DEPARTMENT OF PHYSICS
STIRLING HALL
Physics
Engineering Physics
Astronomy

Queen's University
Kingston, Canada
K7L 3N6

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Dr. P. Parma,
Istituto di Radioastronomia,
c/o Istituto di Fisica 'A.Righi',
Via Irnerio 46,
40126 Bologna,
ITALY.

Dear Paola,

I enclose a copy of the draft of our paper, with my further comments. I am sorry that it has taken me a little while to reply, but your letter came just as I began teaching some new courses here. I have also had to be away for some time with the Design Study for the Canadian VLB array.

I have written my main comments or corrections throughout the copy of the paper, which I am returning.

First, I think that you and Roberto should be at the head of the list of authors, rather than the all-alphabetical listing as on the draft.

Second, I think the abstract should not make stronger statements than the body of the paper. I have changed it a little in the light of the several alternatives we consider for the jet models throughout the text.

I think the discussion in Section 6(b), p.12, will be clearer if we make a distinction between v_{exp}, the actual expansion velocity, and v_s, the internal sound speed in the jet. For the free jet $v_{exp} = v_s$, but in a confined jet v_{exp} is less than v_s. Hence $\tan(\theta/2) \lesssim v_s/v_{fl}$, and so $v_{fl} \lesssim v_s.\cot(\theta/2)$.

Also, the jet length divided by v_{fl} will surely be a <u>lower limit</u> to the source timescale, as it would be the timescale if there were no energy storage in the extended components. I think this means that v_{fl} estimated from the energy argument is also an upper limit. The point of greatest interest is perhaps that both types of argument lead to limits in the same <u>regime</u>, even if the actual values are treated as limits.

I also enclose a copy of the work I have done with Dick Henriksen and Kwing Chan on using turbulence as an energy reservoir for in situ particle acceleration, via generation and damping of MHD waves from turbulent eddies.

If my suggestions seem o.k., please send me a copy of the paper as it is submitted. I could read it again (more quickly, now that teaching is under way) if you see any controversial points, however.

With best wishes,

Alan

CONSIGLIO NAZIONALE DELLE RICERCHE
ISTITUTO DI RADIOASTRONOMIA
c/o ISTITUTO DI FISICA «A. RIGHI»
Via Irnerio, 46 - 40126 BOLOGNA (Italia)
Tel. 23 28 56 - 26 09 91
Telex 211664 INFN BO I

Bologna September 16, 1981

Dr. Alan Bridle
Department of Physics
Queen's University
Kingston, Ontario K7L 3N6
Canada

Dear Alan:

This is the last version of the paper about 1321+31. We have included your comments and rewritten the discussion. As you can see we need the VLA data for tables 2b and 3b. We asked Ron to find out, but could you remind him of it? We would like to receive your comments; please tell us if, after that, you prefer to check the paper again, or if we can send it to the referee.

In a few days I will send you the first part of a paper about 0326+39 (with tables and figures). In it we discuss the Westerbork data. Could you add a discussion about the VLA data?
Best wishes.

Sincerely,

Paola Parma
Paola Parma

Enclosure

Table 1. Observational parameters WSRT

Frequency (GHz)	0.6	1.4	5.0
Obs. date	october 78	october 74	may 79
Obs. time	12	12^h	12
Interferometer spacing (m.)	54 + n 72 234 + n 72	72 + n 72	54 + n 72 234 + n 72
Radius 1st grating	46' x 89'.2	10' x 19'	6' x 11.6'
Primary beam	84'	34'	10'
Number of interferometers	40	20	40

Table 2. WSRT map parameters

Frequency (GHz)	Half power beam width (arcsec)	Interferometer spacings shortest/increment/longest (wavelengths)	R.M.S. noise at field center (mJy/beam)	0 z. l
5.0	6 × 11.6	900 / 600 /26690	0.4	
5.0	24 × 45.5	900 / 600 /6898	0.7	−3
1.4	24 × 45.5	1019 / 343 / 6796	1.0	−2
1.4	24 × 45.5	343 / 343 / 6796	1.0	−3
1.4	25.6 × 48.6	343 / 343 / 3338	1.6	−3
0.6	25.6 × 48.5	402 / 73.5 / 3252	1.8	−2.
0.6	25.6 × 48.5	256 / 73.5 / 3252	1.8	−2.

