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HIGH RESOLUTION RADIO OBSERVATIONS OF LOW LUMINOSITY ELLIPTICAL GALAXIES

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Here are given the results of some observations of a homogeneous and complete sample of bright elliptical galaxies made with the Westerbork Synthesis Radio Telescope at 6, 21 and 50 centimeters.

This sample of galaxies was obtained from the identification of radiosources of the Second Bologna Survey with the galaxies of the Zwicky Catalogue. The coincidences were found by comparing about 8000 B2 sources with as many Zwicky galaxies. The optical positions of the identifications were measured on the P.S.S. prints with an accuracy of a few seconds of arc.

This sample of 54 galaxies has already been used for the determination of the Radio Luminosity Function of elliptical galaxies of low absolute radio luminosity. The results of this work are reported in two papers; the first concerning the radio and optical data, the second concerning the discussion.

BASIC DATA

54 radiogalaxies

$S_{408} \geq 0.2$ f.u. $m_{pg} \leq 15.7$ $24° \leq \delta \leq 40°$

Redshifts (M.H.Ulrich)

21,6 cm total power fluxes from Nançay (J.lequeux,R.Lucas)

50, 21, 6 cm Structure from Westerbork

On the radio side the sample is complete down to 0.2 f.u. at 408 MHz. On the optical side the completeness is that of the Zwicky catalogue, corresponding to about 15.7 photographic magnitude. The redshifts were measured by Marie Helene Ulrich. Observations were made with the Nançay telescope by Lequeux and Lucas at 21 and 6 cm. Others observations were made with the WSRT at 50, 21 and 6 cm. Generally few "short" observations were made at different hour angles. After the so called "clean" technique was used to remove the effect of undesired sidelobes. For few of the most extended sources synthesis observations were made with the WSRT in collaboration with R.D.Ekers.

The sample radioluminosity ranges from 10^{22} to 10^{26} W/Hz at 408 MHz. The sizes go up to 350 kpc with a Hubble costant H = 100.

The aims of this programme are:

1) The study of the radio structure and comparison with radiogalaxies of higher luminosity;

2) Comparison with radiogalaxies of similar radioluminosity, found in radio survey of Abell clusters.

The work is still in progress and the preliminary results are the following:

TENTATIVE CLASSIFICATION OF RADIOGALAXIES

Core only	9	17%
Double	29	76%
Halo or extended	11	
Tails	4	7%

30 of the resolved show a nuclear core	39	78%
9 core only		
11 no core		22%
3 difficult to state		

9 sources appear not resolved and near the galaxy center and are classified as "cores". We call"core" a source whose angular diameter is less than 6" . Generally these compact sources have radio spectra between 408 and 5000 MHz flatter than those of the extended sources. The most common kind of radio structure is double sources .

The WSRT and Nançay data are in good agreement as can be seen in Fig.1. Fig.2 shows the 6 cm map of 22 36+35, which is a classic double source. The scale is in arcsecond in declination and in seconds of time in right ascention. In the lower left corner there is the beam half-sizes. The two components of the radiosource are slightly extended.

Fig.3 shows the 6 cm map of the source 14 22+26 , as one can see the two components show a very rich structure. There is a core in the center coinciding with the optical position of the galaxy. This radiogalaxy was classified as DC. The optical object does not belong to a cluster of galaxies.

In Fig.4 we can see another case of double source with a faint extension in the north-east position. This is a 6 cm map of the source 00 55+26, which belongs to a group of galaxies. Comparing it with the next Fig.5, which represents the same source at 21 cm synthesis map, you can see that the north-east feature is stronger and a new feature appears in the west region, which was not visible in the other map. This is due probably to the difference between the spectral indices of the components. The external components have a steeper spectral index $\alpha = 1.2$,while the inner components have a spectral index $\alpha = 0.7$.

Fig.6 shows the 6 cm map of the source 07 55+37, which is a typical case of a double radio source with a very bright nuclear core.

Fig.7 shows a typical halo-core case.

The 21 cm synthesis map of the source 09 24+30, shown in Fig.8, representes a very interesting case. The galaxy is in the center of the double source. Far from the center there are three compact flat spectrum sources aligned. If the sources are physically associated to the galaxy, the angular distance of the extreme sources is about 36' arcminutes corresponding to a linear size of about almost 1 Mpc (830 kp) with a H = 100. The south-west component coincides within 2" with a very faint ultraviolet object of 21th magnitudine.

Fig.9 shows the 21 cm synthesis map of 16 15+35. Thi is a very beautiful example of a galaxy with a tail stucture. The galaxy is in the head of the structure. Comparing it with the 50 cm map

