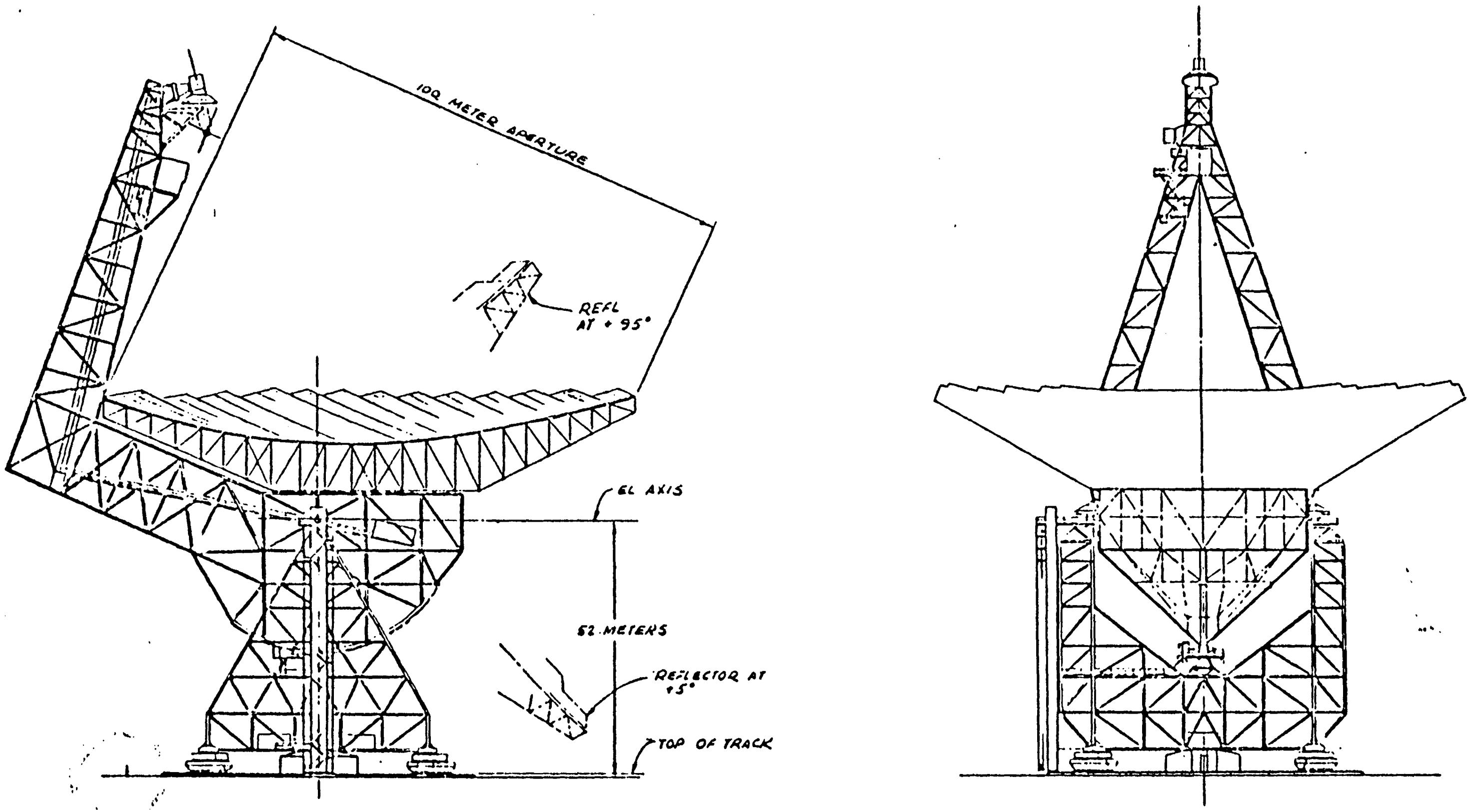


SIDE ELEVATION

FRONT ELEVATION

"ORIGINAL PROPOSAL CONCEPT"

DASH	NEXT ASSY	USED ON	MATL SPEC FINISH	KDI 12-11-9_	SEE SEPARATE PARTS LIST PL
APPLICATION					Ford Aerospace
THIRD ANGLE PROJECTION	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES IN ACCORDANCE WITH ANSI Y14.5 DRILL TOLERANCES ARE PER AND10387	TOLERANCES DEC .X ± DEC .XX ± DEC .XXX ± FRACTIONS ± ANGLES ±			RADIO TELESCOPE GENERAL ARRANGEMENT 100 METER NRAO GBT
					SIZE F · CAGE CODE 11530 · DWG NO SM-2847
					SCALE 1:400 · SHEET 1 OF 1

REVIEW 6/5/91
NRAO GBT

LORAL
Western Development Labs

Seielstad
10/7/91

GREEN BANK TELESCOPE

Design Features for Spectroscopy

- Clear Aperture
    - » High Gain
    - » Low Farout Sidelobes
    - » Discrimination against Interference
    - » Reduced Ground Radiation
    - » Flat Spectral Baselines
- Flexible Operations
    - » Suite of Receivers Available at All Times
    - » Rapid Response to Scientific and Environmental Opportunity
    - » Wideband Receivers
- Efficiency