Table 4. Core parameters

Right ascension	13 21 25.78
declination	31 49 33.4
Flux density at 1.4 GHz (VLA)	7.7 mJy
Flux density at 5.0 GHz (WSRT)	21. "
Spectral index ($S(\nu) \propto \nu^{-\alpha}$)	-0.79
Angular size (from VLA map)	- -
Radio luminosity at 1.4 GHz	$2 \cdot 10^{21}$ W/Hz
% pol. / position angle / ν	~ 5% / $-10°$ / 1.4 GHz < 6%

Table 5. Physical parameters for some locations along the jet

Distance from core		$B_{1.4}$	transverse size		Dep. 50/21	H_{eq}	$H_z n_e l$ (10^{13})	u_{min}	n_e (10^{-4})
arcmin	kpc	mJy/arcsec²	arcsec	kpc		μG	cgs	erg/cm³	cm^{-3}
4.5'	64.8	$2.0\cdot10^{-2}$	(45.0)	10.8	(.90)	2.9		$6.9\cdot10^{-13}$	
4.0	57.6	$2.0\cdot10^{-2}$	(45.0)	10.8	(.90)	2.9		$6.9\cdot10^{-13}$	
3.5	50.4	$1.7\cdot10^{-2}$	(45.0)	10.8	(.90)	2.8	↑	$6.3\cdot10^{-13}$	↑
3.0	43.0	$1.4\cdot10^{-2}$	(45.0)	10.8	.90	2.7	1.2 (.5 - 1.7)	$5.7\cdot10^{-13}$	$2.7^{+.9}_{-1.2}$
2.5 ↑	36.0	$3\cdot10^{-2}$	(38.0)	9.1	.83	3.5	1.6 (1.4 - 1.9)	$9.6\cdot10^{-13}$	$3.2\pm^{.6}_{1.0}$
2.0	28.8	$6\cdot10^{-2}$	30.0	7.2	.80	4.5	1.75 (1.2 - 2.0)	$1.6\cdot10^{-12}$	3.6 ± 0.7
1.5 NW	21.6	$8\cdot10^{-2}$	23.5	5.6	.80	5.3	1.75 (1.2 - 2.0)	$2.2\cdot10^{-12}$	3.9 ± 0.7
1.0	14.0	$8\cdot10^{-2}$	15.5	3.8	.80	5.9	1.75 (1.2 - 2.0)	$2.8\cdot10^{-12}$	5.2 ± 1.0
0.7	10.0	$8\cdot10^{-2}$	11.5	2.8	.78	6.4	1.8 (1.5 - 2.0)	$3.3\cdot10^{-12}$	6.5 ± 1.0
0.5	7.2	$1.2\cdot10^{-1}$	8.0	1.9		8.0		$5.2\cdot10^{-12}$	
0.2	2.9	$6\cdot10^{-1}$	3.5	.8		16.0		$2.1\cdot10^{-11}$	
0.2	2.9	$4\cdot10^{-1}$	4.0	1.0		13.7		$1.5\cdot10^{-11}$	
0.5	7.2	$1.1\cdot10^{-1}$	9.5	2.3		7.5		$4.4\cdot10^{-12}$	
0.7	10.0	$8\cdot10^{-2}$	13.5	3.2	.95	6.2	.9 (-1.2)	$3.0\cdot10^{-12}$	$2.5^{+.9}_{-1.6}$
1.0	14.0	$7.5\cdot10^{-2}$	20.0	4.8	.85	5.4	1.5 (1.0 - 1.9)	$2.3\cdot10^{-12}$	3.8 ± 1.3
1.5	21.6	$6\cdot10^{-2}$	33.0	7.9	.78	4.4	1.8 (1.4 - 2.2)	$1.6\cdot10^{-12}$	$3.4\pm.8$
2.0	28.8	$4\cdot10^{-2}$	(35.0)	8.4	.78	3.9	1.8 "	$1.2\cdot10^{-12}$	$3.4\pm.8$
2.5	36.0	$2.2\cdot10^{-2}$	(40.0)	9.6	.90	3.1	1.2 (.5 - 1.7)	$7.8\cdot10^{-13}$	$2.6\pm.5$
3.0	43.0	$1.4\cdot10^{-2}$	(40.0)	"	1.00	2.8	< 1.1	$4.0\cdot10^{-13}$	<2.5
3.5 SE	50.4	$1.2\cdot10^{-2}$	(40.0)	"	1.00	2.6	"	$5.5\cdot10^{-13}$	"
4.0 ↓	57.6	$1.5\cdot10^{-2}$	(40.0)	"	1.00	2.8	"	$6.3\cdot10^{-13}$	"
4.5	64.8								
5.0									
5.5									