FIG. 1

WSRT / Mançay 1415 MHz fluxes

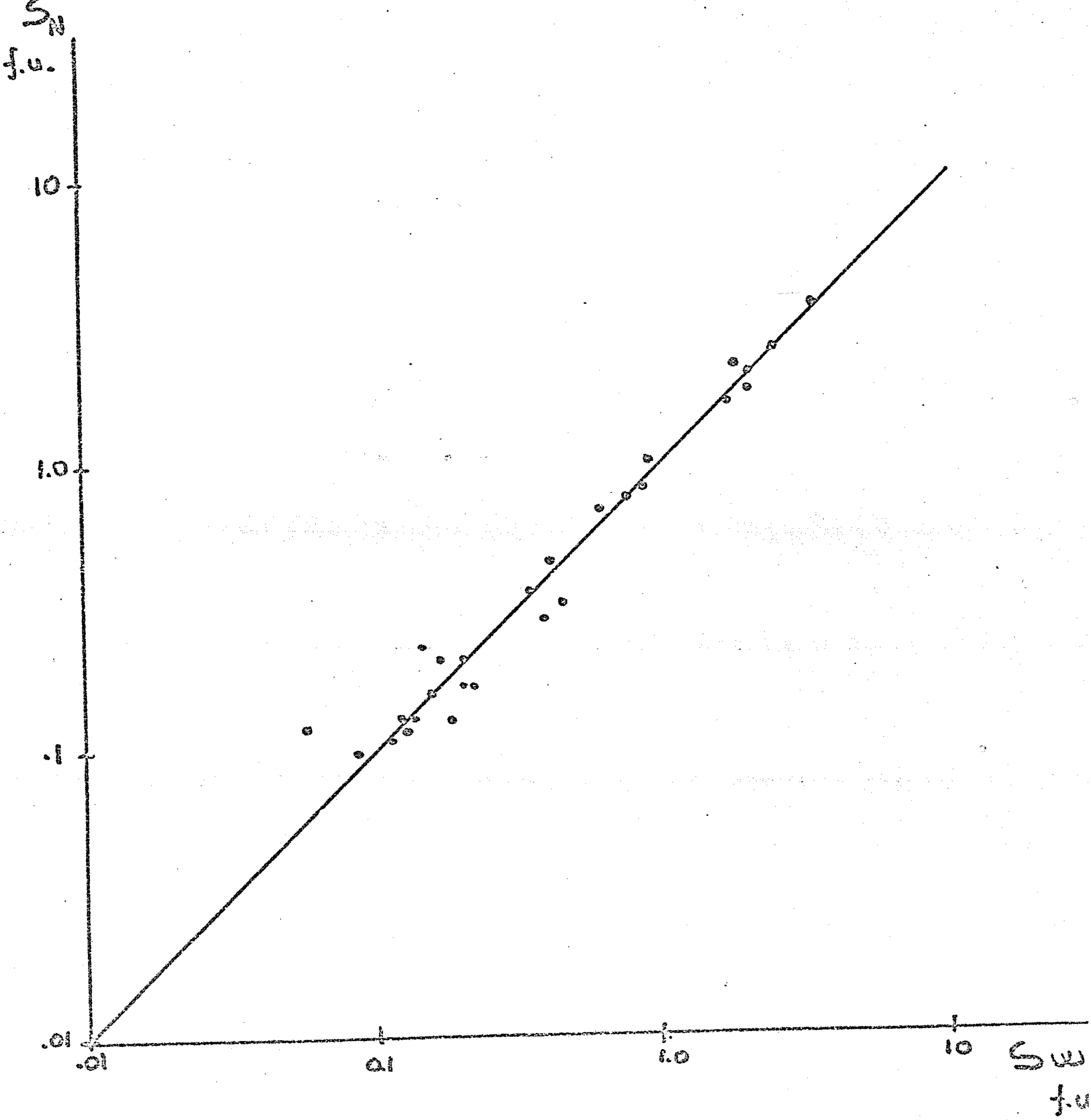


FIG. 2

