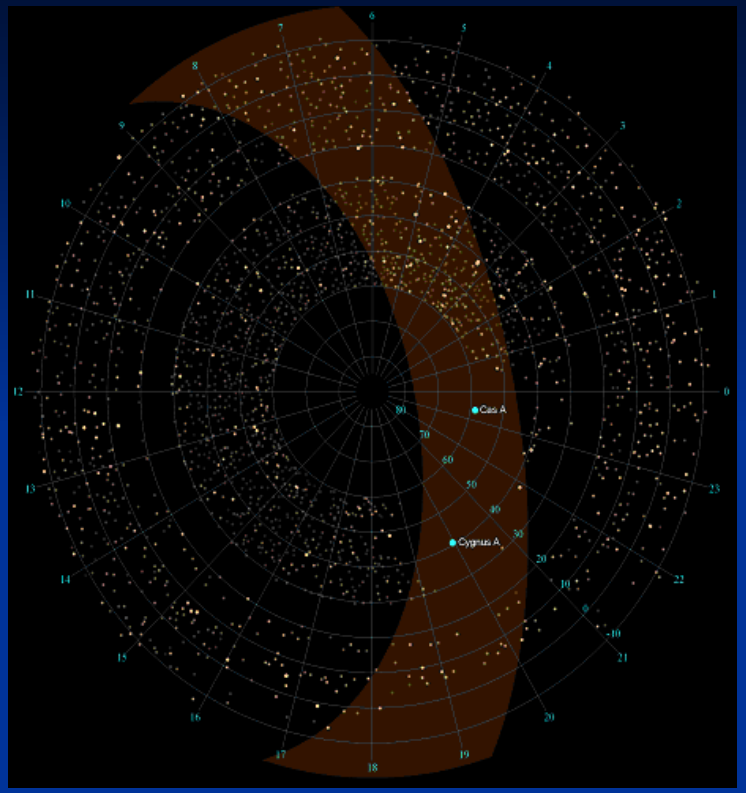
DECAMETRIC CONTINUUM INVESTIGATIONS AT UTR-2

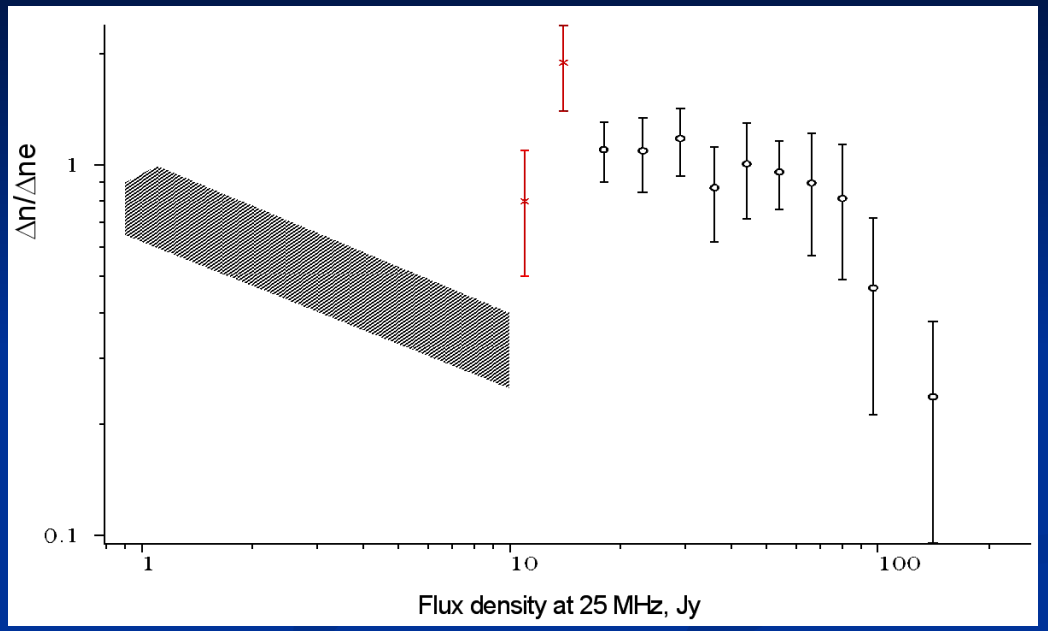
M.A. Sidorchuk, K.M. Sidorchuk, N.M. Vasilenko, E.A. Abramenkov, D.V. Mukha, S.M. Zakharenko

Institute of Radio Astronomy, National Academy of Sciences of Ukraine, Kharkov, Ukraine

