

Library 1984

NATIONAL RADIO ASTRONOMY OBSERVATORY
Charlottesville, Virginia

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

Quarterly Report

OCT 22 1984

July 1, 1984 - September 30, 1984

RESEARCH PROGRAMS

<u>140-ft Telescope</u>	<u>Hours</u>
Scheduled observing	1853.75
Scheduled maintenance and equipment changes	205.00
Scheduled tests and calibration	145.25
Time lost due to: equipment failure	122.00
power	3.25
weather	0.25
interference	14.50

The following continuum program was conducted during this quarter.

<u>No.</u>	<u>Observer</u>	<u>Program</u>
W193	N. White (European Space Agency) J. Culhane (Cambridge) J. Kuijpers (Utrecht) K. Mason (Cambridge) A. Smith (European Space Agency)	Observations at 6 cm of the eclipsing RS CVn system AR Lac.

The following line programs were conducted during this quarter.

<u>No.</u>	<u>Observer</u>	<u>Program</u>
B406	M. Bell (Herzberg) H. Matthews (Herzberg) T. Sears (Brookhaven)	Observations at 13.9 GHz in search of C ₆ H in TMCl.
B422	M. Bell (Herzberg) H. Matthews (Herzberg) T. Sears (Brookhaven)	Observations at 3 cm to search for C ₅ H in TMCl and examination of spectral features in IRC+10216 thought to be due to HC ₉ N or C ₅ H.
B423	M. Bell (Herzberg) H. Matthews (Herzberg)	Observations at 9895 MHz in an attempt to detect C ₃ N in absorption against Cas A.

<u>No.</u>	<u>Observer</u>	<u>Program</u>
B424	W. Batrla	Observations at 9.1 GHz of a newly discovered comet.
C216	F. Clark (Kentucky) S. Miller (Kentucky)	Observations at 6 cm and 18 cm of OH and H ₂ O to study stellar winds and cloud dynamics.
D137	L. DeNoyer (Colgate) J. Dodd (Colgate)	Observations of the galactic plane at $0^\circ < l < 90^\circ$ at 90 cm to determine rotation measures.
G272	P. Godfrey (Monash) R. D. Brown (Monash) W. Irvine (Massachusetts) L. Tack (Monash)	Search at 3.3 cm for the $J = 1-0$ transitions of C ₃ O and H ₂ C ₃ O, and measurements at this wavelength of the $3_{12}-3_{13}$ transition of NH ₂ CHO.
M222	H. Matthews (Herzberg) M. Bell (Herzberg) P. Feldman (Herzberg)	Observations at 4.7 cm of CH ₃ CHO in the direction of Cas A.
M223	H. Matthews (Herzberg) M. Bell (Herzberg)	Observations at 5 cm of anomalous, excited OH emission toward 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 He ⁺ in several galactic HII regions and planetary nebulae.
T158	T. Thuan (Virginia) E. J. Wadiak (Virginia)	Observations at 21 cm to measure the neutral hydrogen content of active galaxies.
T182	B. Turner L. Rickard (Howard)	Search at 4 cm for the $\pi_{1/2}$, $J = 3/2$ rotational state of CH.
Z47	L. Ziurys (Calif., Berkeley) G. Fuller (Calif., Berkeley) R. Saykally (Calif., Berkeley)	Search at 3 GHz for interstellar silicon hydride (SiH).

The following Very Long Baseline programs were conducted, and the stations used in the observations are coded as follows:

A - Arecibo 1000 ft	I - Iowa 60 ft
B - Effelsberg MPIR 100 m	Jb - Jodrell Bank Mk II
F - Fort Davis 85 ft	Km - Haystack 120 ft
G - Green Bank 140 ft	Lb - Bologna 25 m
H - Hat Creek 85 ft	Lm - Medicina 32 m

N - NRL Maryland Point 85 ft
O - Owens Valley 130 ft

Sk - Kirunda, Sweden 60 ft

<u>No.</u>	<u>Observer</u>	<u>Program</u>
B382V	F. Briggs (Pittsburgh) L. Baath (Manchester, UK) M. Davis (Arecibo) K. Johnston (NRL) D. Jones (Caltech) B. Ronnang (Chalmers) S. Unwin (Caltech) A. Wolfe (Pittsburgh) J. Romney	Monitoring of the 932-MHz, redshifted HI-absorption line in AO 0235+164, with telescopes A, G, O, and Sk.
B385V	F. Briggs (Pittsburgh) L. Baath (Manchester, UK) M. Davis (Arecibo) K. Johnston (NRL) D. Jones (Caltech) B. Ronnang (Chalmers) S. Unwin (Caltech) A. Wolfe (Pittsburgh) J. Romney	Monitoring of low-frequency variables at 932 MHz, with telescopes A, G, O, and Sk.
B393V	J. Broderick (VPI & SU) K. Johnston (NRL) K. Mitchell (VPI & SU) W. Waltman (NRL) R. Brown	Observations of the HI absorption lines toward 3C 196 and 1229-021, with telescopes G and N.
H11V	D. Hough (Caltech) A. Readhead (Caltech)	Observations at 2.8 cm of 3C 207 and 3C 212, with telescopes B, F, G, Km, and O.
H12V	D. Hough (Caltech) T. Pearson (Caltech) A. Readhead (Caltech) R. Perley	Observations at 2.8 cm of cores of D2 sources that are candidates for super- luminal motion, with telescopes B, F, G, H, Km, and O.
H201V	M. Hodges (Caltech)	Observations at 607 and 932 MHz of compact doubles, with telescopes G, Jb, and O.
M56V	R. Mutel (Iowa) M. Hodges (Caltech)	Observations at 2.8 cm of outbursts of BL Lac, with telescopes B, F, G, H, Km, and O.
P60V	I. Pauliny-Toth (MPIR, Bonn) R. Porcas (MPIR, Bonn) W. Sheng-Yin (MPIR, Bonn) A. Zensus (MPIR, Bonn) K. Kellermann	Observations at 2.8 cm of 3C 454.3, with telescopes B, F, G, H, Km, and O.