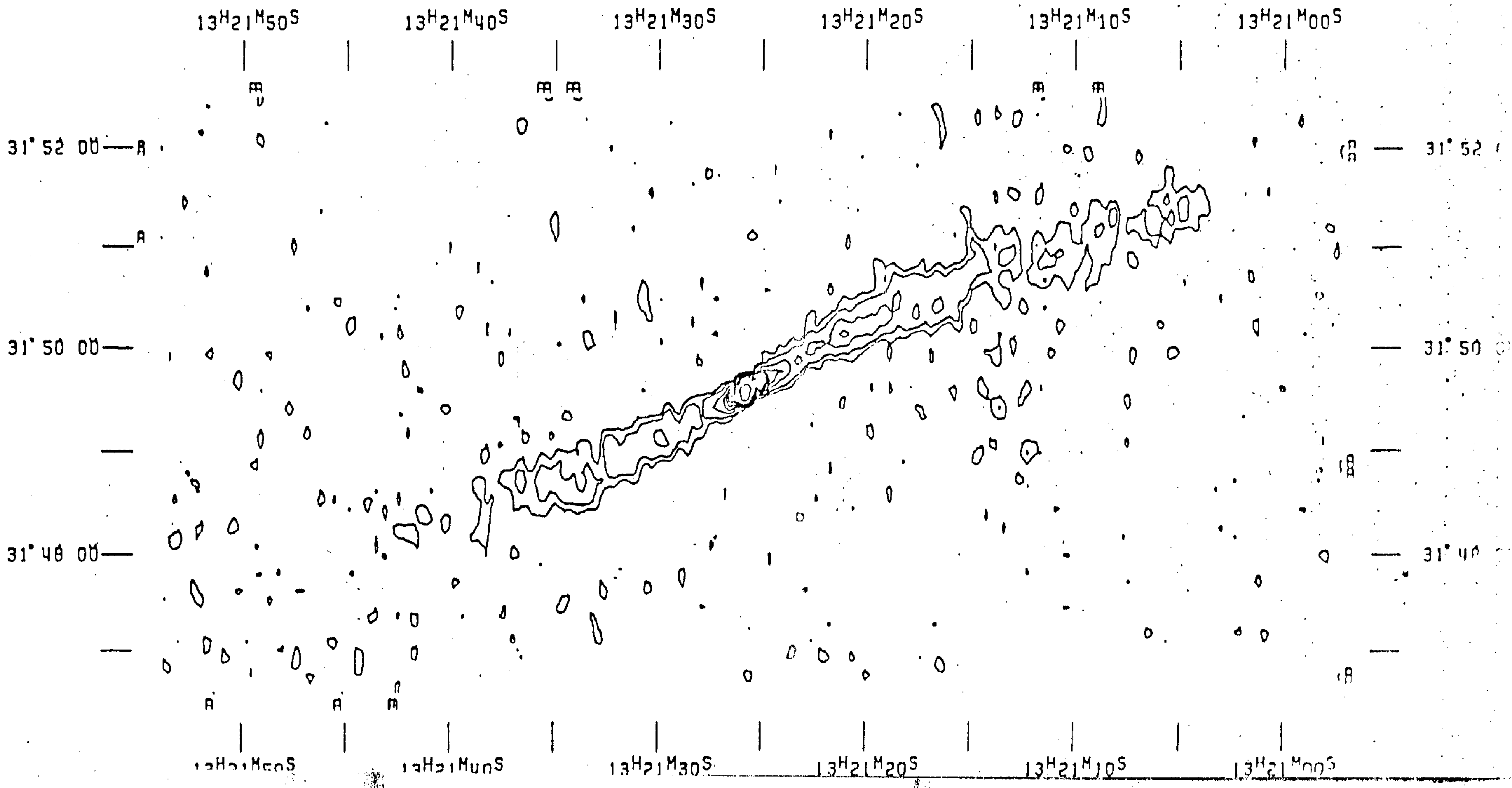
Table 6. Integrated polarization parameters