e-mail: sidor@rian.kharkov.ua

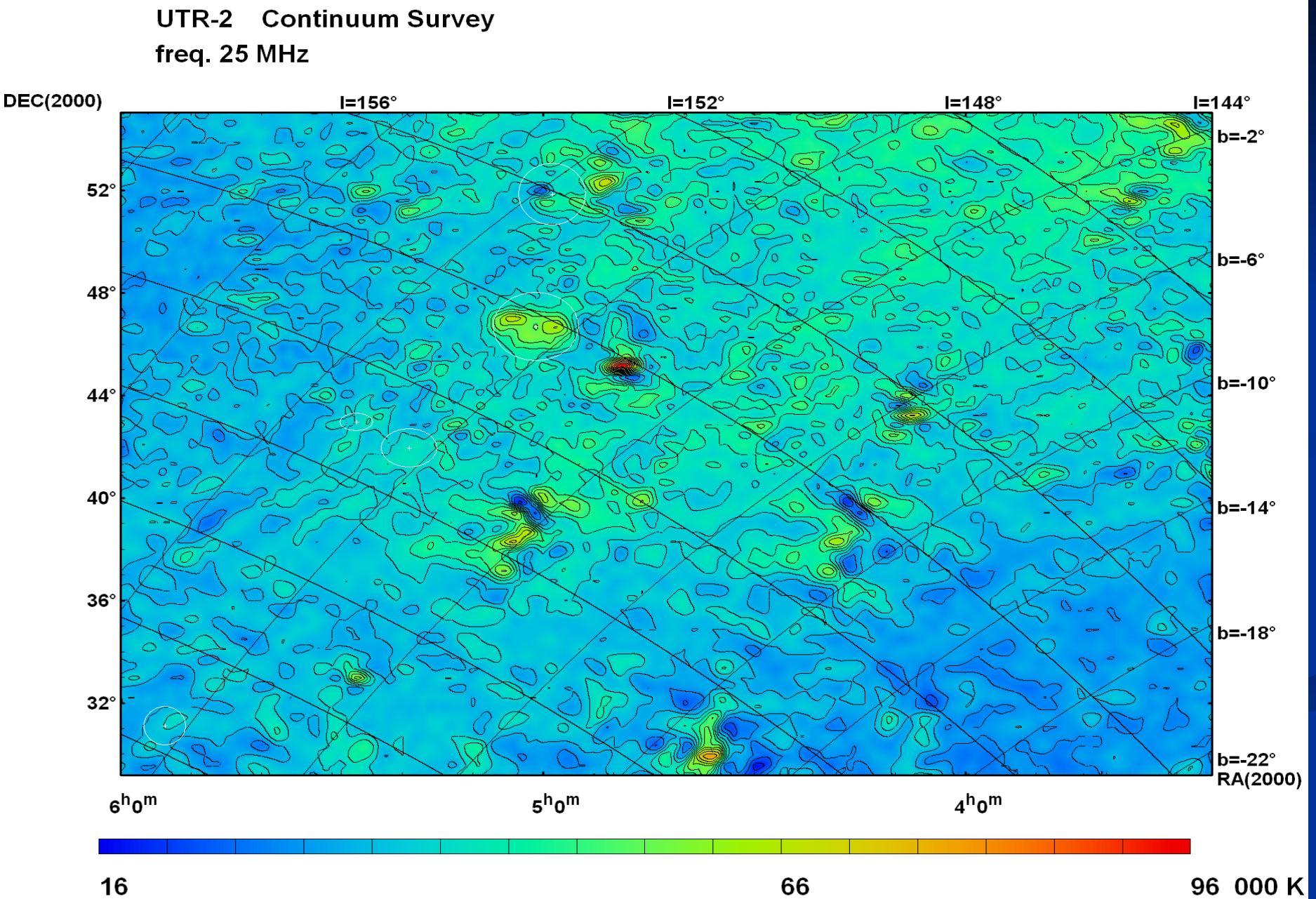
UTR-2 Discrete Sources Survey





- UTR-2 catalogue coverage of the Northern sky. Sizes of individual sources on the figure represent their flux densities. Shaded region is the Galactic disk: |b| < 15°. **2300** discrete sources were detected.
- Results of source count made for UTR-2 survey. Dashed area is the confidence region calculated for confused radio sources. The data in the range of fluxes from 20 to 80 Jy correspond to power law dependence with exponent of **1.84**.

UTR-2 Northern Sky Survey



Maps of the target continuum observations at UTR-2 radio telescope

HII Regions

№	DEC. (° ′)$_{1950}$	R.A. (h m)$_{1950}$	Name	Publication
1	-03 40 – 01 10	04 22 – 06 18	Barnard's Loop, IC434 (HII)	1992SvA....36..246A
2	-01 00 – 04 00	06 05 – 07 08	Sh280,282,284 (HII)	1988AbramenkovPhD
3	02 50 – 08 15	06 00 – 07 05	NGC2237, Rosette nebula (HII)	1978Ap&SS..54..187K
4	06 00 – 12 00	05 10 – 06 07	Sh264 (HII)	1988AbramenkovPhD
5	06 50 – 12 50	06 05 – 07 05	NGC2264 (HII)	1982SvA....26..160A
6	31 50 – 36 50	04 45 – 05 45	IC405, 410 (HII)	1983SvA....27...32A
7	33 50 – 39 00	03 30 – 04 30	NGC 1499 (HII)	1978Ap&SS..58..347K
8	41 30 – 46 10	20 40 – 21 55	Sh117, 119 (HII)	1992Ap.....35..274A
9	50 40 – 55 10	03 30 – 04 35	Sh205,206,209, (HII),L1407(dust cloud)	1985SvA....29..616A
10	57 15 – 62 05	02 05 – 03 35	W4,W5,Sh202 (HII)	1992SvA....36..374A