<u>No.</u>	<u>Observer</u>	<u>Program</u>
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, Km, N, and O.
R30V	J. Romney W. Alef (MPIR, Bonn) N. Broten (Herzberg) I. Pauliny-Toth (MPIR, Bonn) E. Preuss (MPIR, Bonn) K. Kellermann	Observations at 2.8 cm of the structural evolution in 3C 84, with telescopes B, F, G, H, Km, Lm, and O.
S38V	D. Shaffer (Interferometrics)	Observations at 2.8 cm of 4C 39.25 (a contracting source), with telescopes B, F, G, H, Km, Lb, and O.
S275V	S. Spangler (Iowa) J. Cordes (Cornell) R. Mutel (Iowa) J. Benson	A search at 610 MHz for cosmic ray-induced turbulence near the supernova remnant CTA 1, with telescopes G, I, and O.

<u>300-ft Telescope</u>	<u>Hours</u>
Scheduled observing	2049.75
Scheduled maintenance and equipment changes	154.25
Scheduled tests and calibration	0.00
Time lost due to: equipment failure	14.00
power	1.25
weather	0.00
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 and 2695 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 $\delta = 20^\circ$ $< \delta < 45^\circ$.

<u>No.</u>	<u>Observer</u>	<u>Program</u>
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.
G274	P. Gregory (British Columbia) A. Reid (British Columbia) T. Stevenson (British Columbia)	A survey at 6 cm for highly variable and transient radio sources along the galactic plane.
032	C. O'Dea B. Balonek (Williams College) W. Dent (Massachusetts) W. Kinzel (Massachusetts)	Polarization and flux density measurements of variable sources at 2695 MHz.

The following line programs were conducted during this quarter.

<u>No.</u>	<u>Observer</u>	<u>Program</u>
A73	K. Anantharamaiah (Raman, India) W. Erickson (Maryland) V. Radhakrishnan (Raman, India)	Observations of carbon and hydrogen recombination lines in the range 50-80 MHz toward Cas A.
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.

The following pulsar program was conducted during this quarter.

<u>No.</u>	<u>Observer</u>	<u>Program</u>
C214	J. Condon B. Dennison (VPI & SU) D. Stinebring	Observations at 300-500 MHz and 700-1000 MHz to monitor "slow" interstellar scintillations (ISS) of pulsars.

12-m TelescopeHours

Scheduled observing	362.25
Scheduled maintenance and equipment changes	1507.75
Scheduled tests and calibration	338.00
Time lost due to: equipment	35.00
weather	82.00
power	0.00
interference	0.00

The following line programs were conducted during this quarter.

<u>No.</u>	<u>Observer</u>	<u>Program</u>
D133	W. Dent (Massachusetts) R. Hobbs (unaffiliated) T. Balonek (Williams College)	Evolution of extragalactic radio sources at millimeter wavelengths.
G273	J. Gallagher (KPNO) D. Hunter (KPNO)	CO observations of irregular galaxies.
J106	J. Jackson (Massachusetts) A. Barrett (Massachusetts)	Study of HNC0 molecular clouds.
L189	R. Loren (Texas) H. A. Wootten	Study of the chemistry in a shocked region of Rho Oph.
R209	R. Rickard (Howard) L. Blitz (Maryland)	Study of CO emission in selected galaxies.
R210	L. Rickard (Howard) P. Palmer (Chicago)	Continued mapping of CO in galaxies IC 342, NGC 253, and M83.
S241	S. Spangler (Iowa) S. Allendorf (Iowa) W. Cotton	Multi-frequency observations of low-frequency variable radio sources.
T176	H. Thronson (Wyoming)	Mapping of thermal and mass structure of four regions of active star formation.

Very Large Array

The quarter was scheduled 100.0 percent of the time.

Astronomical	1,664.0 hours	(75.3 percent)
Scheduled maintenance	262.2 hours	(11.9 percent)
Scheduled test/calibration	281.8 hours	(12.8 percent)

The following research programs were conducted during this quarter.

<u>No.</u>	<u>Observer</u>	<u>Program</u>
AA30	H. Aller (Michigan) S. Reynolds	High-resolution mapping and polarimetry of 3C 58. 6 cm.
AA32	P. Alexander (MRAO, UK) P. Scott (MRAO, UK) G. Pooley (MRAO, UK)	A search for evidence for possible re- acceleration in radio lobes. 2 cm.
AA35	J. T. Armstrong J. Jackson (MIT) A. Barrett (MIT) P. Ho (CFA)	Search for recombination lines in the Sgr A molecular cloud. 2-cm line.
AA37	P. Appleton (Manchester, UK) W. Sparks (Sussex, UK) A. Wilkinson A. Pedlar (Nuffield, UK)	HI observations of NGC 5898/5903. 21-cm line.
AB129	B. Burke (MIT) J. Hewitt (MIT) D. Roberts (Brandeis)	Monitoring time variations in 0957+561. 6 cm.
AB243	A. Bosma (Leiden) R. Athanassoula (Besancon) A. Rots J. van der Hulst (Nuffield, UK) P. Crane	HI in M51. 21-cm line.
AB254	R. Becker (VPI & SU) D. Helfand (Columbia)	Supernova remnants far inside the Solar Circle. 20 cm.
AB270	R. Becker (VPI & SU) D. Helfand (Columbia)	Neutral-hydrogen absorption measure- ments to estimate distances to 28 galactic SNR. 21-cm line.
AB271	R. Becker (VPI & SU) D. Helfand (Columbia) J. Pye (Leicester, UK) A. Smith (Leicester, UK)	Galactic SNR. 6 cm.
AB274	S. Baum (Maryland) R. Elston (Arizona) B. Januzzi (Harvard) E. Nelson (New Mexico) H. Greidanus (Leiden)	The morphology of W50. 6 cm.