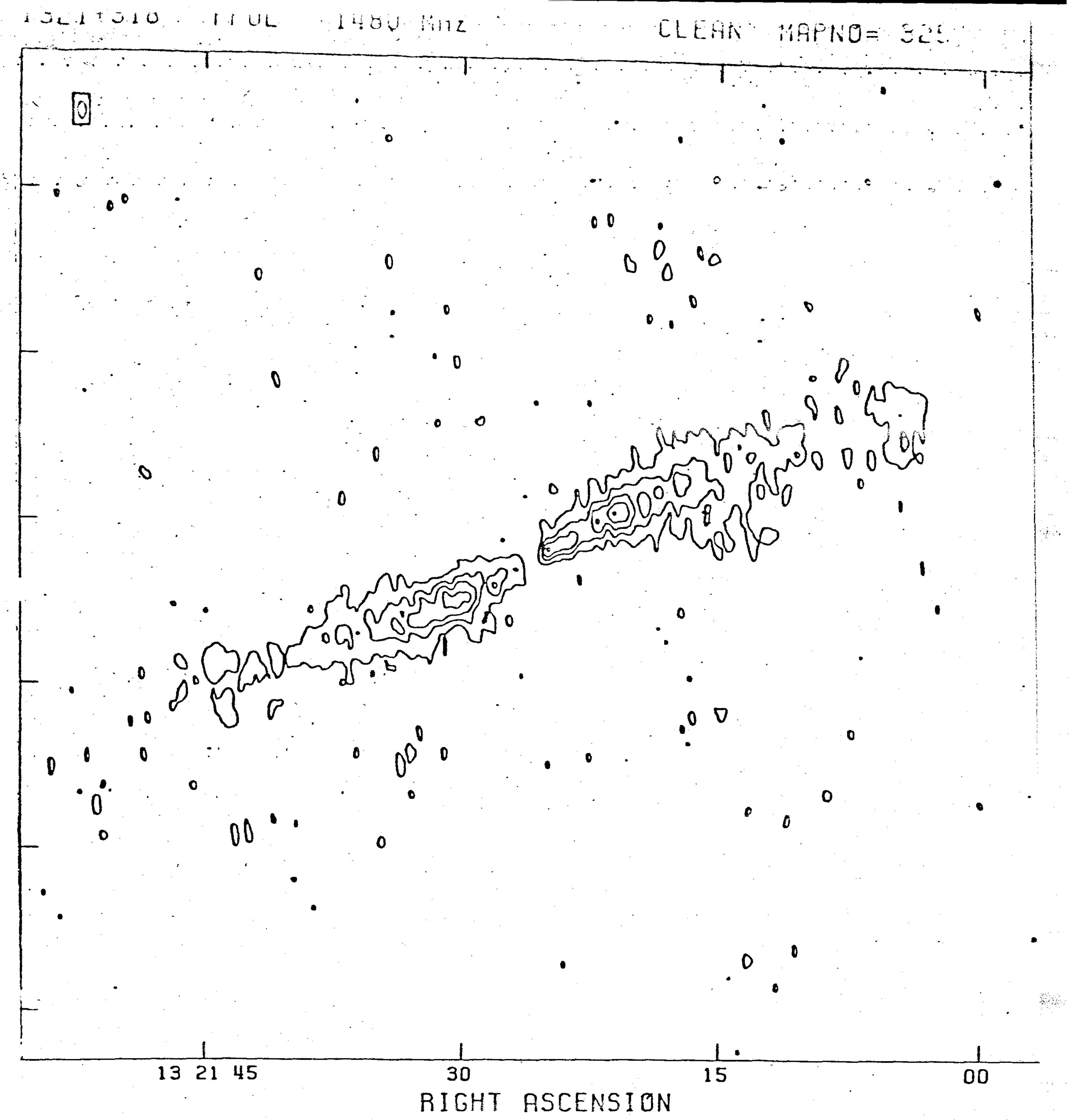
Frequency (GHz)	5.0	2.7	1.4	0.6
Fractional polarisation	20%	19%	21%	16%
Position angle	110°	120°	112°	155° ± 15

Table 7. Intrinsic properties of the broad components

	B2 1321+31	B2 0924+30
Radio Luminosity (W Hz)	$1.0 \cdot 10^{23}$	$1.7 \cdot 10^{23}$
Component sizes (kpc)	$\simeq 45$	80
Volume (cm^3)	$1.5 \cdot 10^{69}$	$7 \cdot 10^{69}$
Equipartition energy density (erg/cm^3)	$2 \cdot 10^{-13}$	$6 \cdot 10^{-14}$
Minimum energy (ergs)	$3 \cdot 10^{56}$	$4 \cdot 10^{56}$
H_{eq} (gauss)	$1.4 \cdot 10^{-6}$	$0.8 \cdot 10^{-6}$
$H_{\parallel} n_e l$ (cgs)	$3.8 \cdot 10^{12}$	—
n_e (cm^{-3})	$\sim 4 \cdot 10^{-5}$	—
Thermal plasma mass ($M_\odot$)	10^{8}	—
Temperature (°K)	$< 10^{8}$	—
Thermal energy (ergs)	$< 2\ 10^{57}$	—
Alfven velocity (km/sec)	600	—