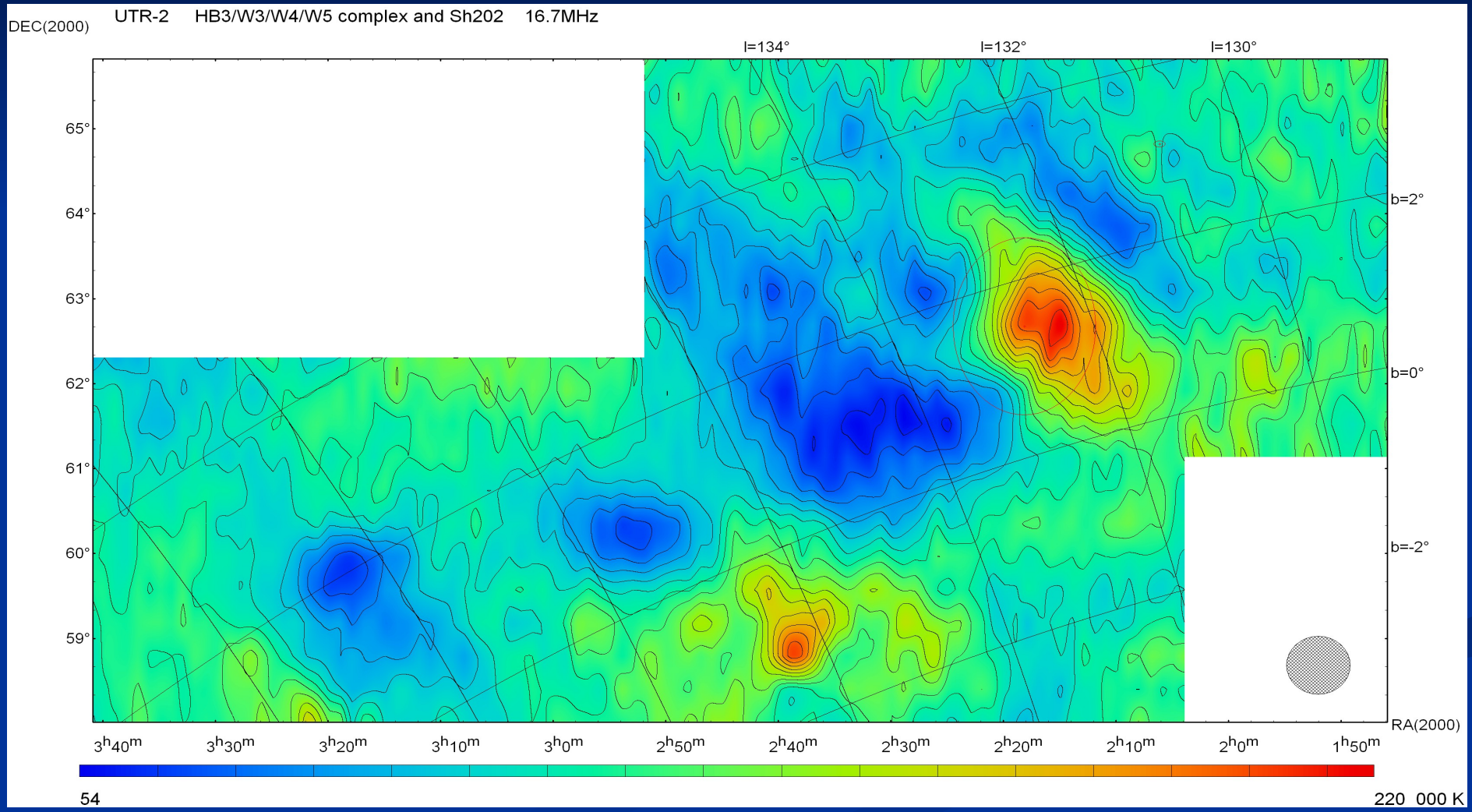
Supernova remnants

№	DEC. (° ′)$_{1950}$	R.A. (h m)$_{1950}$	Name	Publication
1	-03 57 – 03 13	17 38 – 19 40	W44, L=32^0 (SNR's)	-
2	01 50 – 13 00	06 00 – 07 05	Monocer. Neb., PKS0646+06 (SNR's)	1982DoUkr…….44A
3	02 49 – 09 11	18 45 – 19 55	W50, L=40^0 (SNR's)	1987XIXth Gal&ExtgalRA, Abstr.
4	13 55 – 19 23	05 30 – 06 40	PKS0607+17 (SNR)	1988A&A…200..185K
5	21 31 – 23 30	05 54 – 06 33	IC 443 (SNR)	2006RPh&RA (in Russian)
6	27 34 – 32 26	18 39 – 21 40	Cygnus Loop, L=65^0 (SNR's)	2006 XXVI GA IAU, Abs. book
7	44 45 – 49 10	04 05 – 05 15	HB9 (SNR), S216 (PN)	1988SvA....32..634K, 1987KFNT….3…11A
8	48 12 – 52 48	20 10 – 21 20	HB21 (SNR)	1989KFNT….5…44K
9	60 55 – 65 30	01 40 – 02 50	HB3, 3C58 (SNR's)	2006RPh&RA (in Russian)
10	70 00 – 74 33	23 20 – 00 50	CTA1 (SNR)	1990SvA….34..197K

Dust and molecular clouds, galaxy, galactic clusters

1	δ_0 = 25 30	04 15 – 05 10	Heiles2 (dust cloud)	1982SvA....26..303A
2	25 46 – 30 42	12 20 – 13 31	Coma (Gal. Cluster)	-
3	29 20 – 34 10	03 10 – 04 10	Per OB-2 (dust cloud)	1988AbramenkovPhD
4	37 40 – 42 19	09 08 – 10 15	Min. brightness region	-
5	38 41 – 43 20	00 05 – 01 15	M31 (Galaxy)	1991 IRA NASU,Prp.49(in Ru.)
6	63 17 – 64 52	16 56 – 17 26	A2255 (Gal. Cluster)	-
7	69 11 – 70 49	08 38 – 09 38	UMC (molecular cloud)	-

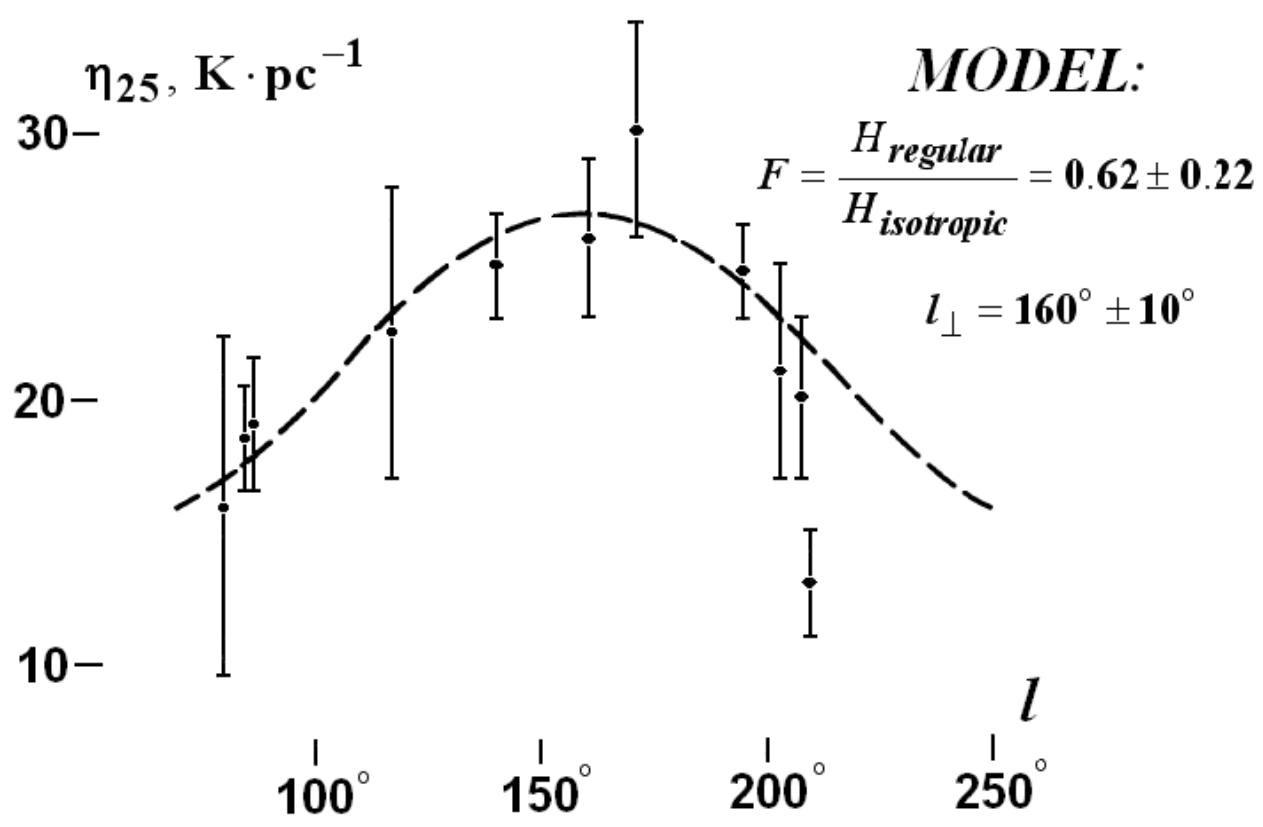
HB3/W3/W4/W5 complex and S 202



Physical parameters of HII regions and volume density of the Galactic background at 25 MHz

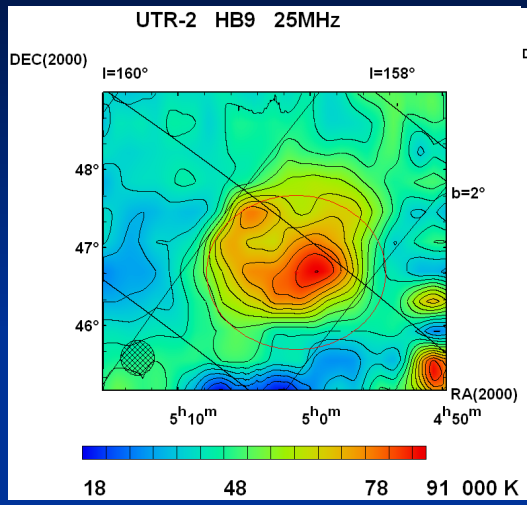
HII region	T_e, K	EM, pc∗cm^{-6}	τ (25MHz)	l (°)	L (pc)	η (K∗pc^{-1})
S 117	7100	5400	6.5	85	1040	18.5 ± 2
S 119	5200	500	0.9	87	870	19 ± 2.5
S 190	4900	1500	3	135	2200	10.5 ± 0.5
S 202	1500	80	1.2	141	1000	25 ± 2
S 220	4400	13000	30	161	490	26 ± 3
S 229	6400	630	0.8	172	650	30 ± 4
S 236	11000	8000	8	174	3000	7.2 ± 1
S 264	2800	200	0.8	195	500	25 ± 2
S 273	4100	275	0.7	203	710	21 ± 4
S 275	3600	3500	10	206	1500	12 ± 1
S 276	5900	220	0.4	209	500	13 ± 2
S 277	6000	1350	2.1	207	500	20 ± 3
S 280	2000	1400	6.4	209	1500	11.5 ± 1
S 282	4900	430	0.9	210	1500	12.5 ± 1
S 284	2000	1550	9.7	212	5200	3.7 ± 0.5