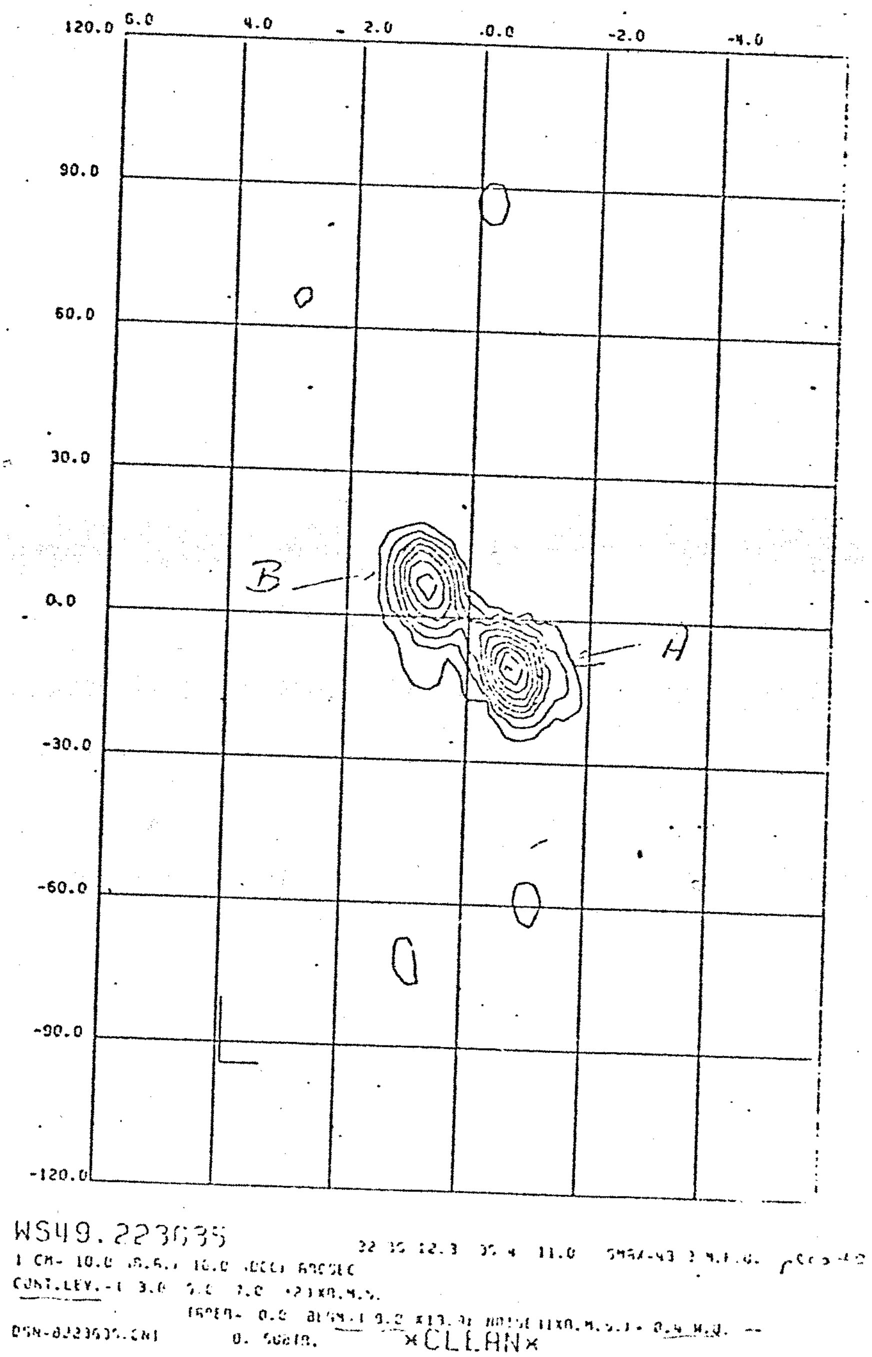
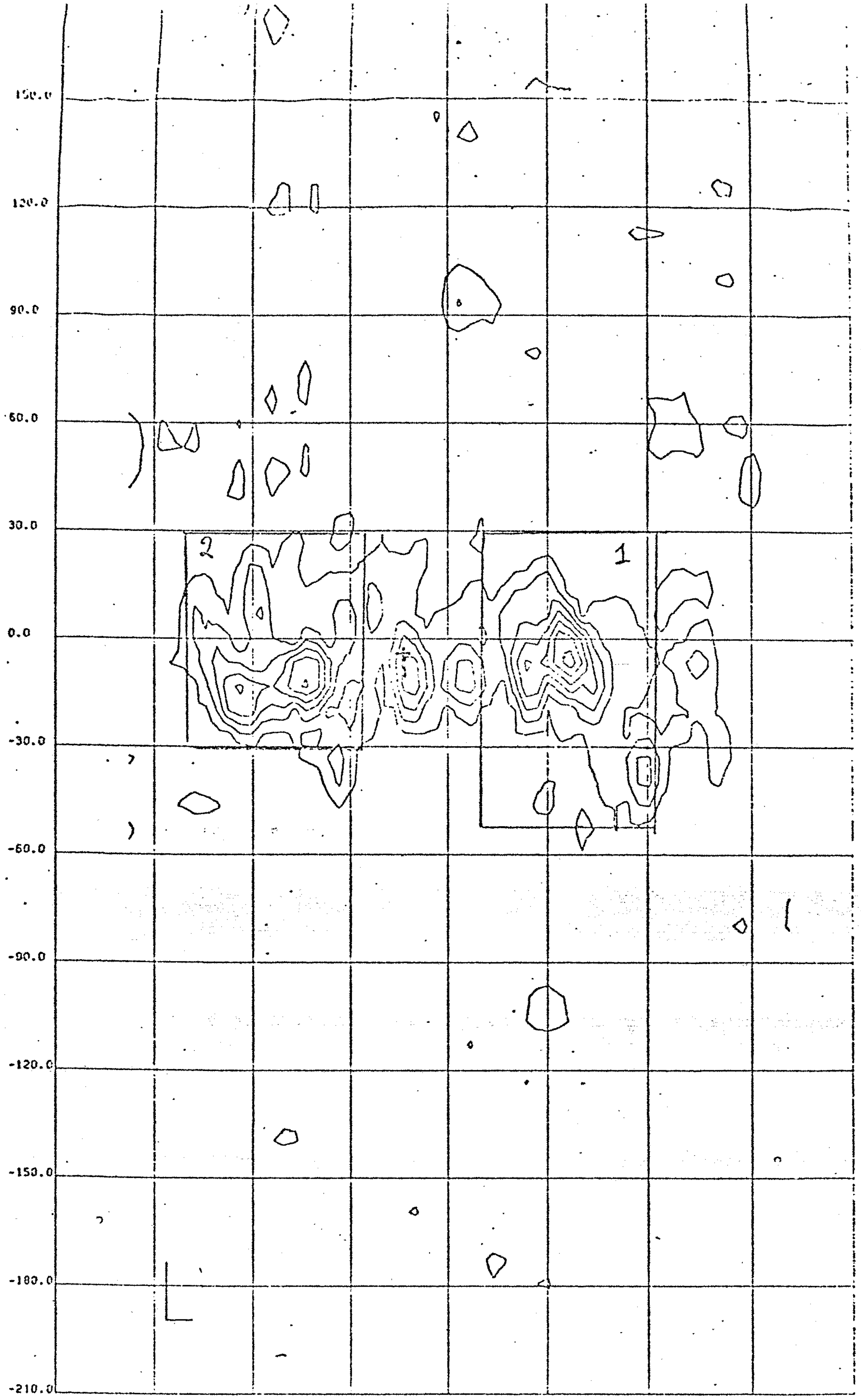