NRAO

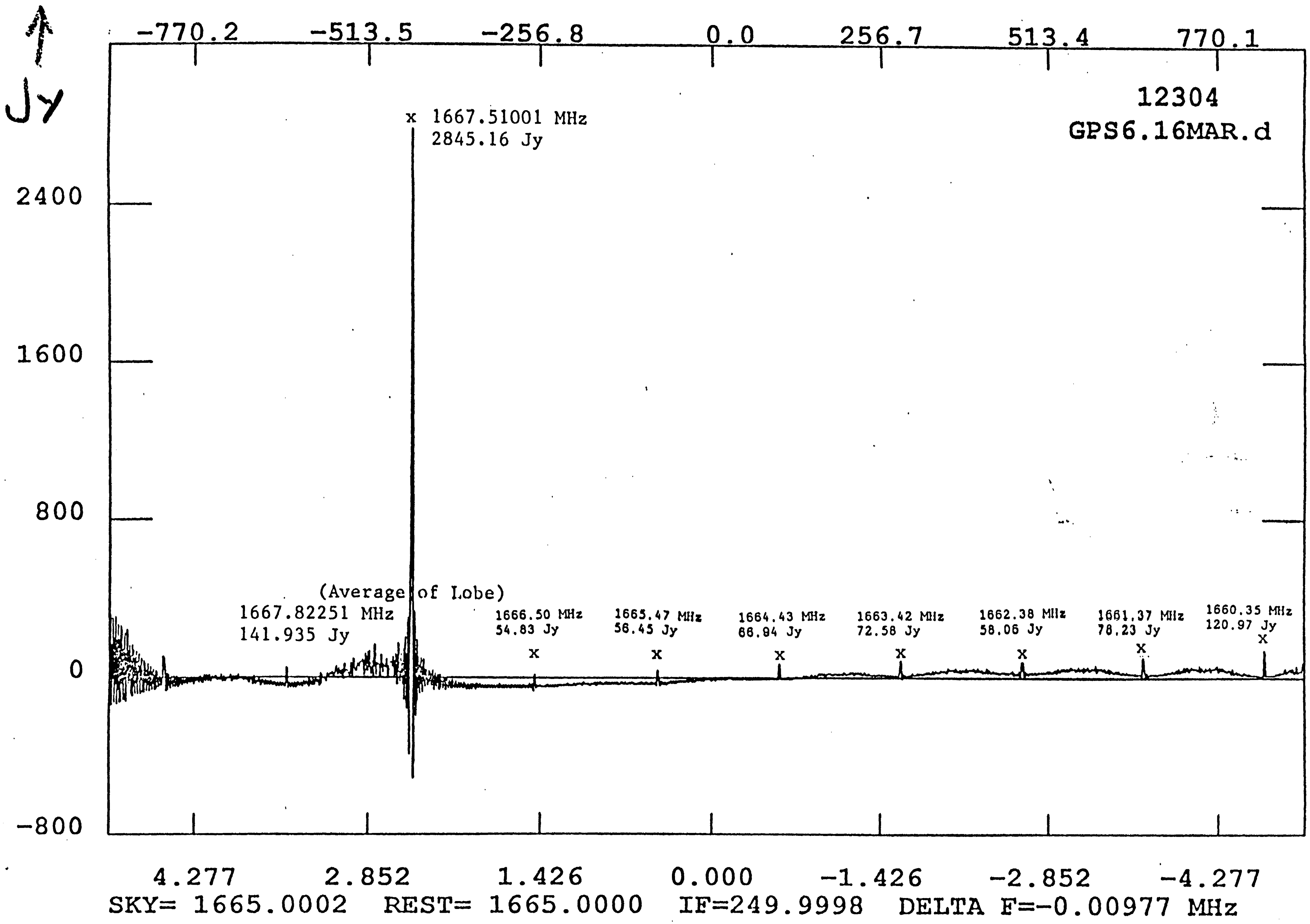