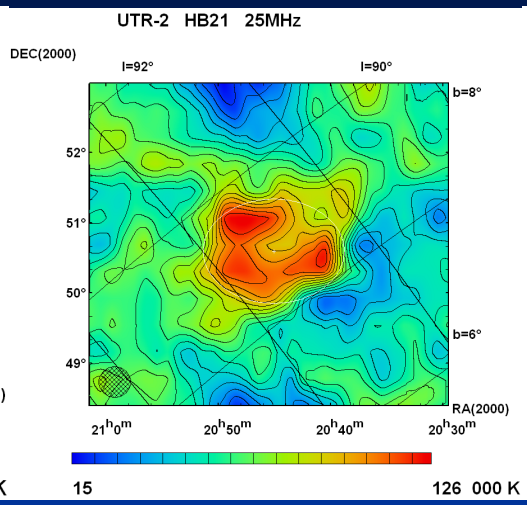
The longitude dependence of the volume density of the Galactic background in the Local arm at 25MHz

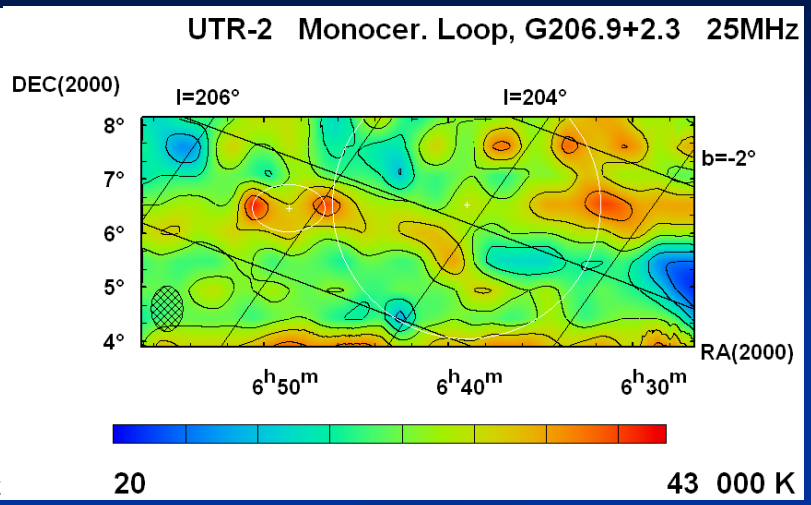


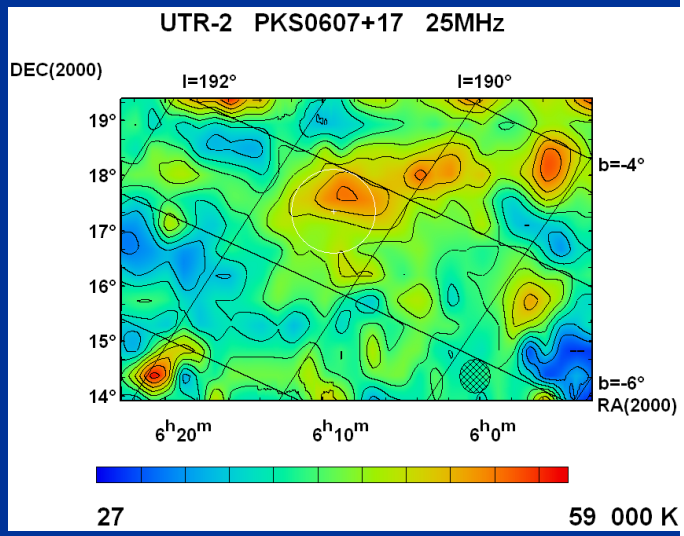
- The approximating dashed curve corresponds to the model of the magnetic field consisting of the regular and isotropic components. $l_\perp$ is orthogonal to the regular component of the field.
- $\eta_\perp = 27 \pm 3$ K·pc^{-1}; $\eta_{interarm} \leq 1$ K·pc^{-1}; $H_{arm}/H_{interarm} \sim 10$