6.0
4.0
2.0
0.0
-2.0
-4.0
120.0
90.0
60.0
30.0
0.0
-30.0
-60.0
-90.0
-120.0
B
H
WS49.223635
×CLEAN×

FIG. 3



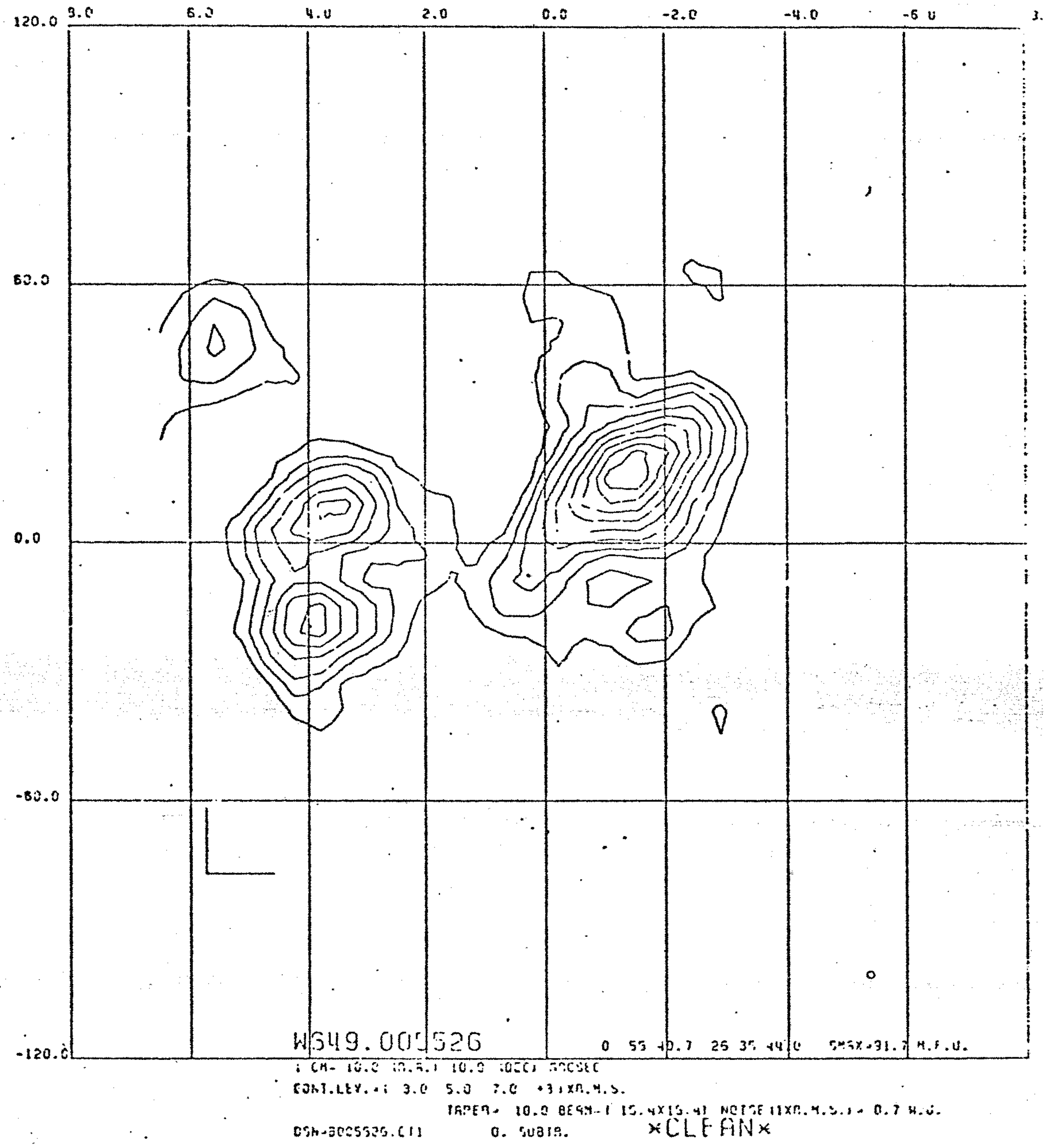
WS49.142225

CONT.LEV. 2.0 4.0 5.0

0.5

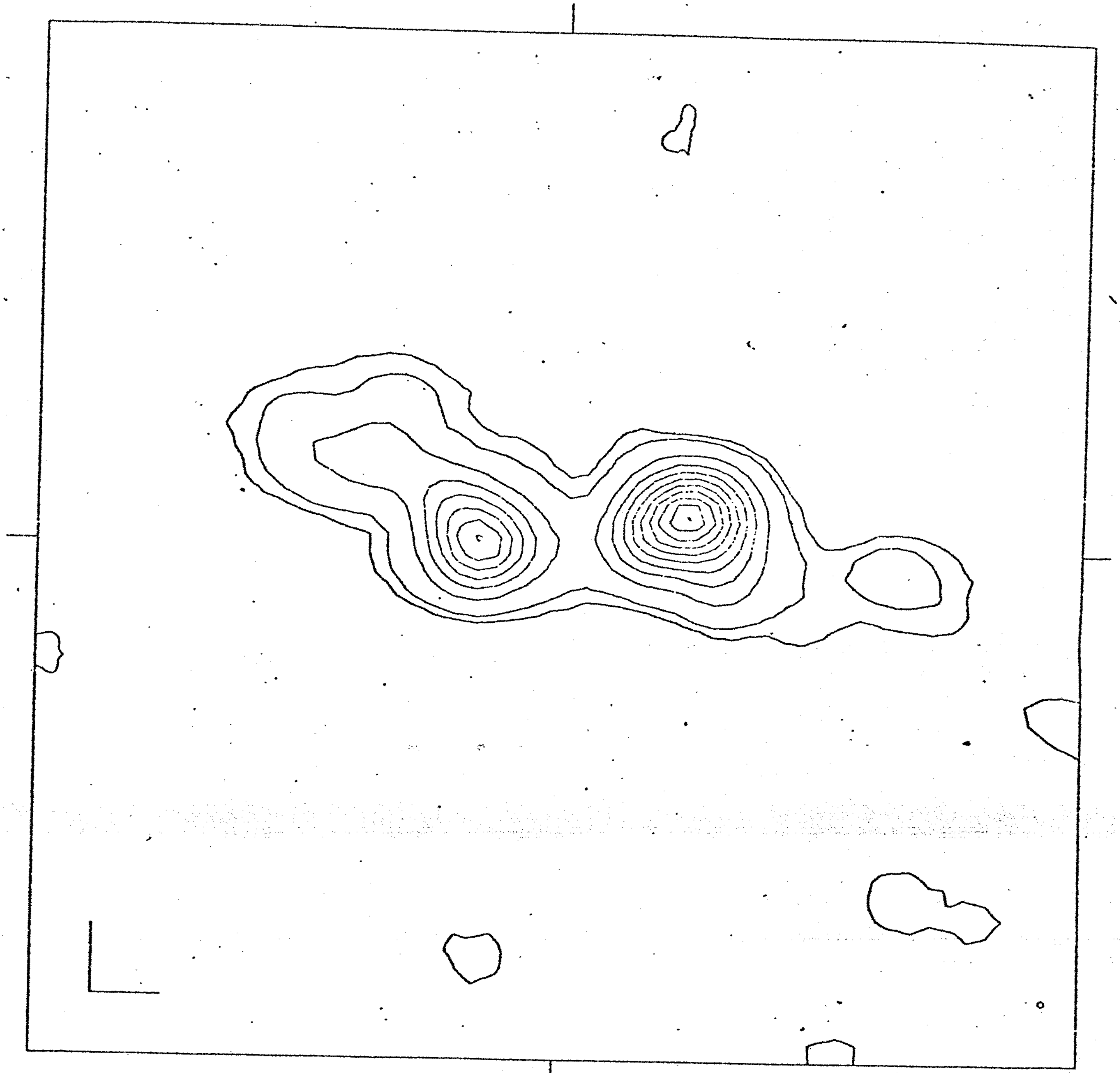
xCLEANx

FIG. 4



8.0
6.0
4.0
2.0
0.0
-2.0
-4.0
-6.0
120.0
60.0
0.0
-60.0
-120.0
W649.001526
CONT.LEV.= 3.0 5.0 7.0
CLEAN

FIG.5



WC62.005526

0 55 42.4 25 35 35.0 SMAX=75.7 W.U.