<u>No.</u>	<u>Observer</u>	<u>Program</u>
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.
AB279	G. Byrd (Alabama) J. Sulentic (Alabama) M. Valtonen (Turku, Finland) S. Haarala (Turku, Finland)	Tail structure of NGC 4869. 6 cm.
AB280	A. Barrett (MIT) J. Jackson (MIT) P. Ho (CFA) A. Haschick (Haystack)	Ammonia in NGC 6334. 1.3-cm line.
AB287	S. Baum (Maryland) R. Elston (Arizona) R. Hjellming B. Januzzi (Harvard) E. Nelson (New Mexico) H. Greidanus (Leiden)	Spectral index and depolarization of selected filaments in W50. 6 cm.
AB290	C. Bennett (MIT) J. Hewitt (MIT) J. Mahoney (MIT) A. Langston (MIT) B. Burke (MIT)	Extremely variable objects from the MG survey. 6 cm.
AB291	R. Brown	Carbon II recombination lines toward the Rho Ophiuchi dark cloud. 6-cm line.
AB292	A. Barrett (MIT) J. Jackson (MIT) P. Ho (CFA)	HI in starburst galaxies NGC 2903 and NGC 3504. 21-cm line.
AB294	J. Biegling (Calif., Berkeley) G. Grasdalen (Calif., Berkeley & Wyoming)	Formaldehyde absorption toward G24.5-0.2 (3C 385). 6-cm line.
AB295	R. Brown G. Chin (NASA-GSFC) J. M. Hollis (NASA-GSFC)	An attempt to detect mass loss from Alpha Lyrae. 6 cm.
AB296	A. Barrett (MIT) J. Jackson (MIT) J. Stutzki (Cologne, FRG) M. Olberg (Cologne, FRG) G. Winnewisser (Cologne, FRG)	Ammonia (1,1) emission from the western lobe of S106. 1.3-cm line.

<u>No.</u>	<u>Observer</u>	<u>Program</u>
AB297	L. Blitz (Maryland) H. Karimabadi (Maryland)	Search for HI scalloping. 21-cm line.
AB298	F. Briggs (Pittsburgh)	HI observation of interacting dwarf galaxies: UGC 1171/1176. 21-cm line.
AB299	F. Briggs (Pittsburgh)	Extended HI distribution around NGC 628. 21-cm line.
AB301	J. Bookbinder (Harvard) D. Lamb (CFA)	Search for radio emission from DQ Her stars. 6 and 20 cm.
AB302	J. Bookbinder (Harvard) D. Lamb (CFA)	Search for radio emission from magnetic A-type stars in close binaries. 2, 6, and 20 cm.
AC94	E. Churchwell (Wisconsin) M. Felli (Arcetri) M. Massi (Arcetri)	Ammonia-line emission from molecular clumps embedded in the M17 HII region. 1.3-cm line.
AC100	C. Carignan (Groningen)	Basic halo parameters in pure disk galaxies. 21-cm line.
AC101	J. Condon	Survey of bright spiral galaxies. 20 cm.
AC105	R. Cameron G. Bicknell (Mt. Stromlo) R. Ekers	Jet radio sources in southern clusters. 6 cm.
AC107	J. Cordes (Cornell) S. Spangler (Iowa)	Search for point sources behind the supernova remnant CTA 1. 6 and 20 cm.
AD94	I. de Pater (Calif., Berkeley) K. Weiler (NSF) R. Fanti (Bologna) C. Fanti (Bologna)	Polarization characteristics in variable radio sources. 2, 6, and 20 cm.
AD114	G. Dulk (Colorado) T. Bastian (Colorado) O. Slee (CSIRO)	Flare stars in stellar clusters. 6 and 20 cm.
AD131	A. Downes (Cambridge) D. Green (Cambridge)	Poorly studied large SNR. 20 cm.
AD134	R. Dettman (MPIR, Bonn) E. Hummel (MPIR, Bonn) R. Wielebinski (MPIR, Bonn)	HI and radio continuum emission of the Magellanic irregular NGC 55. 21-cm line.

<u>No.</u>	<u>Observer</u>	<u>Program</u>
AD135	S. Drake (Colorado) T. Simon (Hawaii) J. Linsky (Colorado)	Radio survey of barium stars and 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.
AD139	H. Dickel (Illinois) W. M. Goss M. Felli (Arcetri) A. Rots	Formaldehyde absorption towards W3 and M17. 2-cm line.
AD140	A. Downes (MRAO, UK) S. Gull (MRAO, UK) S. Tan (MRAO, UK)	First epoch observations of the young SNR G11.2-03. 6 and 20 cm.
AD142	J. Dickel (Illinois) K. Long (Johns Hopkins) Y. Matsui (Johns Hopkins) E. Greisen	Second epoch observations of Kepler's SNR. 6 and 20 cm.
AD143	S. Drake (Colorado) D. Abbott (Colorado) J. Linsky (Colorado)	Are the magnetic B, A, and F stars a new class of radio stars? 2, 6, and 20 cm.
AD145	N. Duric (Toronto) E. Seaquist (Toronto) P. Crane L. Davis (KPNO)	Scaled array observations of the spiral galaxy NGC 4736. 6 and 20 cm.
AD150	J. Dickey (Minnesota) E. Salpeter (Cornell)	Continuum survey of the Cancer galaxy cluster. 20 cm.
AE31	R. Ekers W. M. Goss	NGC 5419 (1401-33). 20 cm.
AE32	R. Ekers W. M. Goss (Groningen) J. van Gorkom U. Schwarz (Groningen)	Sgr A. 6 and 20 cm.
AE33	P. Encrenaz (Meudon) L. Nyman (Onsala) A. Stark (Bell Labs)	Fragmentation in interstellar clouds: ammonia absorption towards Cas A. 1.3-cm line.
AE34	V. Escalante (CFA) J. Moran (CFA) J. Canto (Mexico) L. Rodriguez (Mexico)	Radio recombination lines from the ionized winds in MWC349 and M171Rc2. 2-cm line.