nt. : .1, .2, .4, .6, .8,
1.0, 2.0, 4.0, 6.0,
8.0





PEAK FLUX = 3.6 MJY

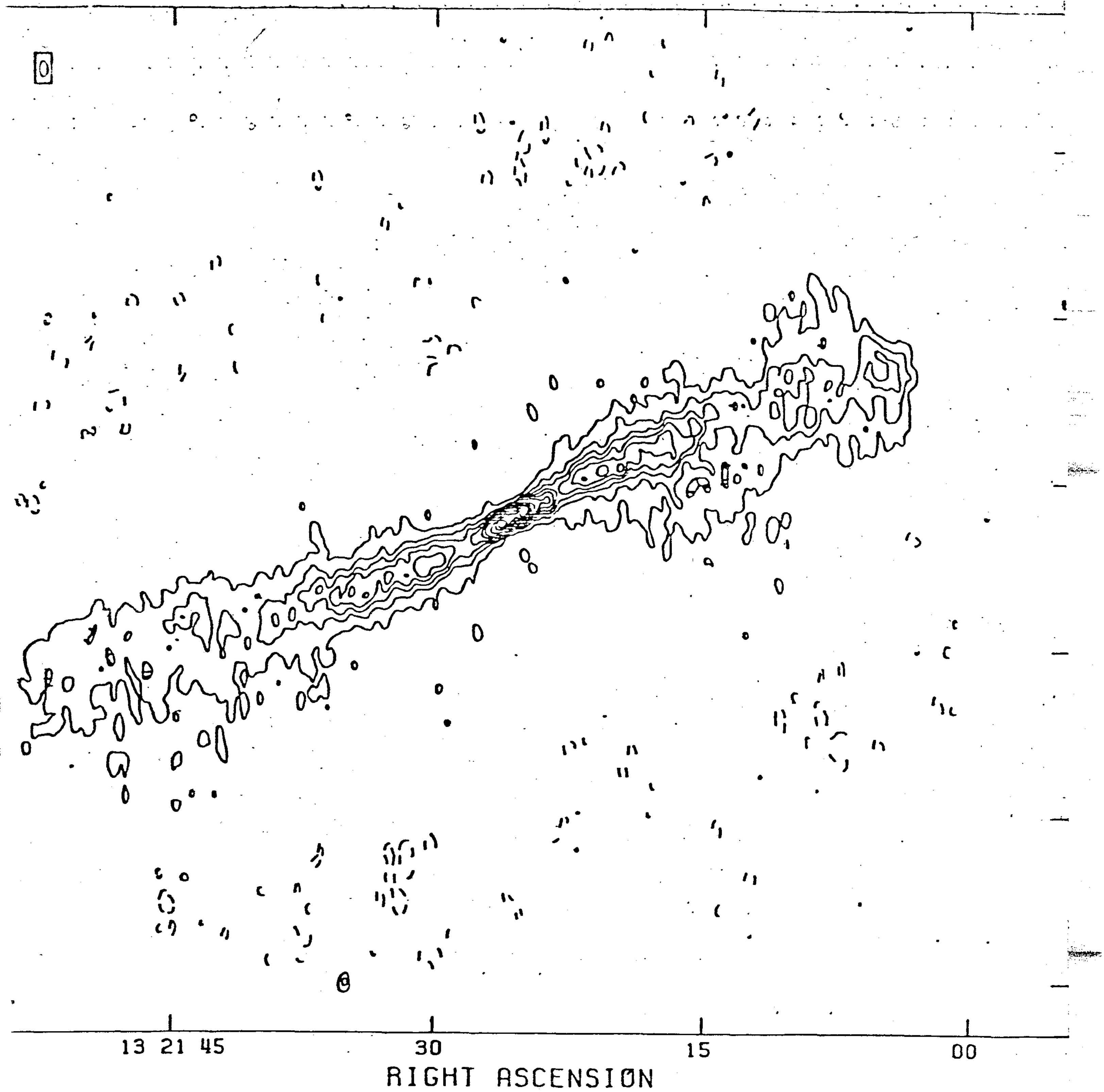
LEVS = 0.70 * (6 5 4 3 2 1)

CLEAN BEAM: MAJ. MIN. PA 12.00 6.00 0.0 NITER = 450

CENTER POSITION 13 21 15.997 31 50 23.96

fig. 3

321+318 IPOL 1480 MHZ CLEAN MAPNO= 325



AK FLUX = 14.0 MJY

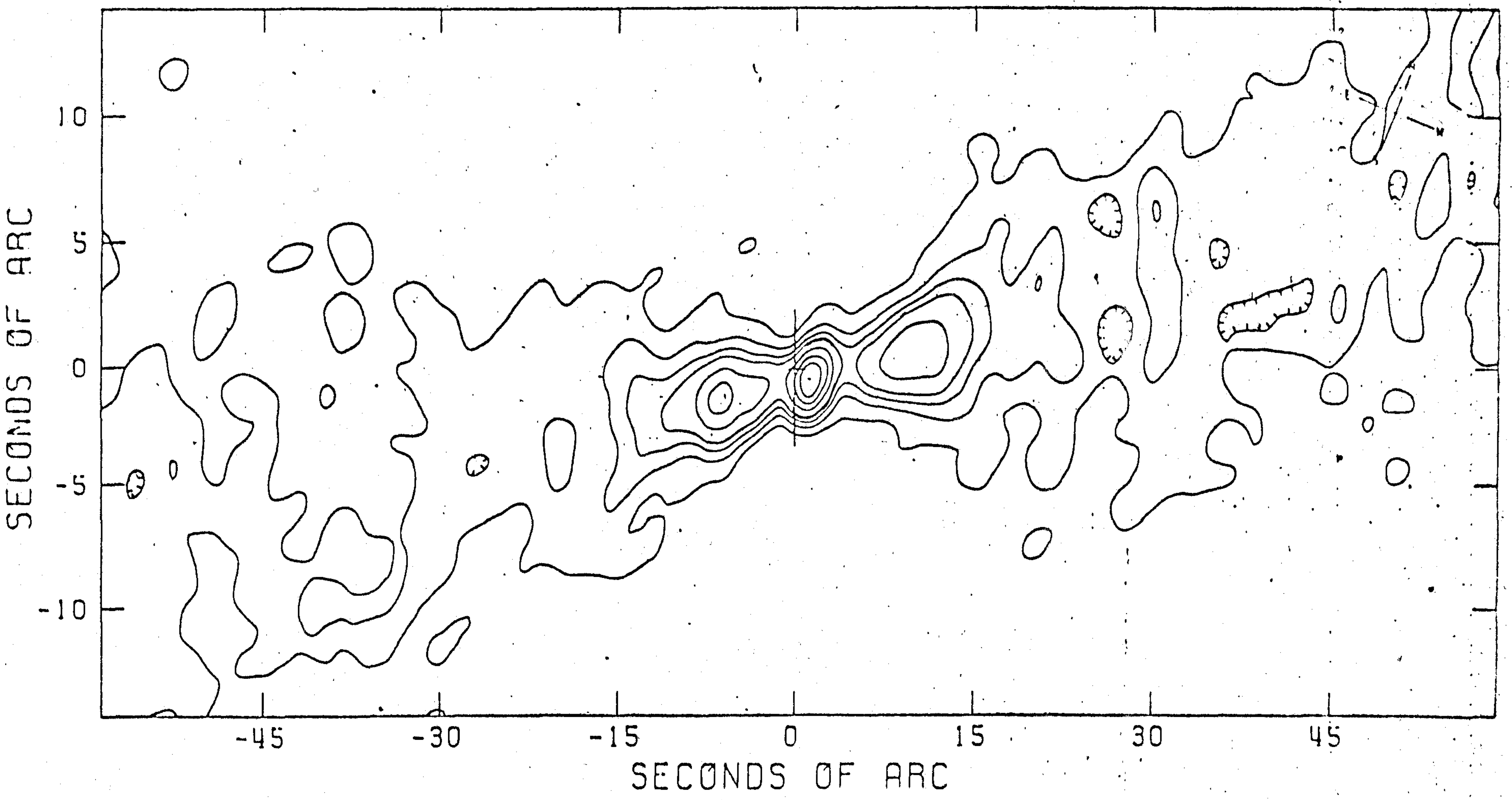
S = 1.00 * (12 10 8 6 5 4 3 2 1 -1)