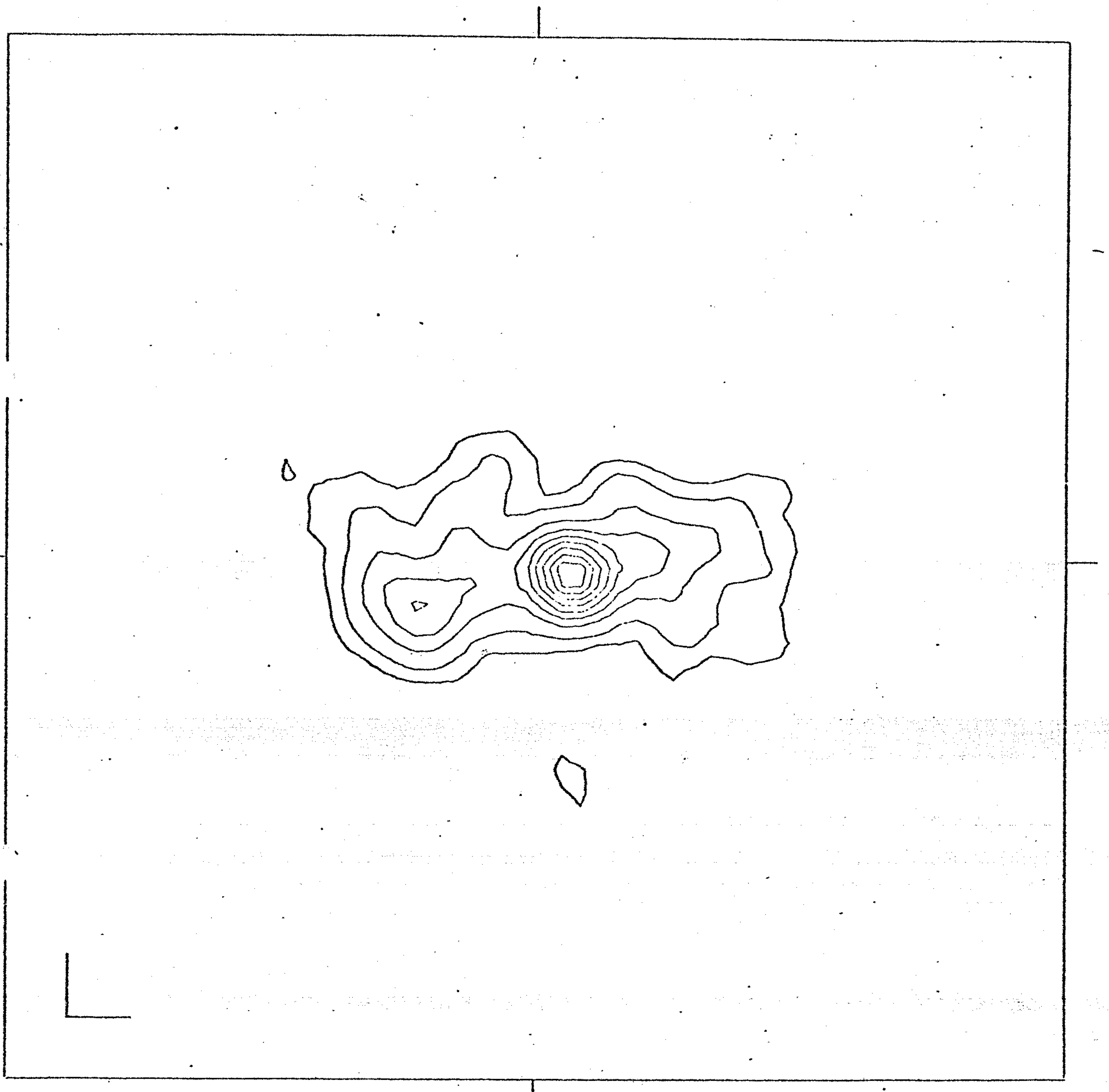
1 CM= 20.0 (R.A.) 44.7 (DEC) ARCSEC

CONT.LEV.=(3.0 6.0 +12XR.M.S.

TAPER= 10.0 BEAM=(23.4X52.4) NOISE(1XR.M.S.)= 0.7 W.U.

0. SUBTR. *CLEAN*

FIG.6



WS49.075537 7 55 10.0 37 55 30.0 SMAX=53.0 W.U.

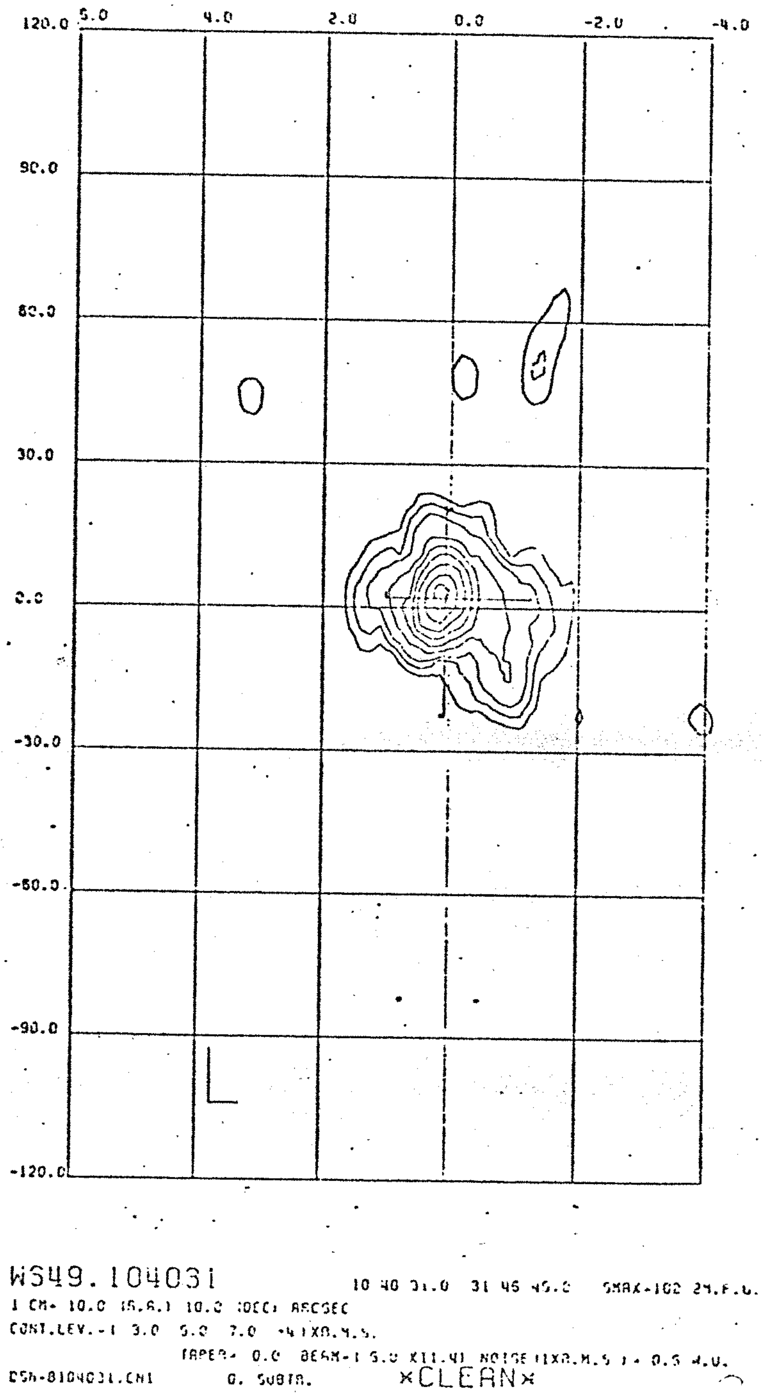
1 CM= 20.0 (R.A.) 32.5 (DEC) ARCSEC

CONT.LEV.=(3.0 6.0 +6)XR.M.S.