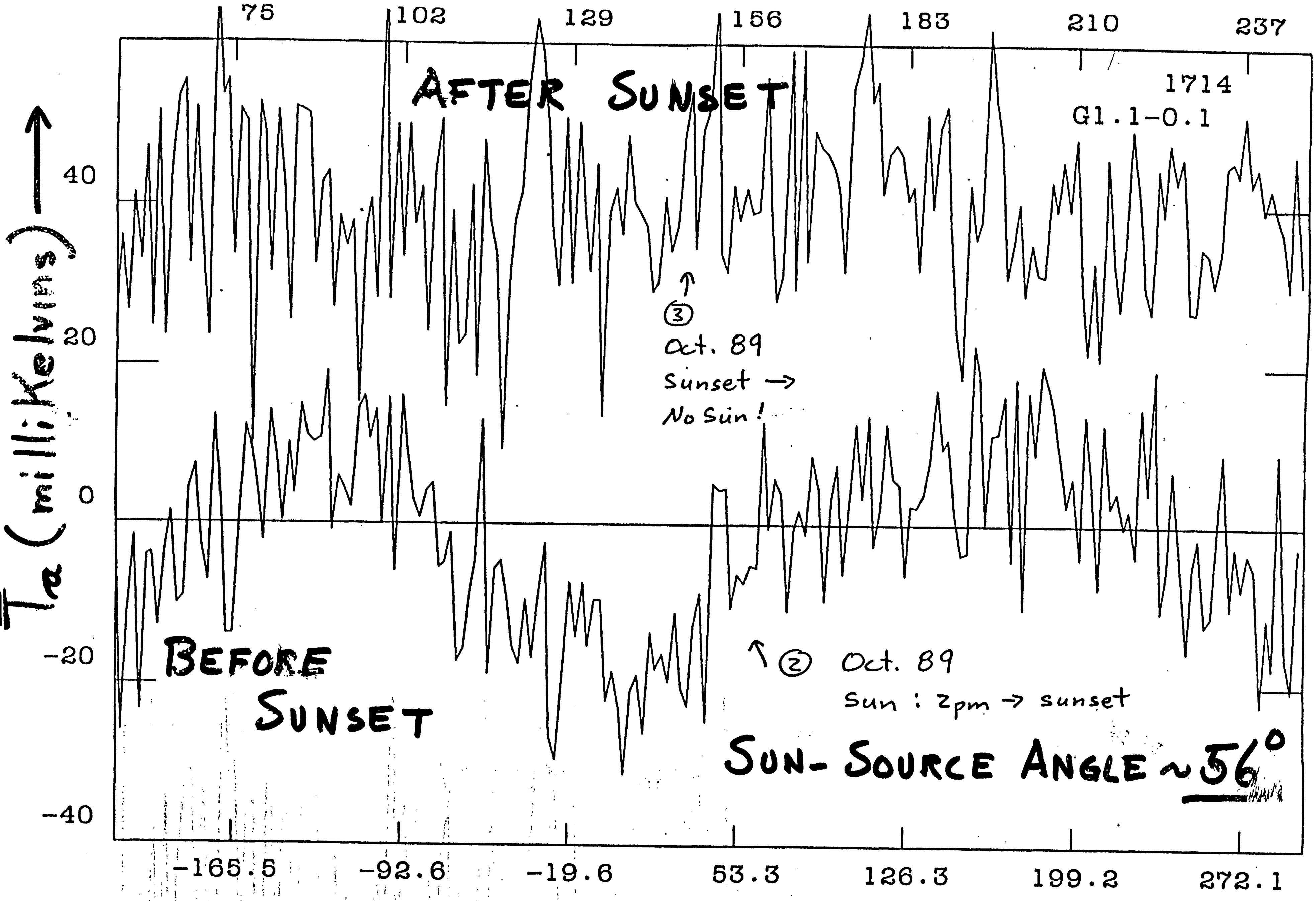
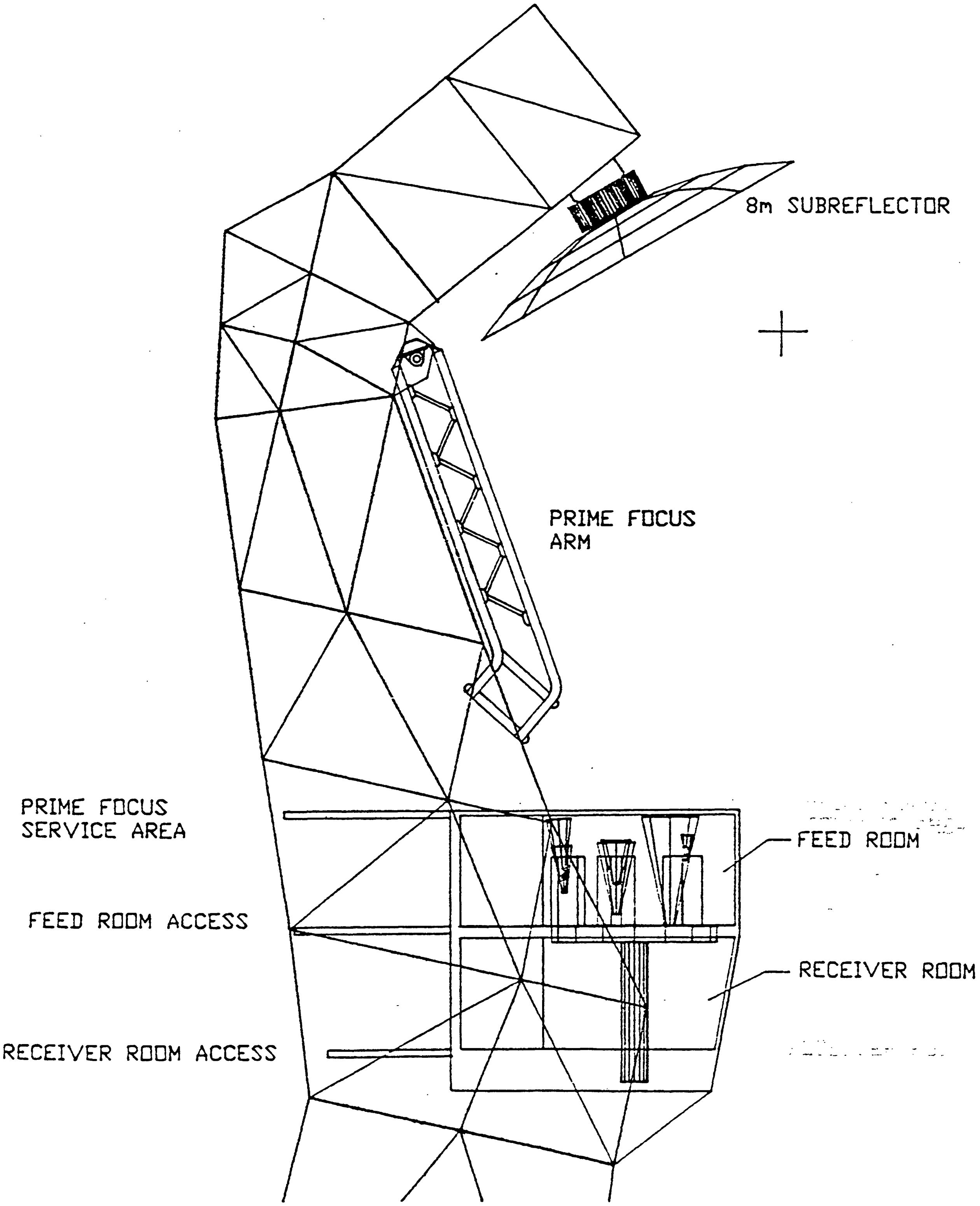