<u>No.</u>	<u>Observer</u>	<u>Program</u>
AE35	R. Ekers J. van Gorkom W. M. Goss U. Schwarz (Groningen)	H76 α recombination line observations of the Sgr A East compact HII regions. 2-cm line.
AE36	R. Ekers T. Cornell P. Wilkinson	Imaging DA240 with bandwidth synthesis. 20 cm.
AF85	G. Fabbiano (CFA) I. Gioia (CFA)	Complete samples of early and late-type spirals. 6 and 20 cm.
AF86	E. Fomalont B. Geldzahler (NRL)	Sco X-1 flux monitoring. 6 and 20 cm.
AF87	E. Fomalont K. Kellermann J. Wall (RGO, UK) D. Weistrop (NASA-GSFC)	Deep survey at 5 GHz. 6 cm.
AF88	J. Forster (CSIRO) J. Whiteoak (CSIRO) F. Gardner (CSIRO)	Molecular structure in L1551. 6-cm line.
AF92	E. Feigelson (Penn State) B. Geldzahler (NRL) K. Johnston (NRL)	Coordinated radio, optical, UV, X-ray observations of OVV H0323+022. 2, 6, and 20 cm.
AG116	D. Gibson (Colorado & NMIMT) W. Friedhorsky (LANL)	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 1300. 21-cm line.
AG145	B. Geldzahler (NRL) P. Schwarz (NRL)	Simultaneous multifrequency observations of Blazars. 1.3, 2, 6, and 20 cm.
AG150	S. Goldstein (Virginia) E. Greisen J. Pisano (Virginia)	Faraday rotation in a low-latitude field. 20 cm.
AG156	D. Gary (Caltech) G. Hurford (Caltech) H. Zirin (Caltech)	Coordinated radio, optical, X-ray observations of solar filaments and prominences. 1.3, 2, 6, and 20 cm.
AG157	D. Gibson (NMIMT) T. Ayres (Colorado)	Coordinated radio, optical and X-ray observations of Sigma Geminorum. 2, 6, and 20 cm.

<u>No.</u>	<u>Observer</u>	<u>Program</u>
AG158	D. Gibson (Colorado & NMIMT) F. Walter (Colorado)	Coordinated radio and EXOSAT observations of AR Lacertae. 2, 6, and 20 cm.
AG159	Gopal-Krishna (TIFR, India) S. Lakshmi (IISc/TIFR, India) A. Singal (TIFR, India) M. Joshi (TIFR, India)	Two extended radio sources in chains of galaxies. 6 and 20 cm.
AG161	G. Grasdalen (Calif., Berkeley) S. Vogel (Calif., Berkeley)	Ammonia (2,1) in L1551 IRS 5. 1.3-cm line.
AH147	L. Higgs (DRAO, Canada) J. Vallee (NRC, Canada)	A remarkable arc-line structure in the galactic plane. 6 and 20 cm.
AH150	P. Ho (CFA) A. Haschick (Haystack)	NH ₃ line studies of OB cluster G10.6-0.4. 1.3-cm line.
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-cm line.
AH-160	V. Hughes (Queens, Canada) B. McLean (Queens, Canada)	Star formation in MON R2. 20 cm.
AH162	P. Ho (CFA) K. Lo (Caltech)	Linear continuum structures in the galactic plane. 20 cm.
AH163	W. Hermsen (MPIR, Bonn) T. Wilson (MPIR, Bonn) C. Walmsley (MPIR, Bonn) C. Henkel (MPIR, Bonn) K. Johnston (NRL)	The hot ammonia source in Orion. 1.3-cm line.
AH164	P. Hintzen (NASA-GSFC) F. Owen	Physically large QSO radio sources. 6 cm.
AH165	A. Haschick (Haystack) W. Baan (Arecibo)	Broad water-vapor lines in distant galaxies. 1.3-cm line.
AH166	P. Ho (CFA) J. Turner (CFA) R. Martin (IRAM, France)	HI synthesis mapping of IC 342. 21-cm line.
AH179	R. Hjellming G. Hennessy	Nova Vulpecula. 2 and 6 cm.
AJ112	N. Jeske (Calif., Berkeley) C. Heiles (Calif., Berkeley)	Supershells in NGC 628. 21-cm line.

<u>No.</u>	<u>Observer</u>	<u>Program</u>
AK106	N. Killeen (Mt. Stromlo) G. Bicknell (Mt. Stromlo) R. Ekers	Jet source PKS0131-36 in lenticular galaxy NGC 612. 6 and 20 cm.
AK107	M. Krause (MPIR, Bonn) R. Beck (MPIR, Bonn) E. Hummel (MPIR, Bonn)	Linearly polarized radio emission from IC 342. 20 cm.
AK109	M. Kundu (Maryland) R. Shevgaonkar (Maryland) M. Melozzi (Maryland)	Coordinated soft X-ray (AS&E rocket) and radio observation of a solar active region. 2 cm.
AK110	K. Kim (Toronto) P. Kronberg (Toronto) P. Dewdney (DRAO, Canada) T. Landecker (DRAO, Canada)	Polarization observation of radio halos in Abell clusters. 20 cm.
AK111	K. Kellermann R. Sramek D. Shaffer (Interferometrics) M. Schmidt (Caltech) R. Green (KPNO)	PG quasars. 6 cm.
AK112	M. Kutner (RPI) K. Mead (RPI) N. Evans (Texas)	HII regions in outer galaxy molecular clouds. 6 cm.
AL78	K. Lang (Tufts) R. Willson (Tufts)	Coordinated radio/IUE observations of flare stars. 20 cm.
AL83	H. Liszt W. B. Burton (Leiden)	Continuum survey near, but outside, Sgr A. 20 cm.
AL84	S. Lakshmi (TIFR, India) Gopal-Krishna (TIFR, India) D. Bagri G. Swarup (TIFR, India)	Selecting calibrators for the OSRT. 6 and 20 cm.
AL85	K. Lang (Tufts) R. Willson (Tufts)	Simultaneous VLA-SMM II-Ratan observations of solar active regions. 2, 6, and 20 cm.
AL86	J. Lestrade (JPL/Paris Obs.) R. Mutel (Iowa) A. Niell (JPL) R. Preston (JPL)	Search for position calibrators around six radio stars. 6 and 18 cm.
AL87	A. Lane S. Reynolds	Extended continuum emission from Herbig-Haro objects. 6 and 20 cm.