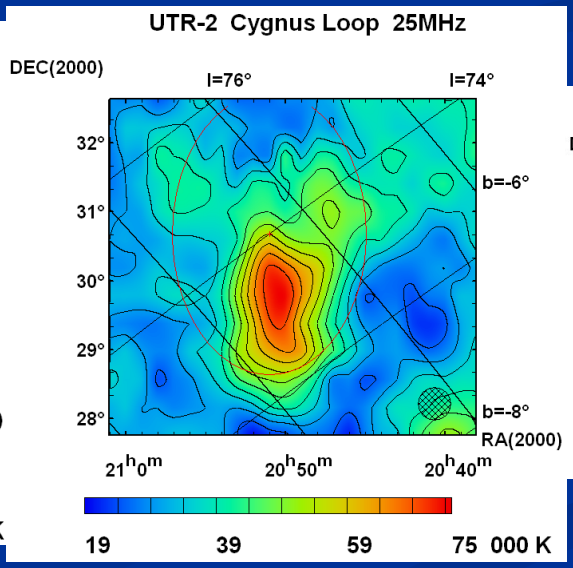
SNR's observed at UTR-2

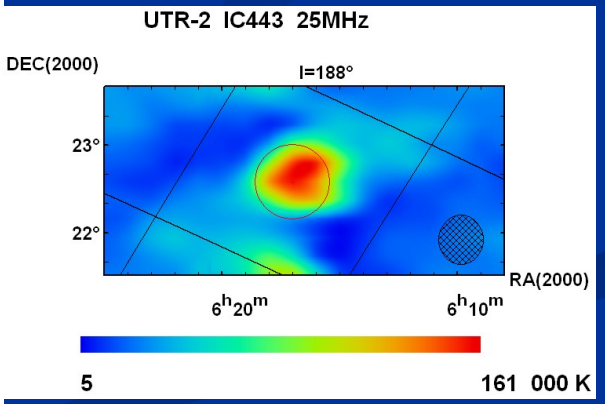




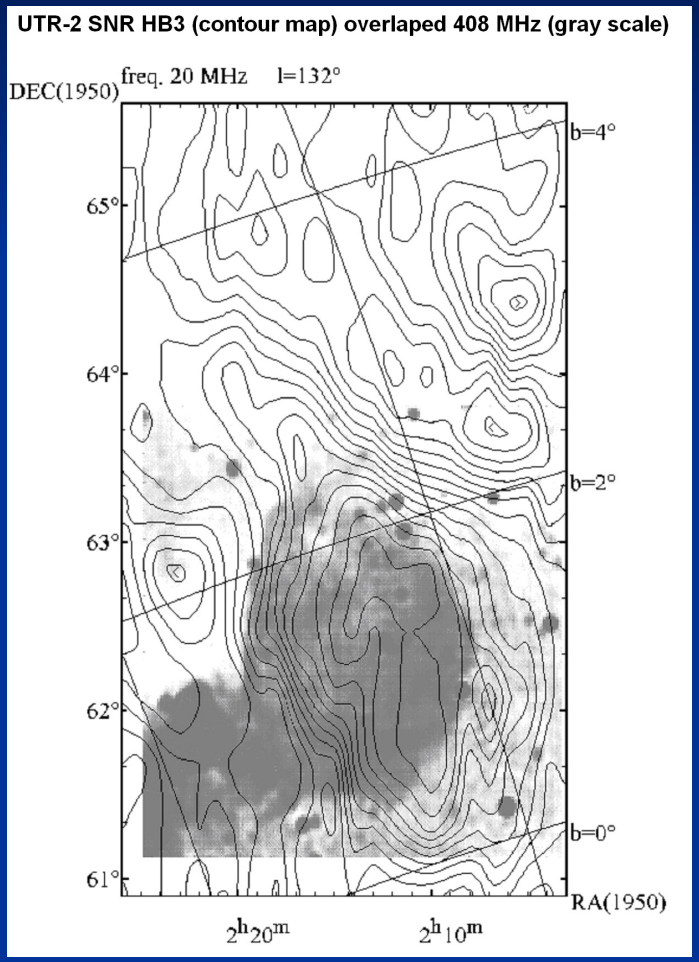


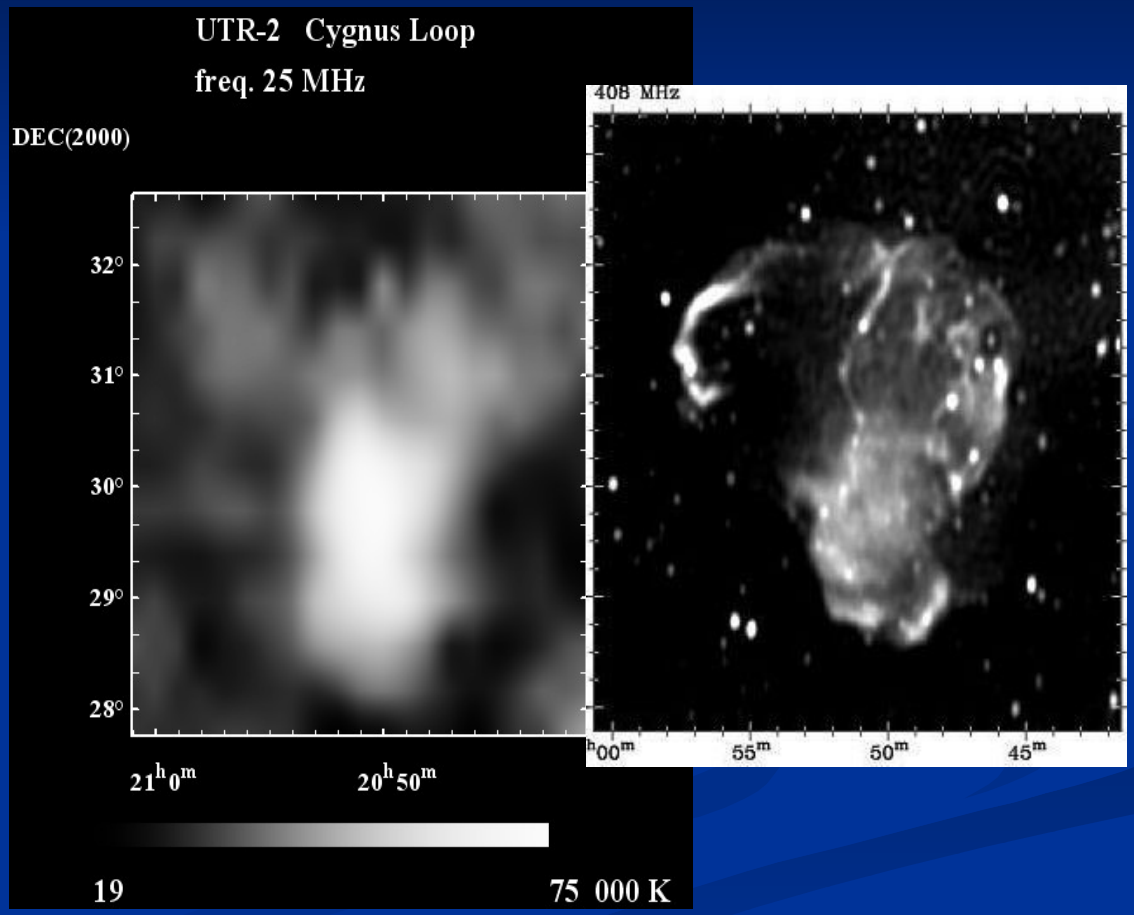






SNR's HB3 and Cygnus Loop

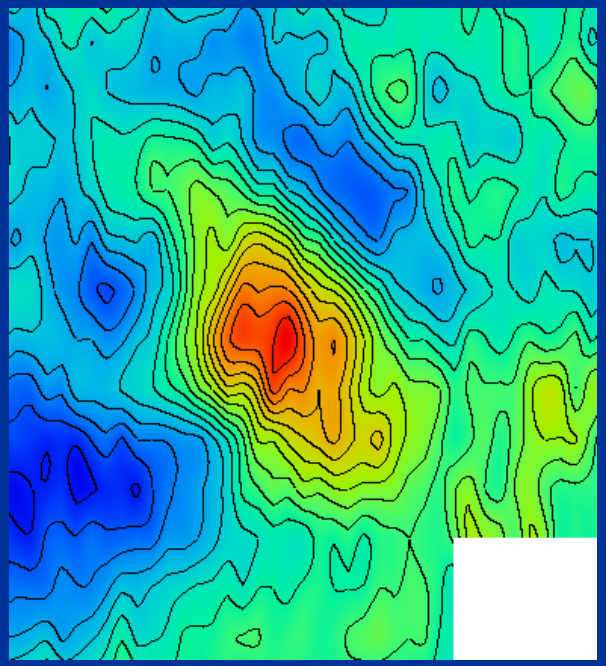


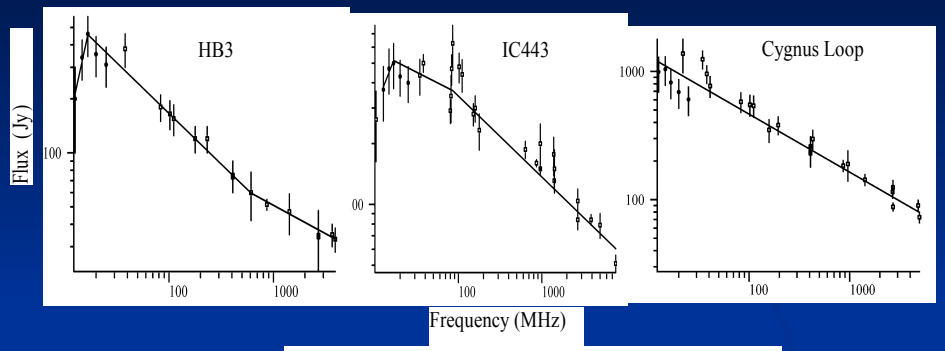


Observational and modeled parameters for HB3, IC443 and Cygnus Loop