Jy
-770.2
-513.5
-256.8
0.0
256.7
513.4
770.1
12304
GPS6.16MAR.d
x 1667.51001 MHz
2845.16 Jy
2400
1600
800
0
-800
(Average of Lobe)
1667.82251 MHz
141.935 Jy
1666.50 MHz
54.83 Jy
1665.47 MHz
56.45 Jy
1664.43 MHz
66.94 Jy
1663.42 MHz
72.58 Jy
1662.38 MHz
58.06 Jy
1661.37 MHz
78.23 Jy
1660.35 MHz
120.97 Jy
4.277
2.852
1.426
0.000
-1.426
-2.852
-4.277
SKY= 1665.0002 REST= 1665.0000 IF=249.9998 DELTA F=-0.00977 MHz

FIGURE 2

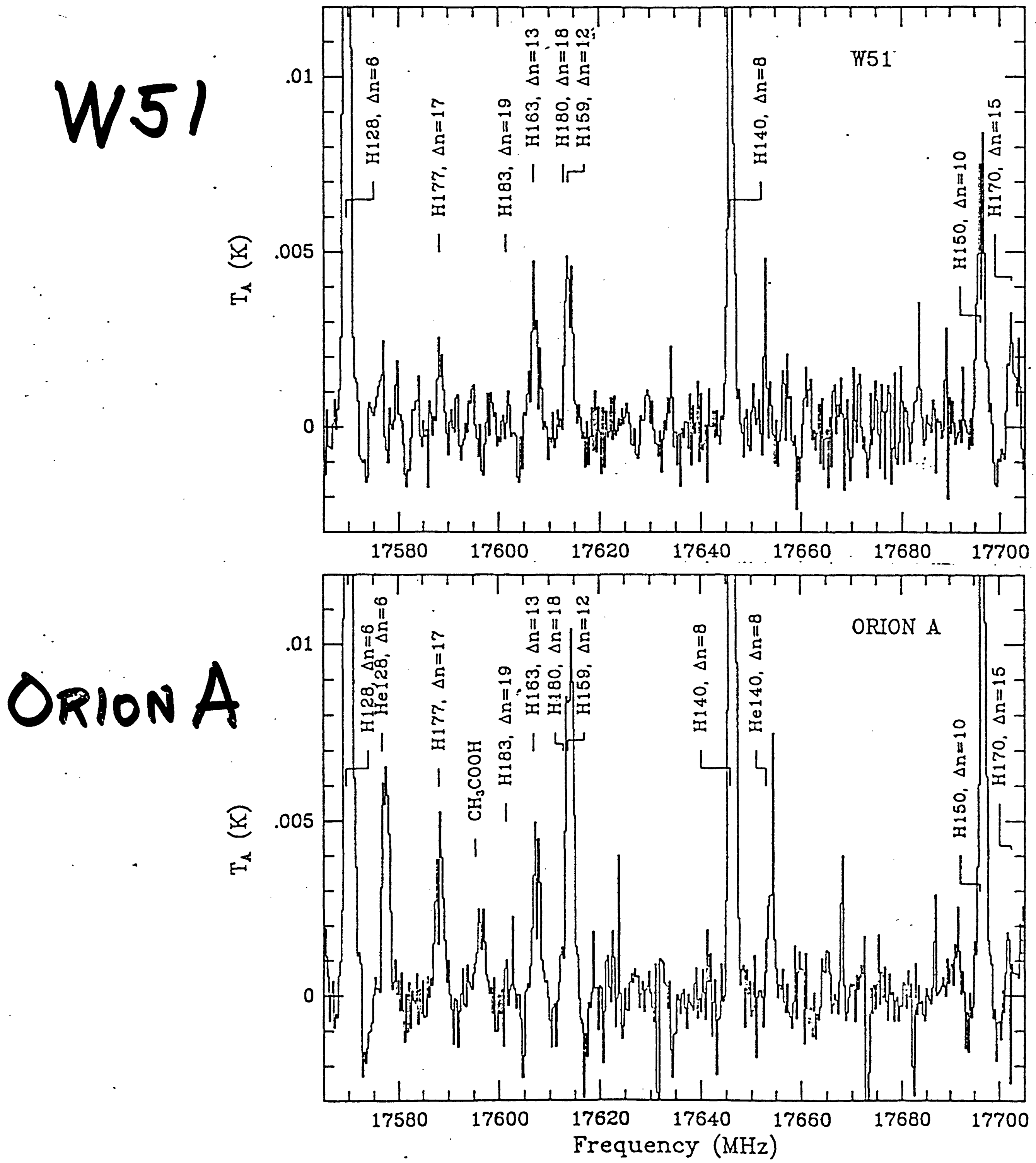

75
102
129
156
183
210
237
AFTER SUNSET
1714
G1.1-0.1
Ta (milliKelvins) →
40
20
0
-20
-40
③ Oct. 89
sunset →
No Sun!
BEFORE SUNSET
② Oct. 89
Sun : 2pm → sunset
SUN-SOURCE ANGLE ~56°
-165.5
-92.6
-19.6
53.3
126.3
199.2
272.1