TAPER= 20.0 BEAM=(20.9X34.0) NOISE(1XR.M.S.)= 1.1 W.U.

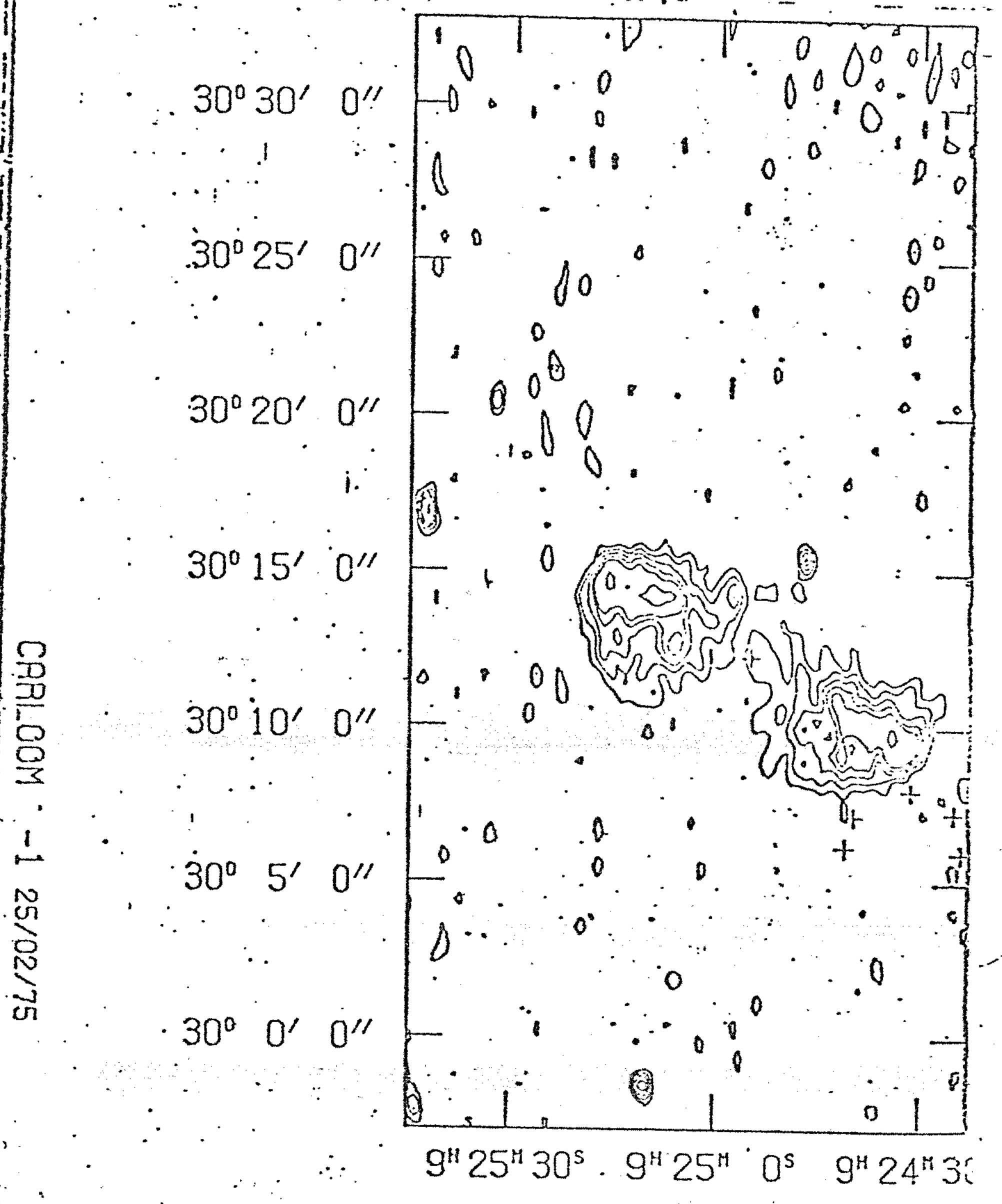
0. SUBTR. *CLEAN*

FIG.7



120.0
90.0
60.0
30.0
0.0
-30.0
-60.0
-90.0
-120.0
6.0
4.0
2.0
0.0
-2.0
-4.0
L
W549.104031
10 40 31.0 31 45 45.0 SMAX-102 24.F.U.
1 CM- 10.0 (S.A.) 10.0 (DEC) ARCSEC
CONT.LEV.-1 3.0 5.0 7.0 -4 IXR.M.S.
TAPER- 0.0 BEAM-1 5.0 X11.41 NOISE(1XR.M.S.)- 0.5 M.U.
DSA-8104031.CN1 0. SUBTR. ×CLEAN×

FIG.8



max angular ext. ≈ 11'.6

FIG. 9

WC 85.1615.35

Cont.: 5, 10, ... a.u.
1, 2, 3, 4 "
0.5 "

6.7"/mm.