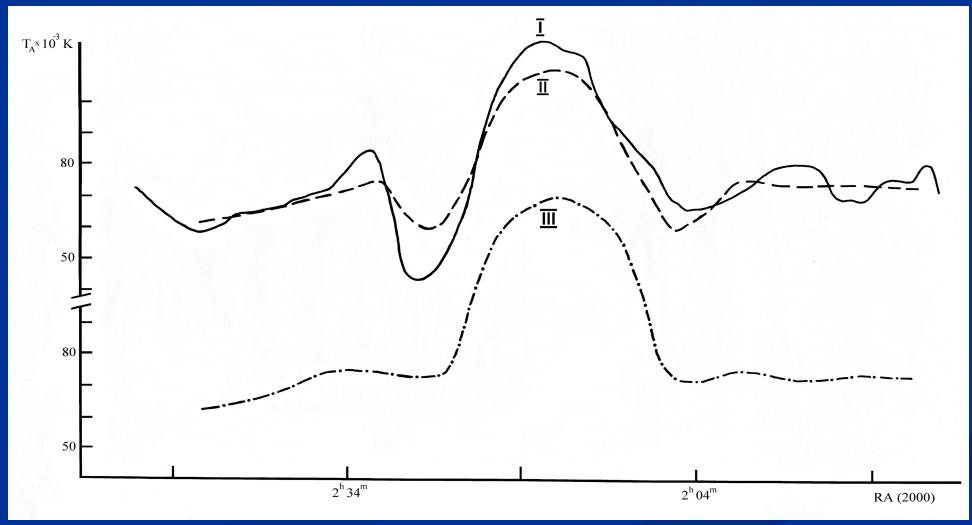
Flux density of the SNRs HB3, IC443, Cygnus Loop

Frequency (MHz)	Flux density (Jy)		
	HB3	IC443	Cygnus Loop
12.6	200 ± 100	370 ± 110	990 ± 300
14.7	340 ± 85	470 ± 120	1040 ± 260
16.7	460 ± 115	500 ± 125	820 ± 205
20.0	355 ± 89	430 ± 107	690 ± 140
25.0	310 ± 77	400 ± 100	605 ± 120



