLBA front-end has been completed and system tests have begun. A receiver noise-temperature of 29 K and a cool-down time of 12 hours have been measured. Reports on the front-end and amplifier design are being prepared.

A cryostat, utilizing a closed-cycle 15 K refrigerator to decrease helium boil-off rate on a 3 K cooling station, has been completed. A helium hold time of greater than one week for 7 liters of helium is expected. This cryostat will be used to cool a superconducting junction, 115 GHz receiver for the Tucson 12-meter telescope. One prototype mixer for this receiver has given < 50 K SSB mixer noise temperature with conversion gain into a 50 ohm IF load impedance; however, the IF bandwidth is narrow (< 50 MHz).

The construction of several 12 Mb/s prototype VLBA cassette recorder systems has been started.

Green Bank

Spectral processor design continued. Specifications in finer detail were set in the areas of the FT pipeline, polarimeter, dedisperser, averaging and RFI excision. Mixer and FFT butterfly component evaluations continued.

The MASSCOMP computer and peripherals for the 300-foot control system were ordered. Studies continued on telescope and receiver control and monitoring requirements and their impacts on software.

The third L-band feed for 1.30-1.36 GHz was fabricated and will be tested early next quarter.

Assembly of the 2-5 GHz receiver reached about 60% of completion. Optimal 3-GHz FET devices were found and development of 2-stage amplifiers began. Work on design and preliminary assembly of the 6-cm, 7-feed receiver continued.

Recabling the 45-foot remote telescope and long delivery of a replacement TWT delayed converting the Huntersville link of the USNO interferometer from L-band to 17 GHz until next quarter. The design study to replace the interferometer control computer with a MASSCOMP was completed.

Fabrication and design of the 7.6-25 GHz polarization splitter and design of the 4.7-7.2 GHz polarization splitter for the 140-foot Cassegrain receivers continued. The B-channel upconverter was repaired in situ. The nutator hydraulics were refurbished. Design started on lateral focusing for the Cassegrain system.

VLBA effort continued on L0 synthesizer design and L-band and 6-cm front-end design and prototyping.

FutureNet computer-aided design software for drafting, schematic and wiring list generation was installed on an IBM-PC and the staff started learning its use. A co-op student started improving the user interface of the circuit design software FARANT running on the lab MASSCOMP.

Socorro

The new design subreflector drive sub-system testing on antenna 12 is complete, and plans for implementing this sub-system on antenna 20 is in process. Also, the new 327-MHz, on-axis feed system and new 327-GHz receiver are being constructed for installation on antenna 20.

The prototype 8-GHz receiver sub-system for the Voyager project of JPL is in the prototype stage, with a cooled 8-GHz receiver presently under test at the Central Development Lab in Charlottesville.

A 230-GHz radiometric system to measure opacity of the atmosphere at the VLA site was received from Tucson. Some manual measurements are in process.

Construction of the new antenna transporter maintenance facility is complete, with the utilities in the process of being installed.

Twelve antennas now have insulation installed to improve their pointing performance.

Tucson

During this quarter the 200-300 GHz cooled mixer receiver was modified to reduce the noise on the local oscillator that was causing bad baseline problems. The modifications have apparently been successful. The receiver was tested up to 270 GHz during this quarter and some problems were experienced with lack of local oscillator drive. The receiver will be modified during the shutdown period to solve these problems.

The inductosyn electronics is now complete and will be installed on the telescope during the summer shutdown.

The aperture efficiency of the antenna at prime focus is now 25% at 230 GHz. The Cassegrain efficiency at the same frequency is 17%, and work on this problem will continue during summer shutdown.

Work continues on the new 90-120 GHz cooled receiver, the 130-170 GHz cooled receiver, and also a single channel, 345-GHz, cooled mixer receiver.

COMPUTER DIVISION

Charlottesville

The AIPS project continued to produce new software as well as studies for future developments. Non-linear image filtering became available via MWFLT (median-window filtering) and NINER (generalized 3x3 kernel operators). Spectral-line analysis was enhanced with XBASL (polynomial baseline correction) and BLSUM (flux determination over irregular blotch regions). Three new paraform tasks for plotting were among the new routines developed. A study of calibration and editing requirements in AIPS was begun. A number of computer and array processor designs were reviewed to determine their suitability to run AIPS programs with high performance.

The design of an internal, generalized format for tabular data (such as clean components) was completed and work on the necessary basic routines was begun. The design will eventually allow users to perform very general operations on tabular data, such as sorting, merging, plotting, editing, and analysis. A full spread-sheet program could even be developed. This internal format was based on the tentative international agreement on a tape format for the interchange of tabular data on FITS tapes. Support for this agreement has appeared in AIPS during the first two quarters of 1984 and will continue to be enhanced.