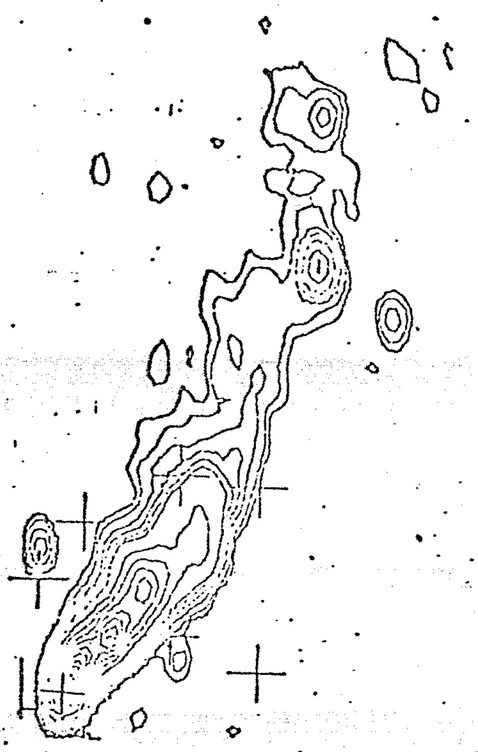


FIG. 10

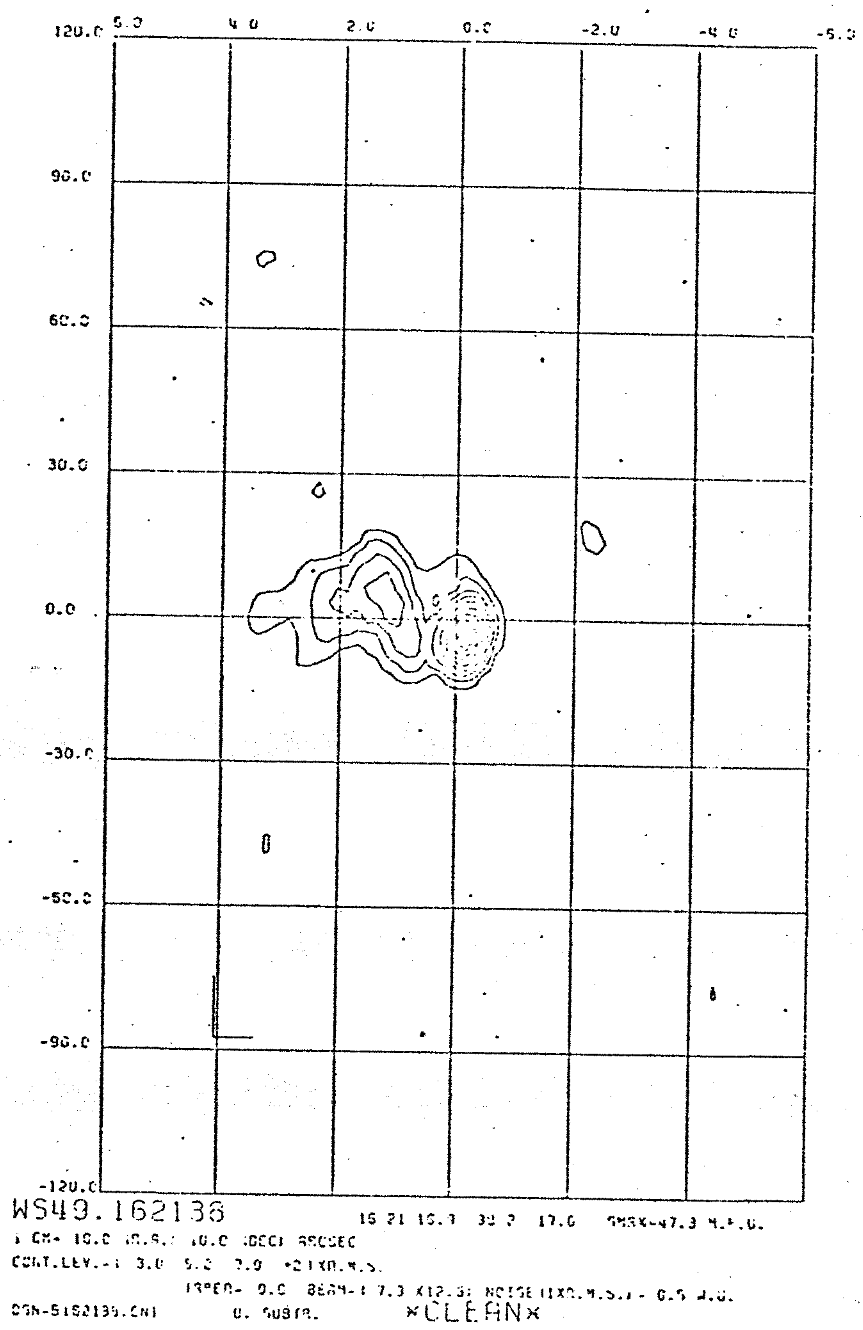
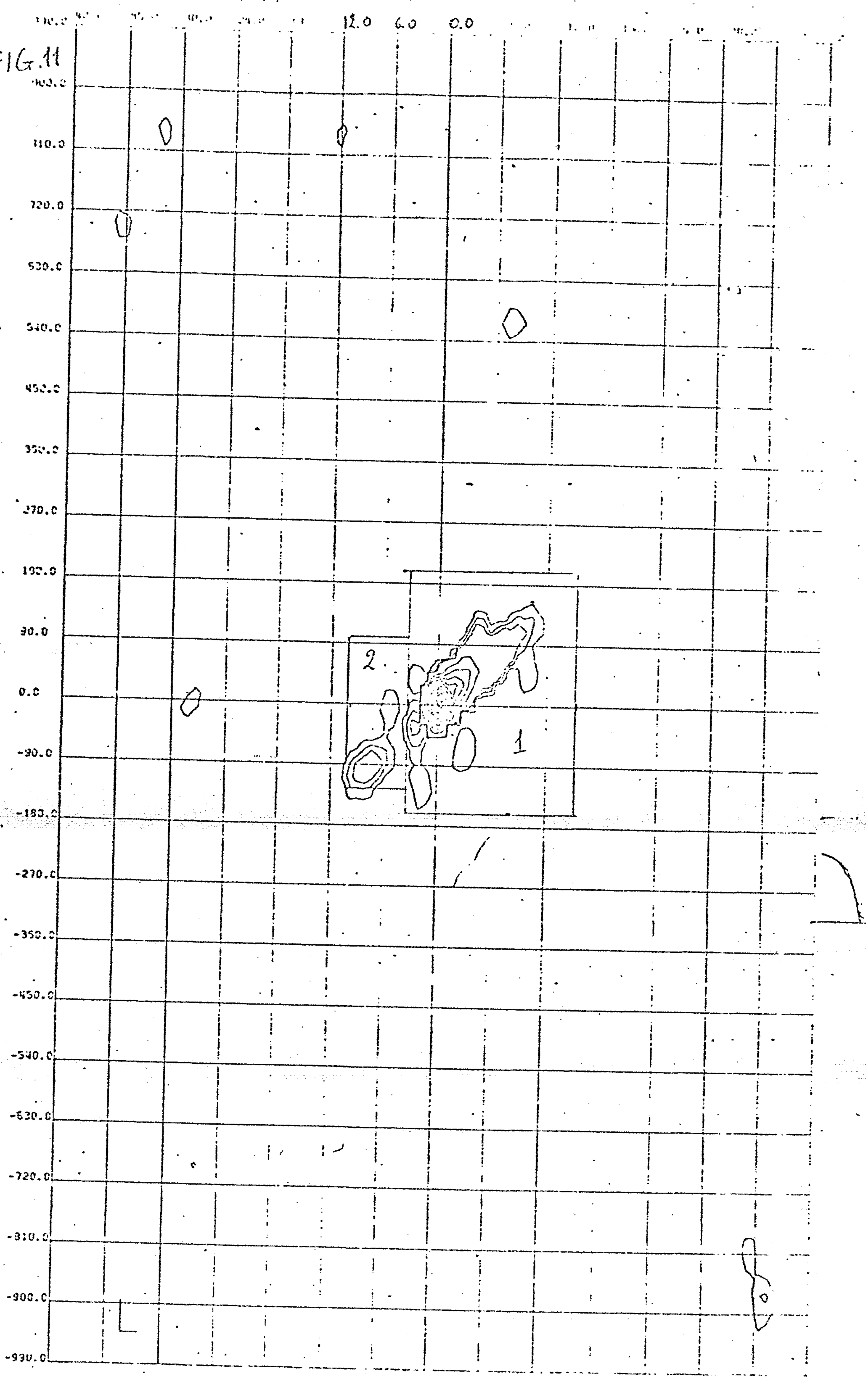