8m SUBREFLECTOR
PRIME FOCUS ARM
PRIME FOCUS SERVICE AREA
FEED ROOM
FEED ROOM ACCESS
RECEIVER ROOM
RECEIVER ROOM ACCESS

BELL, AVERY, & McLEOD

RECOMBINATION LINES

Figure 1



GREEN BANK TELESCOPE

Efficiency Applied to Spectroscopy

- Continuous Frequency Coverage
- Match of Spectrometer Bandwidth to Receiver Bandwidth
- Ability to configure spectrometer for multiple transitions within a frontends band
- Quick Changes of Frontend Bands
- RFI Excision
- Multiple IF Inputs to Spectrometer

MENTEN (1991), Ap. J. LETTERS

METHANOL MASERS

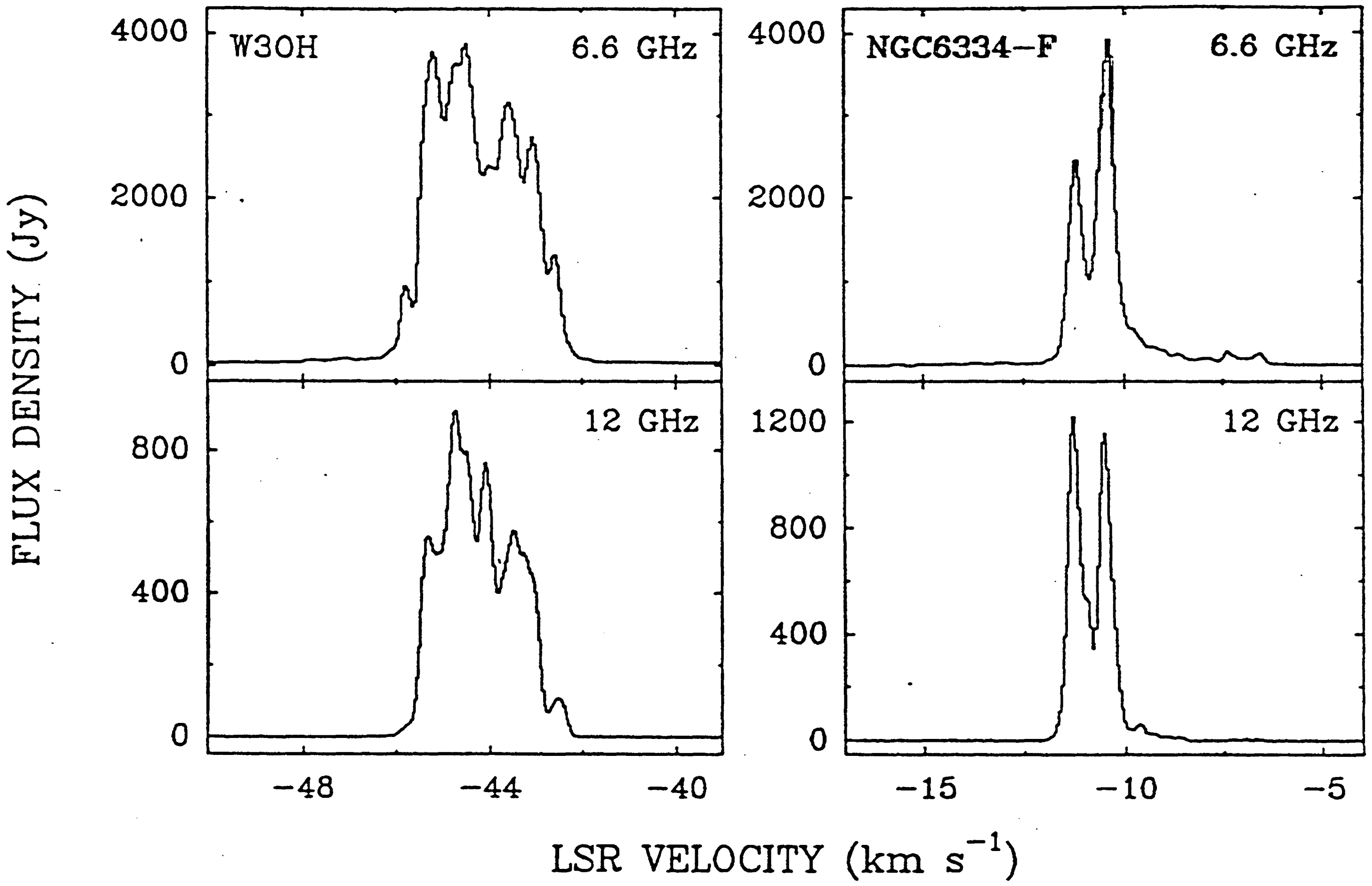
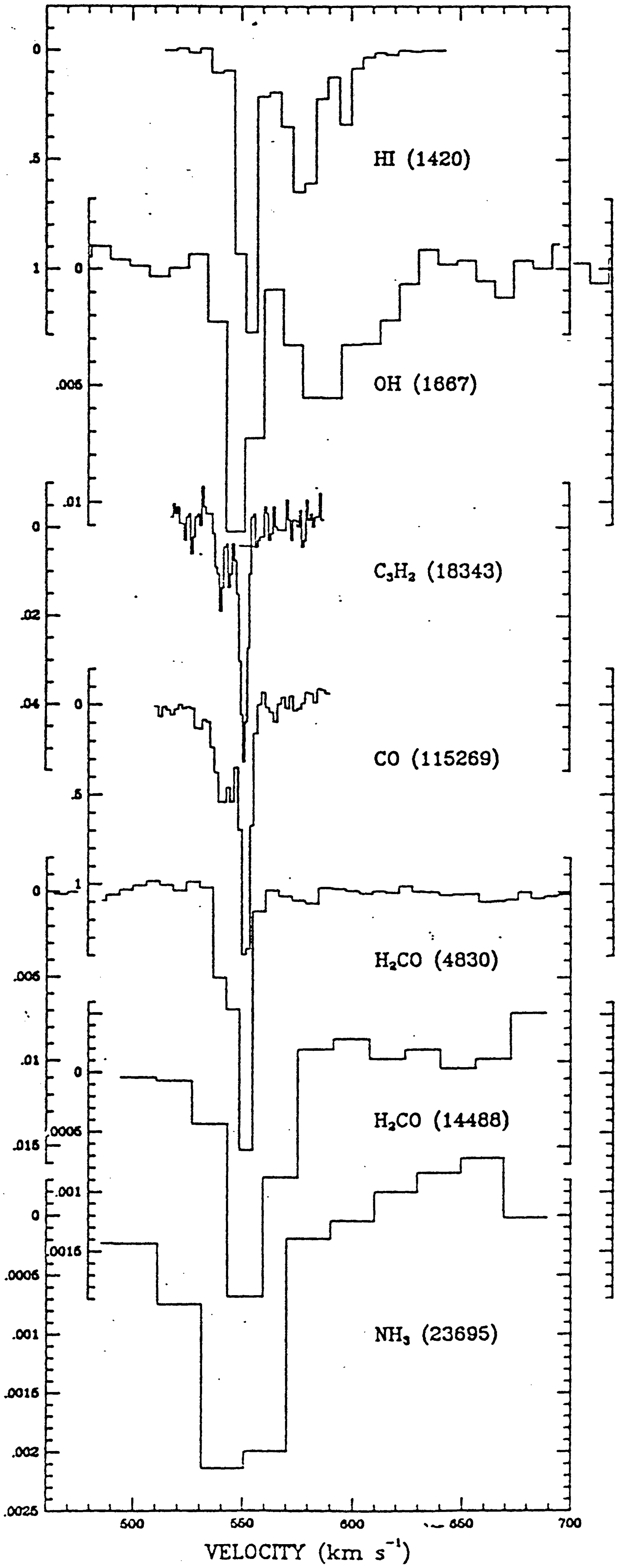