<u>No.</u>	<u>Observer</u>	<u>Program</u>
AL88	L. Little (Kent, UK) S. Davies (Kent, UK) W. Dent (Kent, UK) N. Matthews (Kent, UK) G. White (Queen Mary College)	Ammonia maps of molecular cloud cores 1.3-cm line.
AM121	M. Margulis (Arizona) C. Lada (Arizona)	The A22 star-forming association in M31. 20 cm.
AM123	H. Martin B. Partridge (Haverford) M. Ratner (CFA)	Search for anisotropies in the cosmic background. 6 cm.
AM124	I. McHardy (Leicester, UK) R. Warwick (Leicester, UK) A. Smith (ESTEC, Netherlands)	Monitoring OVVS. 2, 6, and 20 cm.
AM127	P. Myers (CFA) M. Reid (CFA) P. Benson (Wellesley)	NH ₃ observations of dense gas near low-mass stars. 1.3-cm line.
AM129	G. Miley (STScI & Leiden) R. de Grijp (Leiden)	Survey of infrared, nonthermal candidates. 6 cm.
AM137	R. Mutel (Iowa)	Coordinated VLA Exosat observations of RS CVn stars. 2 and 6 cm.
AN27	Nguyen-Q-Rieu (Meudon)	Ammonia and HC ₇ N in GL 2688. 1.3-cm line.
A047	C. O'Dea F. Owen	Four narrow angle tails. 6 cm.
A049	F. Owen C. O'Dea J. Burns (New Mexico) L. Smarr (Illinois)	Wide angle tail sources. 6 cm.
A054	C. O'Dea F. Owen	A flat spectrum knot in NGC 1265. 1.3 1.3 cm.
AP71	R. Perley J. Dreher (MIT)	Cygnus A. 2 cm.
AP73	A. Pedlar (Manchester, UK) R. Davies (Manchester, UK) R. Perley P. Crane	Extended structure in NGC 1275. 20 cm.

<u>No.</u>	<u>Observer</u>	<u>Program</u>
AP84	V. Pankonin (NSF) J. Whiteoak (CSIRO) F. Gardner (CSIRO) W. M. Goss P. Roelfsema (Groningen)	H76, He76 α observations of Sgr B2. 2-cm line.
AP86	P. Palmer (Chicago) J. Davidson (Chicago) A. Stark (Bell Labs)	Search for continuum emission associated with certain far-infrared sources. 2 cm.
AP87	P. Palmer (Chicago) J. Davidson (Chicago) R. Hildebrand (Chicago)	Search for ammonia structures in two dark nebulae
AP88	P. Palmer (Chicago) A. Harris (Calif., Berkeley) C. Townes (Calif., Berkeley) E. Sutton (Caltech)	The (2,2) line of NH ₃ in B335. 1.3-cm line.
AP91	A. Patnaik (TIFR, India) J. van Gorkom	HI absorption in NGC 4782/NGC 4783/ 3C 278. 20-cm line.
AR110	L. Rodriguez (Mexico) M. Roth (Mexico) M. Tapia (Mexico) P. Persei (IAS, Italy) M. Ferrari-Toniolo (IAS, Italy)	Monitoring flux of Cyg OB2 No. 5 and other OB stars with possible variable radio fluxes. 2, 6, and 20 cm.
AR111	M. Reid (CFA) J. Moran (CFA)	Do compact HII regions expand? 1.3 and 2-cm line.
AR112	M. Reid (CFA) J. Moran (CFA)	Recombination line in G34.3+0.6. 1.3 and 2-cm line.
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, Netherlands) K. Weiler (NSF)	Monitoring supernovae SN1980 in NGC 6946 and SN 1979c in M100. 6 and 20 cm.
AS173	A. Smith (Leicester, UK) L. Jones (Leicester, UK)	SNR W44. 20 cm.
AS188	M. Simon (SUNY, Stony Brook) J. Fischer (NRL)	IRAS strong IR galaxies. 2 cm.

<u>No.</u>	<u>Observer</u>	<u>Program</u>
AS192	P. Schwartz (NRL) K. Shivanandan (NRL) C. Albert (Naval Academy)	FIRSE and IRAS galactic sources. 6 and 20 cm.
AS199	S. Sukumar (TIFR, India) T. Velusamy (TIFR, India)	Thirteen nearby spiral galaxies. 6 and 20 cm.
AS200	S. Simkin (Michigan State) J. Su (Purple Mountain, China) J. van Gorkom	HI observations of Seyferts of dif- ferent morphological type. 21-cm line.
AS202	P. Schechter (Mt. Wilson/ Las Campanas) J. van Gorkom T. Steinman-Cameron (Mt. Wilson/ Las Campanas)	HI in S0 galaxies with polar rings. 21-cm line.
AS204	P. Schwartz (NRL)	Sharp ionization rims. 2 and 6 cm.
AS205	E. Seaquist (Toronto) M. Bode (LANL/Manchester, UK) D. Frail (Toronto)	Radio shell of GK Per. 6 cm.
AS206	R. Snell (Massachusetts) J. Bally (Bell Labs) P. Schwartz (NRL)	Bipolar wind of L1551 IRS-5. 1.3, 2, and 6 cm.
AS207	E. Skillman (Washington) R. Terlevich (RGO, UK) H. van Woerden (Groningen) A. Aparicio (RGO, UK)	HI synthesis of the dwarf-irregular galaxy Sextons A. 21-cm line.
AV91	W. van Breugel (Calif., Berkeley) P. Barthel (Leiden) W. Jaegers (Leiden)	The giant quasar 4C 34.47. 6 and 20 cm.
AV96	J. van der Hulst (NFRA, Netherlands) R. Sramek K. Weiler (NSF)	Monitoring a radio supernova in NGC 4258. 6 and 20 cm.
AV100	W. van Breugel (Calif., Berkeley) E. Fomalont R. Ekers	Fine structure in Fornax A. 6 and 20 cm.