N BEAM: MAJ. MIN. PA 12.00 6.00 0.0 NITER = 1210

ER POSITION 13 21 15.997 31 50 23.96

Fi 7

1321+318 IPOL 1480 MHZ CLEAN MAPNO= 330



PEAK FLUX = 7.7 MJY

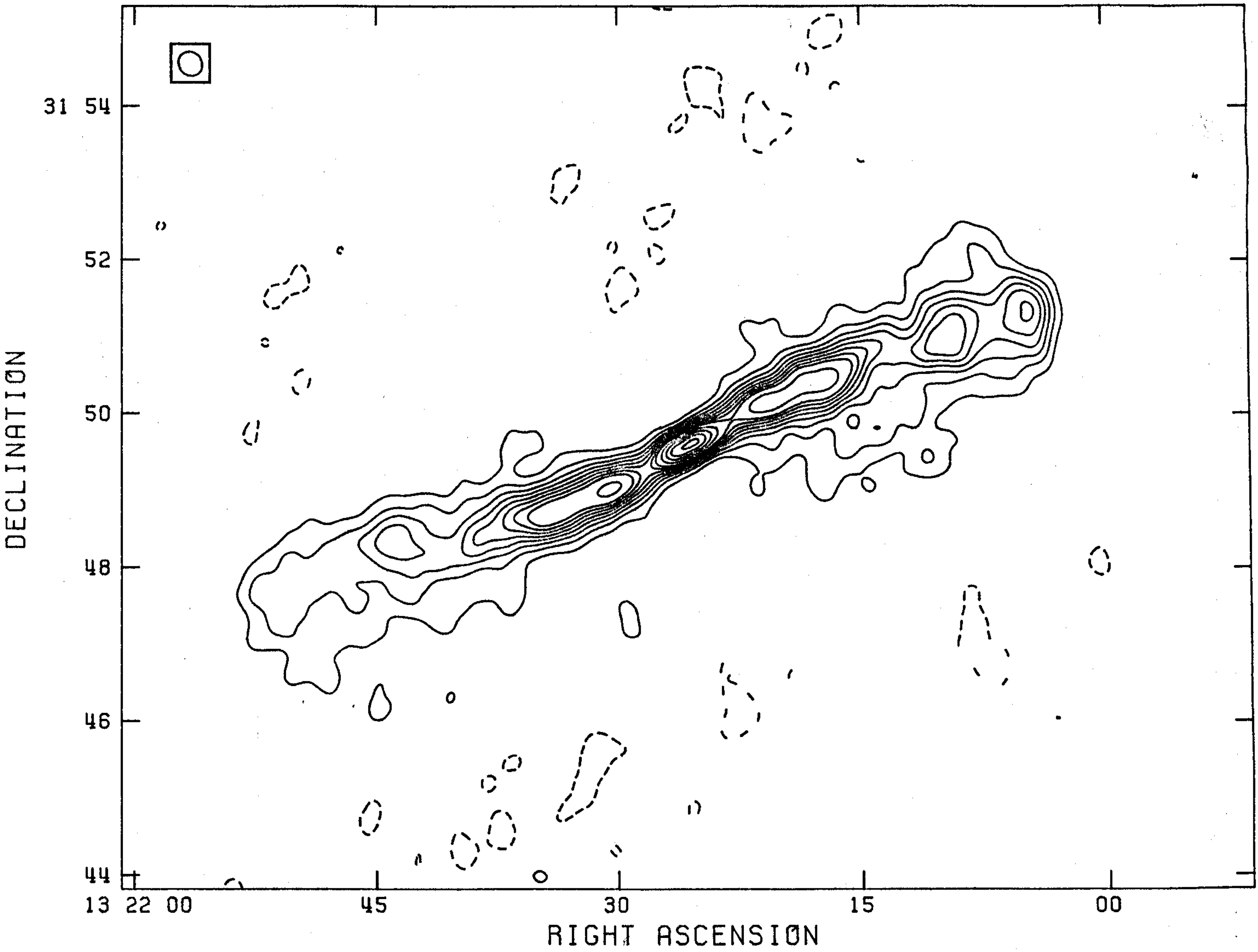
LEVS = 0.60 * (10 8 6 4 3 2 1 ,
-1)