FIG. 2.—Spectra of the 6.6 GHz $5_1 \rightarrow 6_0 A^+$ and 12 GHz $2_0 \rightarrow 3_{-1} E$ transitions of methanol toward the prototypical Class II methanol maser sources W3(OH) (*left*) and NGC 6334-F (*right*). Velocity resolutions are 0.055 km s^{-1} for both 6.6 GHz spectra and 0.038 and 0.060 km s^{-1} for the 12 GHz spectra of W3(OH) and NGC 6334-F, respectively.

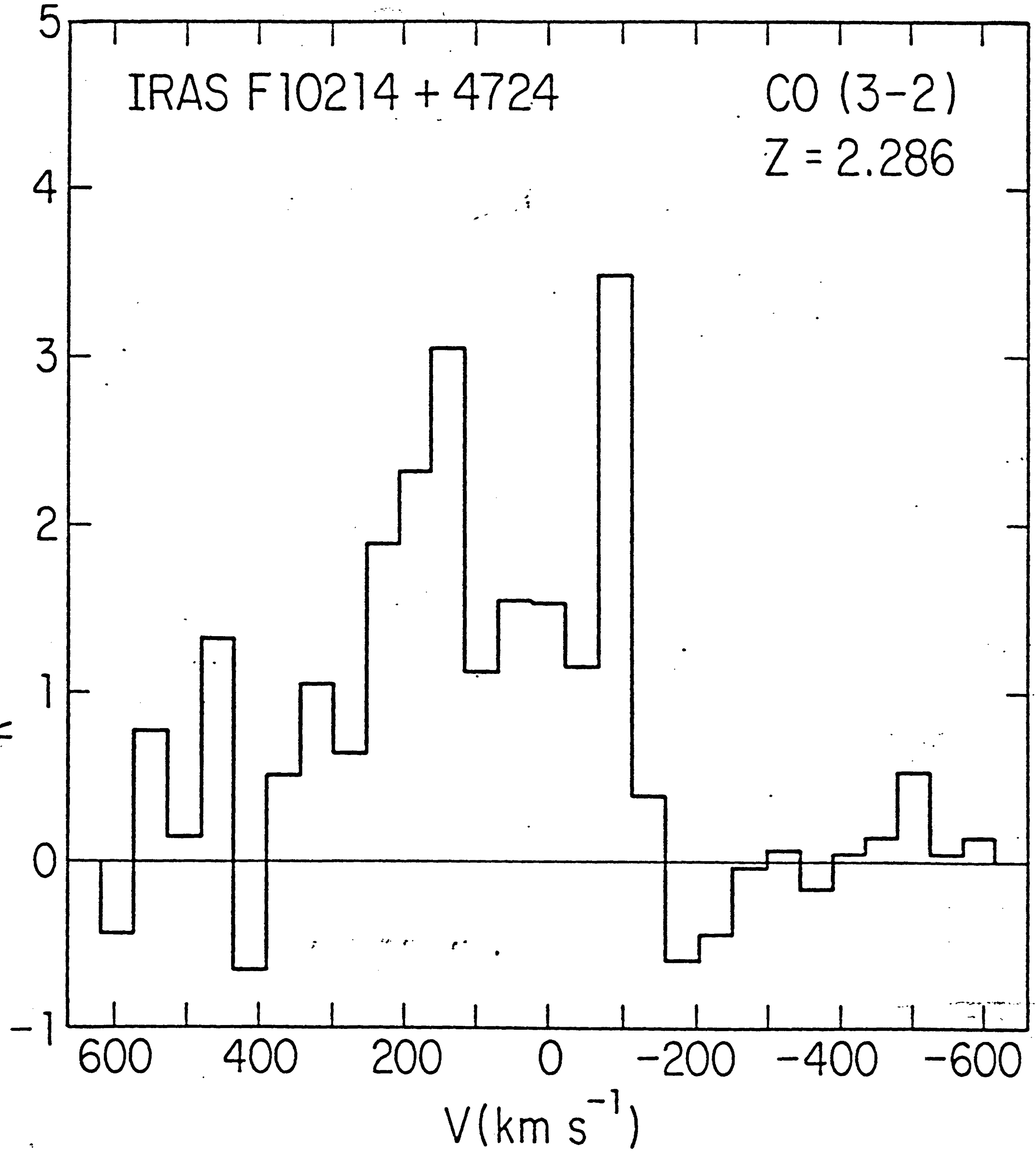
GBT RECEIVERS

Center Frequency (GHz)	Bandwidth (MHz)	Treceiver (K)
1.44	580	5
2.17	870	5
3.28	1350	6