<u>No.</u>	<u>Observer</u>	<u>Program</u>
AV105	J. van Gorkom G. Hunt A. Patnaik (TIFR, India) C. Salter P. Shaver (ESO, FRG)	Six nonthermal, galactic radio sources. 2, 6, and 20 cm.
AV110	J. Vallee (NRC, Canada) J. MacLeod (NRC, Canada) N. Broten (NRC, Canada)	Faraday rotations in Abell 2319. 6 and 20 cm.
AV111	P. Vanden Bout (Texas) W. M. Goss (Groningen)	HI in galactic molecular clouds. 21-cm line.
AV112	W. van Breugel (Calif., Berkeley)	Extended radio galaxies. 6 and 20 cm.
AV113	J. van Gorkom W. M. Goss (Groningen)	Helium recombination lines in Sgr A West. 2-cm line.
AV114	J. van Gorkom R. Laing (RGO, UK)	HI emission in NGC 5363. 20-cm line.
AV115	G. van Moorsel	HI observations of a subfield of the NGC 697 group. 21-cm line.
AV118	F. Viallefond (Meudon) G. Conte (Marseille) J. Lequex (Marseille)	HI in irregular dwarf galaxies. 20-cm line.
AW113	E. J. Wadiak (Virginia) R. Rood (Virginia) T. Wilson (MPIR, Bonn) W. Batrla	Formaldehyde emission in Rho Oph B. 2-cm line.
AW114	E. J. Wadiak (Virginia) R. Rood (Virginia) T. Wilson (MPIR, Bonn) W. Batrla	Six centimeter formaldehyde towards W49. 6-cm line.
AW117	T. Wilson (MPIR, Bonn) C. Walmsley (MPIR, Bonn) K. Johnston (NRL) C. Henkel (MPIR, Bonn)	Two centimeter formaldehyde in Orion. 2-cm line.
AW118	J. Wink (MPIR, Bonn)	Helium stromgren spheres. 2-cm line.
AW119	G. White (London) J. Phillips (London)	Survey of bipolar nebulae. 2 and 6 cm.

<u>No.</u>	<u>Observer</u>	<u>Program</u>
AY5	F. Yusef-Zadeh (Columbia) M. Morris (Calif., Los Angeles) J. van Gorkom	Recombination line emission from the galactic center. 6-cm line.
AY6	F. Yusef-Zadeh (Columbia) M. Morris (Calif., Los Angeles) D. Chance (Columbia)	The polarized region of the arc. 2 and 6 cm.

ENGINEERING DIVISION

The installation of the spoiler on the 300-ft telescope was completed. The design for the north-south travel of the feed mount on the 300 ft was updated. Design of modifications at the focal point to accept the north-south travel was started.

The new deformable subreflector for the 140-ft telescope was measured and accepted. Specifications and a request for a quotation for a low-frequency reflector in the new feed system on the 140 ft were prepared and mailed to prospective suppliers. Conceptual designs and models were prepared for the splitter to be used in the new feed system for the 140 ft.

The technical proposals for the VLBA antennas were reviewed and technical discussions were held with the proposers.

Prospective architect-engineering firms (A/E) to design VLBA sites, control buildings, and antenna foundations were screened and interviewed. A firm was chosen to design the first site (Pie Town). Other prospective sites for VLBA antennas were reviewed and facts updated as to wind, RFI, and availability.

ELECTRONICS DIVISION

Charlottesville Electronics

The prototype 8.4-GHz, VLBA front-end has been completed and shipped to the VLA for antenna evaluation. The unit is documented as VLBA Technical Report No. 1. Construction of a second front-end has been started and development of an improved amplifier utilizing HEMT (high-electron mobility transistor) devices is planned.

Low-noise HEMT developmental devices from Cornell, General Electric, and TRW have been tested at cryogenic temperatures. The best results are a noise temperature of 11 K at 8.4 GHz for a Cornell device and 37 K at 23 GHz for a TRW unit.

The construction of a 115-GHz SIS (superconductor-insulator-superconductor) receiver using hybrid refrigeration (a mechanical 15 K refrigerator plus a low boil-off helium reservoir) is nearing completion. A helium hold-time of five days and SSB system temperature of approximately 100 K has been measured. A second SIS mixer giving lower noise temperature is under development.

The construction of a hybrid (analog filter-digital correlator) spectrometer for use at the Tucson 12-m telescope has been started. Parameters of the receiver are 1536 channels at a maximum of 2.4-GHz bandwidth.

Green Bank Electronics

Spectral processor design continued, mainly in the area of the FFT butterfly board. The MASSCOMP computer for the 300-ft control system was delivered and set up in the lab for testing the data acquisition and control processor (DACP) and for developing software.

The 2.5-GHz receiver assembly neared completion for the 2.0 to 3.5-GHz range. It will be tested on the 140-ft telescope next quarter. Assembly of the 5-GHz, 7-feed receiver continued. A cooled coaxial switch was added to the 300-1000-MHz receiver to allow changing certain feeds without warming, opening, and re-cooling the dewar; now all feed changes require only three hours or less.

A wide-band, singly-polarized dipole feed was designed, constructed by the shops division, and used on the 300-ft telescope for spectral-line measurements in the 25 to 50 MHz range.

Fabrication of the 7.6-25-GHz polarization splitter for the 140-ft Cassegrain receivers continued with the assistance of the Engineering and Central Shops Divisions. The reflector for the 4.7-7.2 GHz splitter was designed and an order placed for fabrication. Engineering completed tests on the new deformable subreflector, but the deforming control servo must be re-optimized before installation.