Socorro

In the synchronous system, Doppler tracking for spectral-line observations have been implemented. There is also a new observing mode available to measure the atmospheric extinction at K-band using tipping curves.

At long last the pipeline has been released for general use. Although there are still some known deficiencies with this system, there are no major bugs. The default path for all data gathered from VLA observations is now into the pipeline, relieving some of the burden on the DEC-10 and providing enhanced capabilities for spectral-line observers.

ENGINEERING DIVISION

Orders were placed for long delivery items for the north-south travel of the feed mount system for the 300-foot telescope. Final design drawings are being prepared for the shop to start fabrication.

Assistance was provided in the supervision of the painting contract for the 300-foot and 140-foot telescopes.

Fabrication and design drawings were made and sent to the shop for modification of the Cassegrain building and the installation of the new feed system on the 140 foot.

The contract for the deformable subreflector was monitored for fabrication progress and measured results.

VLA antenna design calculations and design were updated. Answers to questions submitted by prospective proposers for the antenna were prepared.

Review and further studies of prospective VLBA sites continued.

VERY LONG BASELINE ARRAY

General

The VLBA program underwent an independent committee review in May. The Review Panel, assembled by the National Science Foundation, consisted of Dr. Bruce L. Chrisman, Dr. Richard B. Neal, Dr. Irwin I. Shapiro, Dr. Joseph H. Taylor (chairman), Dr. William J. Welch, and Dr. Robert R. Wilson. The panel reviewed the project in detail for two days and concluded the following:

- The VLBA is scientifically desirable and will be an important major new tool for probing the universe.
- The design specifications are appropriate and appear to be attainable with diligence.
- NRAO's staffing and management plans are adequate to the task, laudably flexible in a number of ways, and basically sound.
- Early stages of the project appear to have been skillfully and purposefully managed.
- Construction and operating costs appear to be credible.
- The time schedule seems realistic under the proposed funding scheme.

As a result of the House/Senate Appropriations conference on the FY 1985 budget, funding for the VLBA in 1985 has been appropriated at \$9 million. This was a reduction from the requested \$15 million. Further, a prohibition was placed by Congress on the issuance of RFP's from the date of enactment until April 1, 1985. Considerable effort by the project team has been spent restructuring the project to fit the revised budget plan.

Sites

Statements of qualifications have been received from architect/engineer firms proposing to perform the Array Operations Center design, typical antenna site design, and antenna foundation design for the VLBA. The firms are currently being evaluated. Studies have continued to determine the space and layout requirements for the Operations Center and the typical antenna control building. Discussions have been held with the administration of the New Mexico Institute of Mining and Technology at Socorro regarding possible locations for the Operations Center on campus.

The Bureau of Land Management responded to the application for the Pie Town, New Mexico, site with a request for additional information. Also, the antenna site at Kitt Peak, Arizona, has been chosen.

Antennas

Proposals for the design, manufacture, erection, and test of the VLBA were received from three firms: ESSCO, Radiation Systems, Inc., and TIW Systems, Inc. The proposals are currently being evaluated.

Electronics

The prototype design for the 8.4-GHz receiver is complete. Five units are being assembled in Green Bank for cryogenic testing.

The high efficiency shaped profiles for the main and subreflectors of the VLBA dish were generated, and work has begun on verifying and optimizing them.

An RFI trailer has been equipped and taken to the Pie Town, New Mexico, site where RFI surveying of the eleven VLBA frequency bands was begun.

Data Recording

Data-recording specifications and interface descriptions have been written. The data-recording group has continued to evaluate both longitudinal and cassette recording systems. Preliminary design has been performed on block diagrams for the acquisition terminal.

Experimentation with video cassette recorders continues in an attempt to duplicate the partial response coding system. Two 14-megabit VCR systems are being built and tested for shipment to and evaluation by the project team at Haystack.

Monitor and Control

Prototype monitor and control interface circuits were designed and tested on the bench.

Correlator

Contract negotiations have been continued with the California Institute of Technology (Caltech). Caltech has developed a detailed work plan for the first project phase, the system architectural design. More general plans have been developed for the correlator development, prototype construction, production, and testing. Also, work has continued at Caltech on testing the VLSI chip proptotype.

PERSONNEL

New Hires

H. R. De Ruiter	Visiting Assistant Scientist	05/07/84
R. E. Barvainis	Research Associate	05/10/84
J. E. Tohline	Visiting Assistant Scientist	05/21/84
J. A. Gil	Visiting Research Associate	06/01/84

Rehires

F. O. Clark	Visiting Associate Scientist	06/07/84
P. E. Palmer	Visiting Scientist	06/18/84

Terminations

J. E. Tohline	Visiting Assistant Scientist	06/21/84
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Change in Status

R. L. Brown	to Assistant Director/Tucson Oper.	06/01/84
M. A. Gordon	to Scientist	06/01/84