4.9	1900	7
7.02	2350	8
9.1	1800	10
11.2	2400	11
13.9	3000	12
16.7	2600	13
20	4000	15
24.25	4500	20
29.75	6500	25
36.5	3000	27
42.5	5000	30
47.5	5000	35

CENTAURUS A


HI
OH
C_3H_2
CO
H_2CO
H_2CO
NH_3
HI (1420)
OH (1667)
C_3H_2 (18343)
CO (115269)
H_2CO (4830)
H_2CO (14488)
NH_3 (23695)
OPTICAL DEPTH
VELOCITY (km s^{-1})
500
550
600
650
700
0
.5
1
0
.005
.01
0
.02
.04
0
.5
1
0
.005
.01
.015
0
.0005
.001
.0015
0
.0005
.001
.0015
.002
.0025

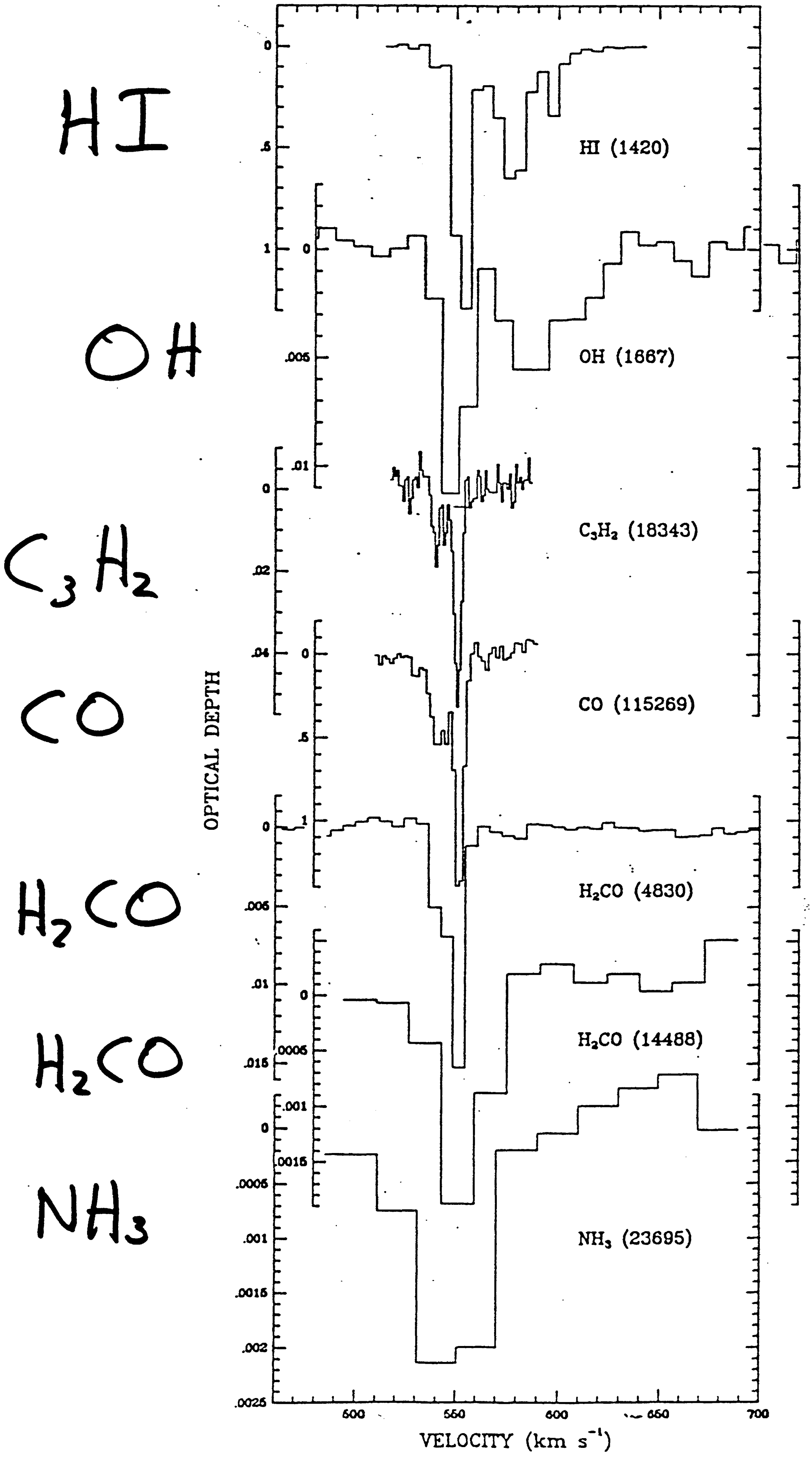
BROWN & VANDEN BOUT (1991)