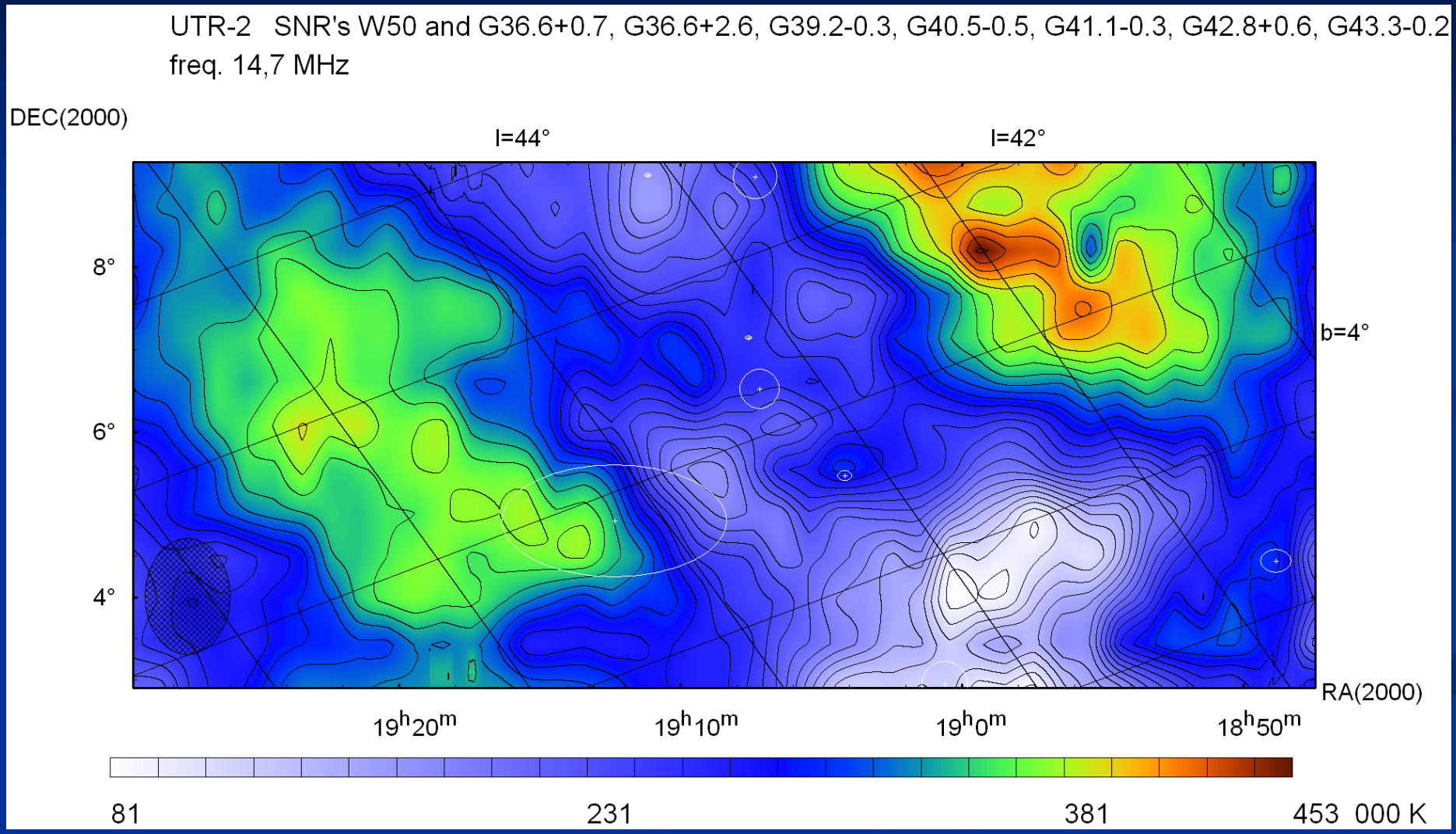


The spectra of SNR's HB3, IC443 and Cygnus Loop

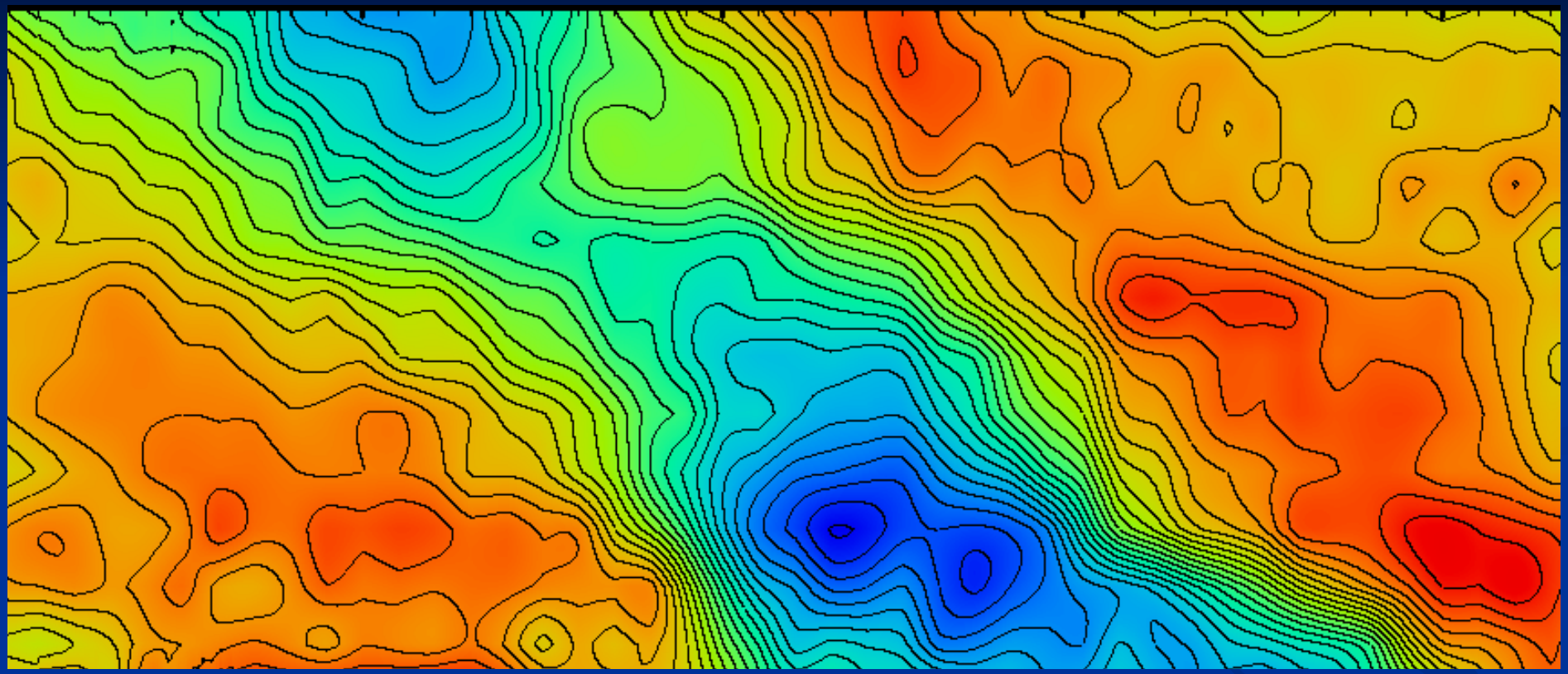


Scans of brightness temperatures of the SNR HB3 observed at 20 MHz for δ_{2000} = 62°.74 (curve I) and modeled with (curve II) and without (curve III) account of the HII envelope