VLBA effort continued on designs for the LO synthesizer, L-band front-end, and 6-cm front-end. An automated system to stress-test five CTI Model 22 refrigerators went into operation.

The USNO interferometer link to Huntersville was converted from L-band to 17 GHz to eliminate a source of 22-cm RFI.

Report EDIR No. 249, "The Interferometer Microwave Link," was issued this quarter.

Tucson Electronics

During this quarter the Baldwin encoders have been replaced with inductosyn systems. The VAX has been moved to the telescope and is now in operation.

Further holographic surface measurements have been made, and we hope to re-adjust the surface during November in an effort to increase the aperture efficiency from its current prime focus value of 25% at 230 GHz.

One mini dewar of the new 70-120 GHz receiver was tested on the telescope during this quarter. A noise temperature of 220 K SSB was measured at both 90 GHz and 115 GHz, and the aperture efficiency at the Cassegrain focus was 45% at 90 GHz. Three more dewars will be fabricated during the next quarter and will be incorporated into the new 3-mm receiver.

Fabrication has started on a single-channel, 345-GHz, cooled mixer receiver, and work has started in the machine shop on a dual-channel 130-170 GHz receiver.

Very Large Array

Antenna 20 was outfitted with a new subreflector drive subsystem, the new on-axis feed system for 327 MHz, an 8-GHz feed horn for the JPL Voyager project receiver, and a long-periodic antenna for 75 MHz.

The prototype, 8-GHz receiver subsystem for the JPL Voyager program was received from the Central Development Laboratory in Charlottesville. This receiver is in the process of being interfaced with the local oscillator and monitor and control subsystems.

Construction of the 327-MHz receiver and a simple 75-MHz receiver for antenna 20 is almost complete.

Thirteen antennas now have insulation installed to improve their pointing performances.

Construction for the new antenna transporter maintenance facility is complete.

An RFI measurement trailer was outfitted and instrumented. RFI measurements have been made at two VLBA sites, Pie Town and Los Alamos, New Mexico. The measurements at Los Alamos are complete and only the higher frequency bands need to be measured at Pie Town.

COMPUTER DIVISION

Computer Advisory Group Meeting

The NRAO Computer Advisory Group met in Green Bank on September 18 and 19, 1984. The purpose of the meeting was to review the Observatory's long-term computer plans for VLA and other synthesis processing. NRAO technical personnel prepared a plan recommending the use of a Class VI supercomputer for this work. The Advisory Group reviewed this plan. Although their final (written) report is not yet available, their preliminary report strongly endorsed the use of a supercomputer for the problem. They further recommended that we begin immediately to get experience on the use of AIPS on

these machines, with computer time made available by the NSF through its computer initiative.

The membership of the Advisory Group and their affiliations is: Dr. Alfred Brenner, Fermi National Accelerator Laboratory; Dr. Wim Brouw, Netherlands Foundation for Radio Astronomy; Dr. Paul E. Green, Jr., Thomas J. Watson Research Center (IBM); Dr. Kenneth King, Cornell University; Dr. Paul Kunz, Stanford Linear Accelerator Center; Dr. H. S. McDonald, Bell Telephone Laboratories; Dr. G. S. Patterson, Technical Computation Systems, Inc.; Dr. Peter Patton, Microelectronics and Computer Technology Corporation; and Dr. Fred Ris, Thomas J. Watson Research Center (IBM).

AIPS Software Development

In the third quarter of 1984, the AIPS system underwent a number of significant changes. Henceforth, 32-bit integers will be allowed when needed which removes a software complexity introduced in an attempt to support old PDP 11 computers. A large number of routines are being revised to use this simplification. We have also introduced a generalized table handling format and applied it to CLEAN component files. Both changes necessitated a format conversion. Several new programs have appeared, the fringe-fitting task was substantially improved, and a generalized uv-modeling package was written and inserted in all appropriate tasks. The AIPS system has been changed from a 2-month to a 3-month update cycle, using freeze dates of 15 January, 15 April, 15 July, and 15 October. The implementation of AIPS on IILS Model 75 televisions has been shown to work correctly.

VLA

The hardware and software necessary for the first stage of the on-line (synchronous) computer upgrade was received and installed. The system generation and initial tests, using various parts of the software from the current computer system, have been completed. A software update procedure, based on the current one, has been implemented and is now in use on the new system.

In the current on-line system, the incorrect flagging of bad data in the on-line system at the beginning of scans has been causing problems in the pipeline because of the lack of a general-purpose flagging facility there. Two major steps have already been addressed with high priority. In addition, support for the upcoming addition of 75-MHz receivers has been implemented.

Since the pipeline was released for general use, it has been used with mixed success. Most of the problems have been caused by hardware problems and the difficulty of diagnosing their origin in a very complex system. When it is functioning correctly, it is a valuable asset. In order to increase the reliability, a major effort is being made to upgrade the operating systems on the PDP-11 computers.

In order to enhance the capability of data calibration and editing for users who make use of the dial-in facility, a disk is now reserved for such projects during the night hours on the DEC-10 computer.

VERY LONG BASELINE ARRAY (VLBA) PROGRAM

In the antenna area, proposals for final design, procurement of materials and components, fabrication of the structure, and site assembly and testing of the VLBA antennas were received on July 2 from three vendors. Technical and business evaluation committees appointed by the Director of NRAO reviewed the proposals for completeness, content, qualifications of the proposers, and adequacy of the proposals to accomplish the NRAO objective.

Committee reports were submitted to the VLBA Project Manager in late July. Questions to the vendors directing attention to elements of the proposals requiring clarification or modification were prepared and technical discussions with vendors were held on September 6, 7, 10, and 11. Proposal prices have been analyzed in preparation for negotiations with vendors scheduled for early October. Design for the focusing feed mounts for use on the VLBA antennas is being performed in house and is approaching completion.