CO(1-0) REDSHIFTED TO 35 GHz

$$1000\ \frac{km}{sec} \longleftrightarrow 117\ MHz$$

CENTAURUS A


HI
OH
C_3H_2
CO
H_2CO
H_2CO
NH_3
HI (1420)
OH (1667)
C_3H_2 (18343)
CO (115269)
H_2CO (4830)
H_2CO (14488)
NH_3 (23695)
OPTICAL DEPTH
VELOCITY (km s^{-1})
0
.5
1
0
.005
.01
0
.02
.04
0
.5
1
0
.005
.01
.015
0
.0005
.001
.0015
0
.0005
.001
.0015
.002
.0025
500
550
600
650
700

A COMPLETE SURVEY FOR HI ABSORPTION IN THE REDSHIFT INTERVAL $0.4 < Z < 0.9$

$1000 > \nu > 750$ MHz

The absorption spectrum of a distant QSO reveals the presence of condensations of intervening matter unrelated to the QSO or its environs whose existence would otherwise be unknown. Our present understanding suggests that the bulk of the material giving rise to QSO absorption lines consists of clouds of relatively low neutral hydrogen column density, $N_H < 10^{14}$ cm^{-2}, which are responsible for the "Lyman forest" seen at optical wavelengths just short of the QSO Lyman alpha emission lines. A much smaller proportion of the absorption clouds exhibit lines from metals, MgII, CIV, at redshifts identical to that of identifiable Ly-α absorption lines. Apparently these clouds have greater column densities than the Lyman forest clouds. Finally, we know of only a small group of absorption systems with a column density greater than 10^{21} cm^{-2} that Wolfe (1988) argues are nascent galaxy disks seen at an early evolutionary phase.

The disk systems figure importantly in our assessment of galaxy evolution and indeed provide one of the cornerstones of most evolutionary scenarios, vis., that galactic disks formed over a small range of cosmological epoch at $z = 2$-3. There is, of course, a significant selection effect: Lyman alpha disk absorption systems can only be identified in objects with a redshift sufficiently large that (1 + z) 1215A is shifted into the visible. We have very little idea of how many "disk absorption systems" there are at $z < 2$ or indeed whether it is even true that such systems are most common at redshifts between 2 and 3. One of the HST "key projects" is meant to address this subject by searching for "damped" Lyman alpha absorption lines in QSO's with $z < 2$. Radio searches for 21 cm absorption lines provide a complementary way to approach the question.

Large column densities of cold neutral atomic hydrogen will produce absorption lines in the spectra of distant QSO's if they have an angular size large enough to cover a significant fraction of the background QSO radio continuum source. For the bright, compact QSO's this means that the HI needs to be a few tens of parsecs in size, not unreasonable for a cloud with $N_H \sim 10^{21}$ cm^{-2}. Radio searches for the disk absorption systems also have the significant advantage that, in principal, there are no selection effects: the radio spectrum can be searched thoroughly and completely from $z = 0$ to the emission redshift of the object. In practice there is a "selection effect," namely radio interference. The searches that were done a decade or more ago in Green Bank were limited by RFI: whenever the interference was sufficiently intense to "ring" the autocorrelator the entire spectral band being analyzed was corrupted by the sin(x)/X response. In recent years wideband spectroscopy at frequencies less than 1300 MHz has been so severely compromised by RFI that comprehensive searches for redshifted HI have become impossible. Fortunately, the spectral processor, now available for spectroscopy at the 140-Foot Telescope, changes the situation.

250 MHz @ 10 kHz RESOLN. → 25,000 CHANNELS