CLEAN BEAM: MAJ. MIN. PA 3.00 2.10 -30.0 NITER = 1055

CENTER POSITION 13 21 25.882 31 49 33.93

25.78 33.4

1321+318 IPOL 1480 MHZ CLEAN MAPNO= 310

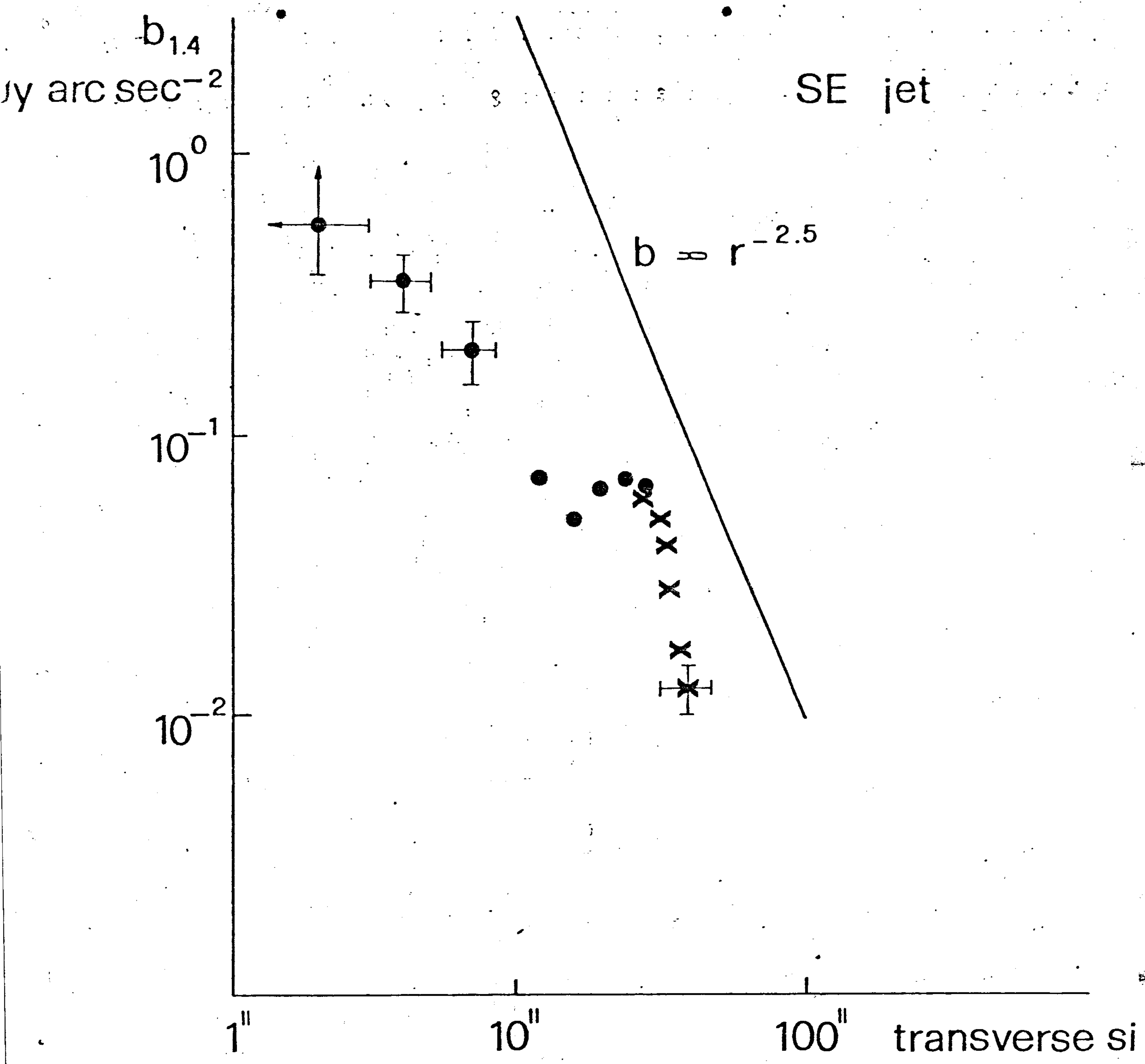


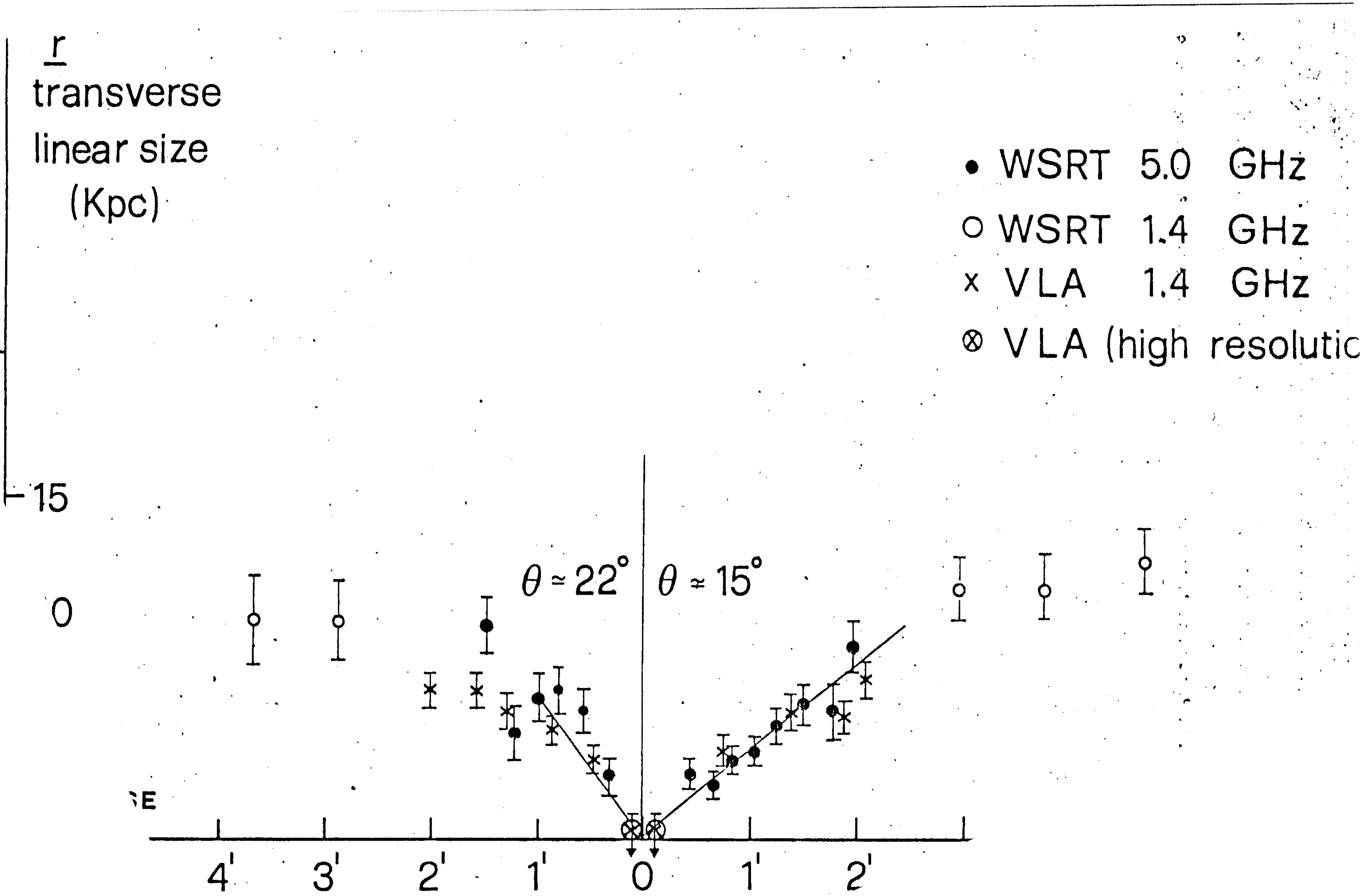
PEAK FLUX = 32.8 MJY

LEVS = 2.00 * (16 14 12 10 8 7 6 5 4 3 2 1 -1)

CLEAN BEAM: MAJ, MIN, PA 19.96 17.97 37.9 NITER = 800

CENTER POSITION 13 21 25.882 31 49 33.93


$b_{1.4}$
y arc sec^{-2}
SE jet
10^0
$b \propto r^{-2.5}$
10^{-1}
10^{-2}
1''
10''
100''
transverse si


r
transverse
linear size
(Kpc)
15
0
● WSRT 5.0 GHz
○ WSRT 1.4 GHz
x VLA 1.4 GHz
⊗ VLA (high resolutic
θ ≈ 22°
θ ≈ 15°
4'
3'
2'
1'
0
1'
2'