In the area of site selection, a trailer has been purchased and equipped to monitor RFI at the prospective antenna sites. Monitoring has been performed at the Pie Town, New Mexico site, and RFI does not appear to be a problem there. The trailer has been moved to the prospective site at Los Alamos, New Mexico and is currently monitoring RFI there. Other prospective sites were reviewed and facts updated as to wind, RFI and availability.

Prospective architect-engineer (A/E) firms to design sites, control buildings and antenna foundations were screened and interviewed. The firm of Stevens, Mallory, Pearl & Campbell of Albuquerque was selected to undertake negotiations preliminary to contracting for the A/E services.

In electronics during the past quarter, the work has been concentrated in the area of development of feeds and cryogenic front ends. Fabrication of prototype feeds for 330 MHz/610 MHz and for 8.4 GHz has been started. Checking by computer of the profiles for the main reflector and subreflector of the antennas has also continued throughout this quarter.

The 8.4-GHz prototype front end constructed in the Central Electronics Laboratory was shipped to the VLA site during September, and as the quarter closed preparations were being made to mount it on a VLA antenna. This will allow measurement of the full system temperature, and provide an opportunity to determine reliability under field conditions. The prototype 1.5-GHz front end under construction at Green Bank underwent the first cool-down tests in late September, and an initial cool-down time of approximately 30 hours was obtained. This time can be reduced by decreasing the mass of the orthomode transition, which is cooled to 50 K, and, if necessary, by using a larger capacity refrigerator. A setup for life testing of up to six refrigerators has been assembled at Green Bank, and two units are currently under test. These are the small CTI model 22 refrigerators that it is proposed to use on most of the VLBA front ends. NRAO staff visited CTI during September to discuss problems found in some of the first model 22 refrigerators procured, and believe that with some minor improvements in quality it should be possible to obtain good reliability with these units.

A design study has been completed for a radio link between the VLA site and Pie Town to provide a local oscillator at Pie Town using the hydrogen maser at the VLA site. Attention has also been given to revision of the overall VLBA electronics procurement plan as required by the recent changes in the funding schedule.

In the data-recording system area, a meeting was held at Haystack on August 30 to review the recording technology. At this meeting it was decided to adopt the longitudinal recording system for the VLBA. This decision was made after it was demonstrated that this technology should have no difficulty meeting the VLBA recording requirements of recording at 100 Megabits/sec for 24 hours without the need for operator intervention. While it looks like the cassette system could also meet this requirement, it would generate more than 50 pounds of tape per day and would require at least 10 cassette recorders per rack.

The longitudinal recording system developed at Haystack primarily for the NASA Crustal Dynamics Project has now been used in several POLARIS experiments with a record density in excess of 10 Megabits per square inch. The preliminary operational tests of this high-density recording system which uses a track width of 40 micrometers have demonstrated that the system has adequate performance margins to allow a further decrease of track width to 20 micrometers, which along with the use of larger reels of tape should allow the system to meet the requirements with only 2 transports per station.

The data playback system interface to the processor has been discussed with the group designing the VLBA correlator and a memo describing the details of the interface specifications has been issued. At a meeting held at Caltech on September 27 there was general agreement on the interface, although some of the details may be further refined.

The design of the I.F. processing electronics is progressing and the specifications, block diagrams, and signal flow charts are available for the I.F. distributor, I.F. to video converters and formatter.

In the correlator development area, work has been performed on general correlator architecture, how the correlator modules will be interconnected, and what operating modes will be allowed. The performance of the correlator in experiments of more than 10 antennas has been particularly studied. A review of the correlator to tape recorder interface with Haystack and NRAO personnel was recently held.

Additional work is continuing in studying gate array options for a VLSI chip and investigating computer-aided design tools for the project. Work is also continuing on the evaluation of semi-custom VLSI chips designed and produced through JPL facilities. Recommendations have been devised for computer hardware and software selection for the correlator. In addition, initial specification of the fringe processing software has been completed.

In the monitor and control area, the third quarter was spent in investigating hardware and software systems, primarily for the use of the station computers.

A firm choice of station computer, network protocols, and implementation languages is expected in the early days of the fourth quarter.

An interconnect bus for the station computer and its devices has been designed and specified, although other alternatives remain under investigation. A prototype has been built and is available in unit quantities to device designers who would like to begin the interfacing of their devices.

In the data-processing area, the bulk of the software needed for the normal processing of astronomical data from the VLBA is currently available and is in routine production use. There are three general areas which are being developed. First, the interface to the correlator and monitor data base is awaiting further specification. Second, work on the calibration and editing software is proceeding. Currently, the effort is centered on specifying the general techniques both for handling the data and the effects to be corrected. A formal mechanism has been established for the specification of the necessary software and data files and a list of desired functions is being assembled. The details of the information to be kept in the database are also being developed. Third, the needs of geometric observations are being considered in the design of the design base. Advice is being solicited from various outside organizations.

PERSONNEL

New Hires

Edwin L. Childers	Electronics Engineer I	06/84
Andrew V. Dowd	Electronics Engineer II	07/84*
Erich T Schlecht	Electronics Engineer II	09/84
Humphrey P. Murphy	Scientific Prog. Anyl. II	08/84
Patrick K. Moore	Scientific Prog. Anyl. II	09/84
Joel N. Bregman	Associate Scientist	09/84
Franklin H. Briggs	Visiting Associate Scientist	09/84
Paul B. Sebring	Assist. to the VLBA Project Mgr.	09/84

Rehires

Anthony N. Lasenby	Visiting Electronics Engineer I	07/84
Wyman L. Williams	Visiting Electronics Engineer II	08/84
Jerszy Machalski	Visiting Scientist	09/84

Terminations

Barbara A. Williams	Research Associate	07/84
William M. Goss	Visiting Scientist	07/84
James S. Ulvestad	Research Associate	08/84
Graham G. Moorey	Visiting Electronics Engineer I	08/84
Anthony N. Lasenby	Visiting Electronics Engineer I	08/30
Wyman L. Williams	Visiting Electronics Engineer II	09/84
Patrick E. Palmer	Visiting Scientist	09/84

* (originally hired part-time 09/82)