SNR's at the direction l = 40°

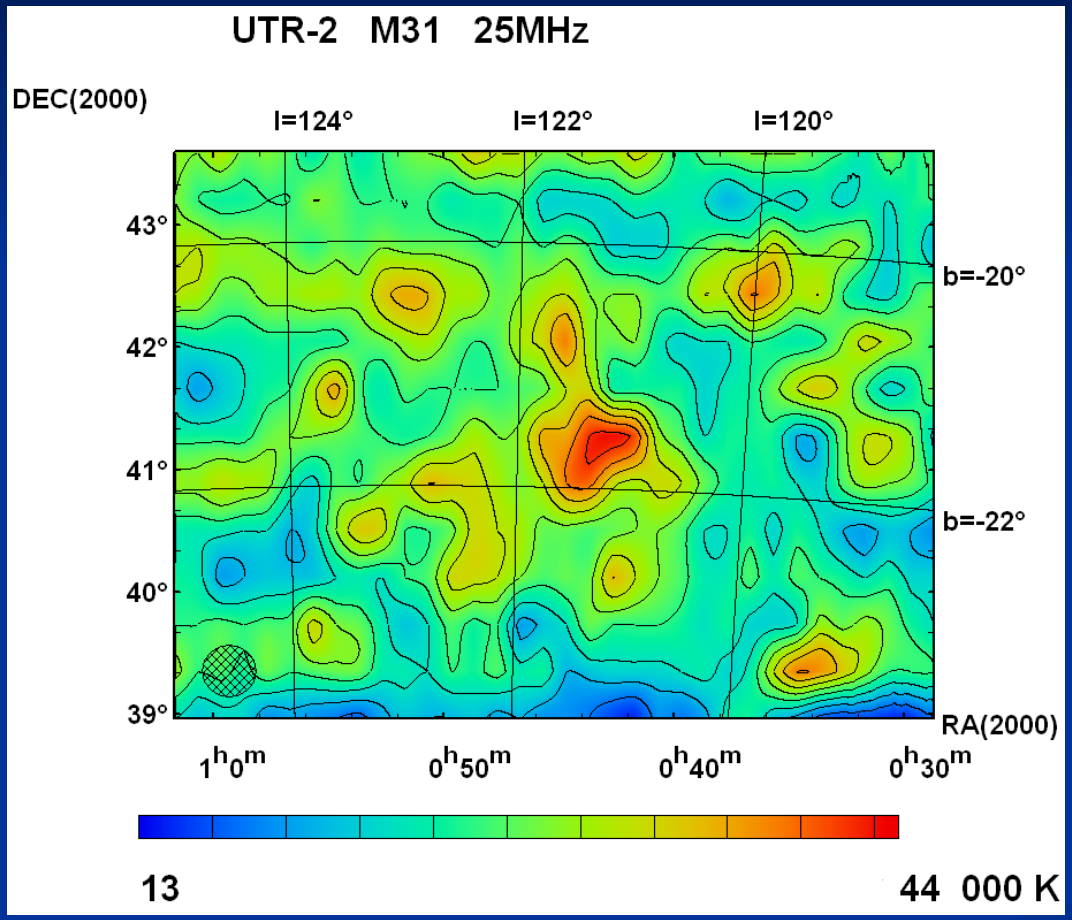


SNR's at the direction $l = 32^{\circ}$



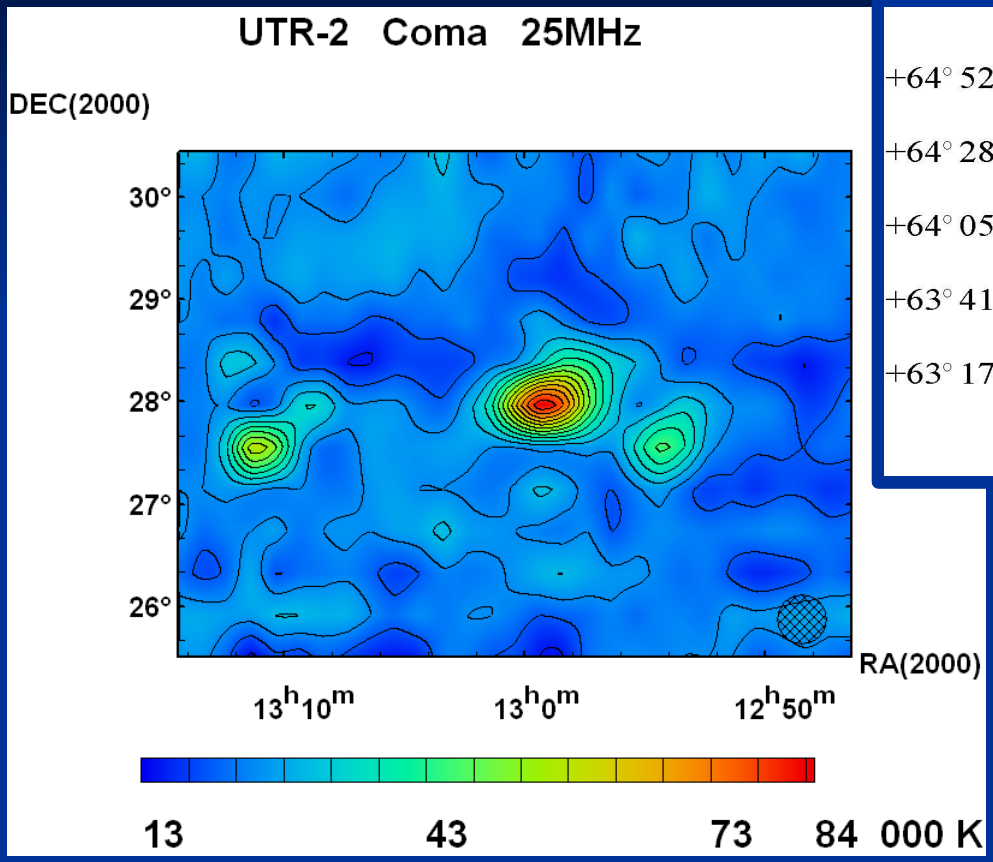
UTR-2 maps of the sky area at 25 and 14.7 MHz containing SNR's W44 (G34.7-0.4) and G28.6-0.1, G28,8+1.5, G29.6+0.1, G29.7-0.3 (Kes75), G30.7-2.0, G30.7+1.0, G31.5-0.6, G31.9+0.0 (3C391), G32.0-4.9 (3C396.1), G32.1-0.9, G32.8-0.1 (Kes78), G33.2-0.6, G33.6+0.1 (PKS0646+06), G36.6-0.7

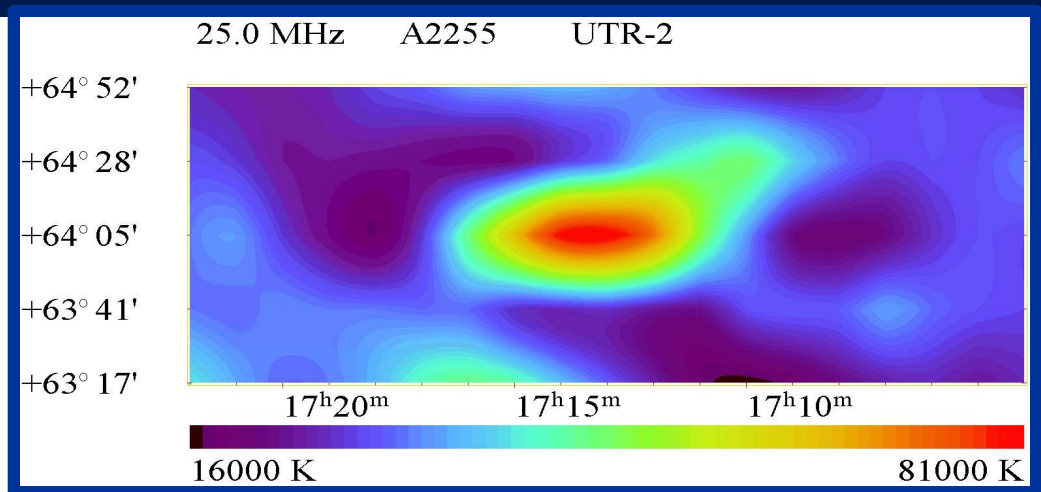
Andromeda Nebula

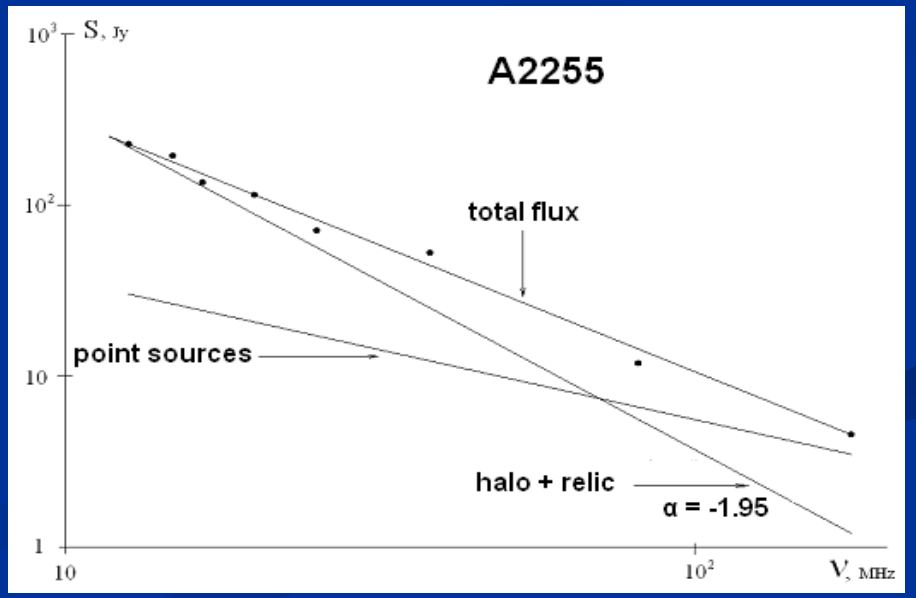


- The disk of M31 is surrounded by the halo with the major axis of 240′.
- The ring of ionized hydrogen (axis = 140′) is located in the M31 disk with $n_e = 0.07$ cm^{-3}.
  - $\alpha_{disk} = 2.65 \pm 0.06$
  - $\alpha_{halo} = 2.85 \pm 0.07$

Clusters of galaxies







~ 80% of A2255 total emission at decameter waves come from halo and relic

Conclusion

- LOFAR can make clear the existence of n(S) curve inflection for S < 20 Jy at low frequencies.
- Having much better statistics for HII regions, LOFAR can investigate Galactic arm structure in more detail and estimate IMF.
- Have SNR's a relict HII envelope, "halo"? – LOFAR can answer.
- LOFAR have good prospects in research on halo in galaxies and clusters of galaxies.