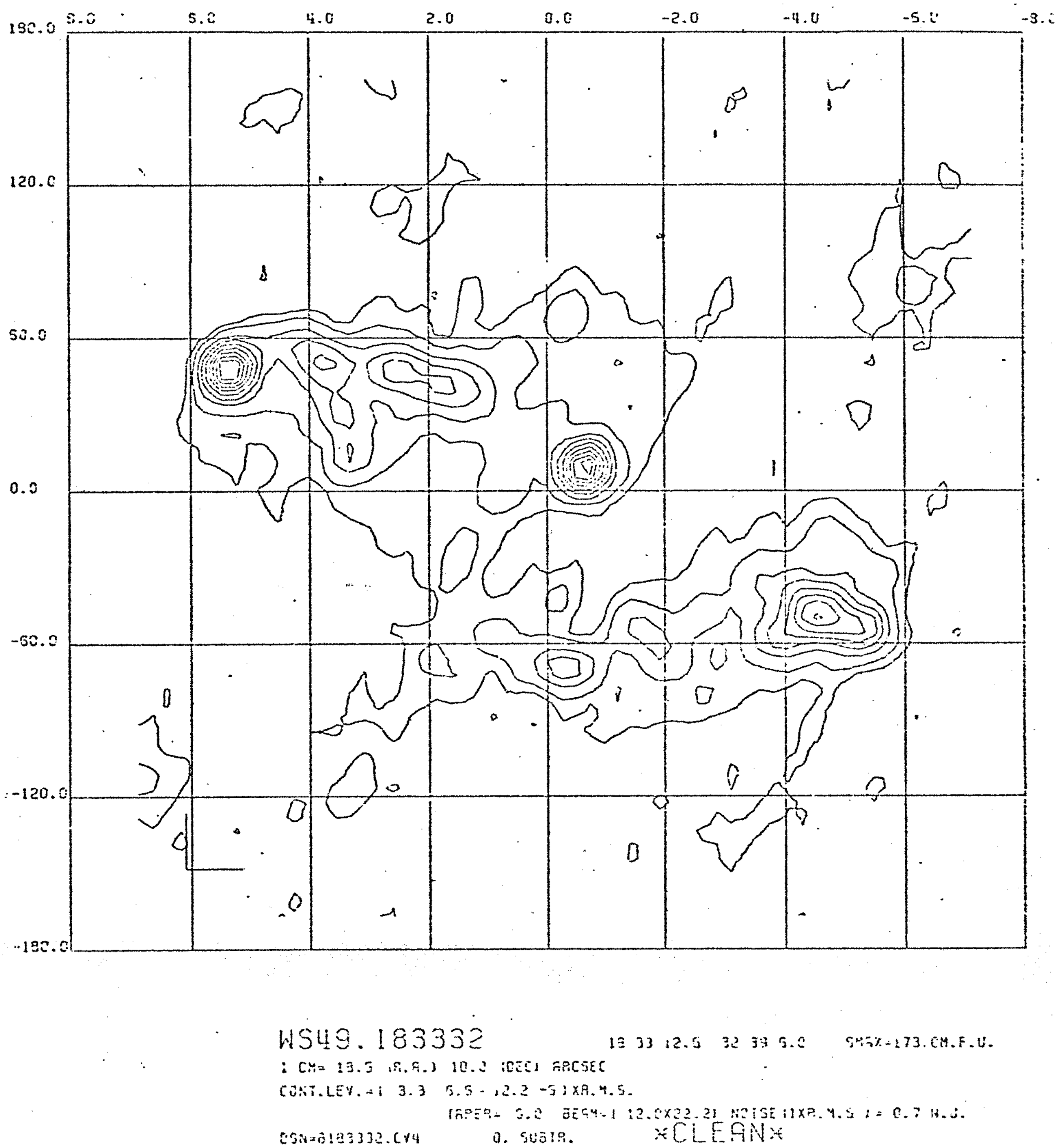
FIG.11



WS62.00SS30

CONT.LEV

FIG. 12



4.0
2.0
0.0
-2.0
-4.0
180.0
120.0
60.0
0.0
-60.0
-120.0
-180.0
WS49.183332
18 33 12.5 32 38 5.0 SMAX=173.CM.F.U.
1 CM= 13.5 (R.A.) 10.2 (DEC) ARCSEC
CONT.LEV.=(3.3 6.5 - 12.2 -5)XR.M.S.
TAPER= 5.0 BEAM=(12.0X22.2) NOISE(1XR.M.S.)= 0.7 M.J.
DSN=6183332.CV4
0. SUBTR.
×CLEAN×