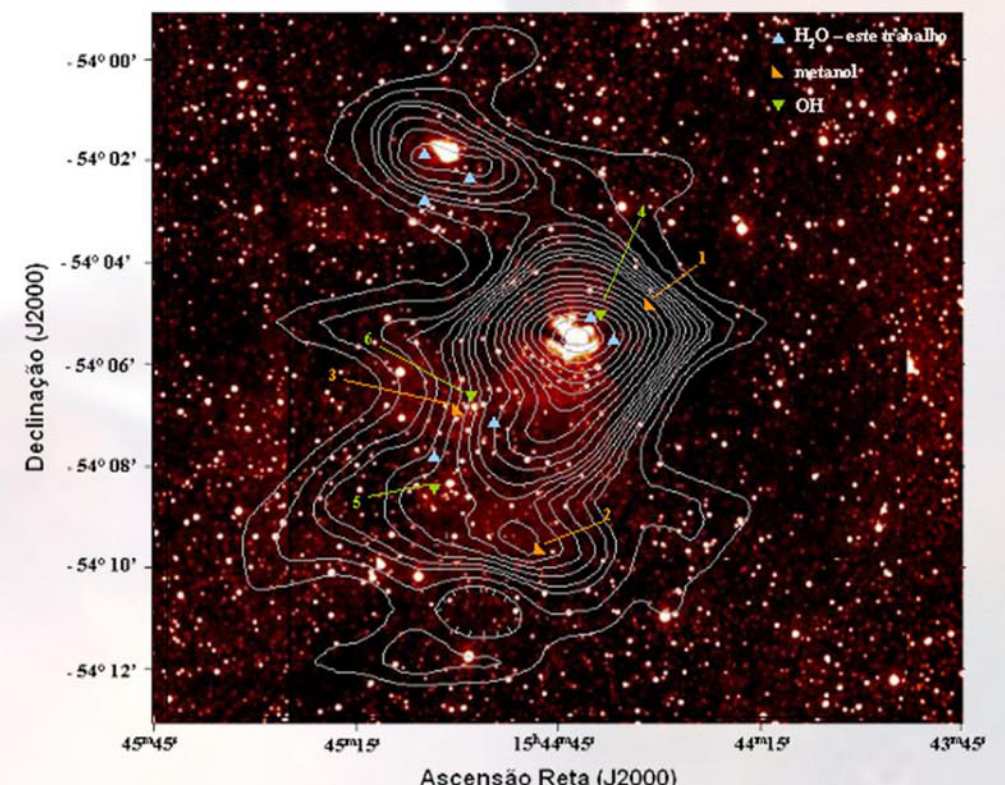


**Abstract.** RCW 95 was selected for study as part of a larger program of search for YSOs in the Galaxy. The project is an example of successful exploitation of large galactic surveys and combined molecular and maser line data with IRAS observations to select potential sites of massive star formation to be studied in the near-IR. Motivated by the discovery of two compact HII regions in the cloud, we present a 7 mm continuum map and a complete water maser survey of RCW 95. This survey resulted in the identification of at least one additional HII region in the cloud (the IRAS source 15412-5359) revealing the presence of a young association of OB stars.

## RADIO MAP AND WATER SURVEY

RCW 95 is a southern hemisphere cloud first identified as an HII region in H $\alpha$  by Rodgers et al. (1960). Previous radio observations in 5 GHz (Goss & Shaver 1970) detected strong emission towards the region but were unable to resolve it in individual sources due to low angular resolution. The detection of different maser species in the direction of RCW 95 along the years (see Panel 1) and the recent discovery of two large clusters of young massive stars in the cloud (Roman-Lopes & Abraham 2004 and 2006) motivated this more detailed study in radio.

Panel 1 — Radio continuum 43 GHz map contours and



1. Batchelor, R. A. et al. 1980, Aust. J. Phys. 33, 139; 2. Ellingsen, S. P. et al. 1996, MNRAS, 280, 378E; 3. Ellingsen, S. P. et al. 1996, MNRAS, 280, 378E; 4 & 5. Cohen, R. J. et al. 1995, MNRAS, 274, 808; 6. Caswell, J. L. 1998, MNRAS,

The free-free continuum emission of RCW 95 was mapped in 43 GHz with 2' resolution using the Brazilian Itapetinga Radio Observatory (Panel 1). The resolution is sufficient to identify the origin of the emission as being associated to three IRAS sources within the cloud, with colours of compact HII regions (see table 2).

From the radio flux we estimated the number of UV photons necessary to explain the ionization of the cloud and found this to be compatible with the spectral types of the stars detected in association to the IRAS sources. We also detected a radio source without any IR counterparts and associated to a methanol maser (Panel 1, line 2) in a highly absorbed portion of the cloud.

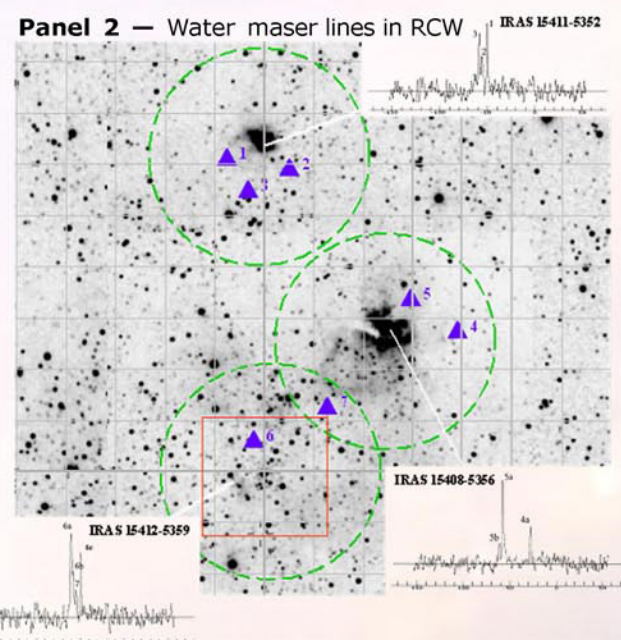
### YSOs Survey

- IRAS PSC sources with colours of compact HII regions according to Wood & Churchwell (1989);
- presence of CS emission on the survey catalogue of Bronfmann et al. (1996);
- counterpart 5 GHz radio continuum emission detected on survey by Goss & Shaver (1970);
- stellar population of selected compact regions studied from 1 to 8  $\mu$ m using data from 2MASS

### 1. Water Maser Lines

Line	RA	DEC	Vlsr (km/s)	Flux (Jy)
1	15:45.2	-54:02.8	-51.6 (6)	72.5 $\pm$ 0.8
2	15:44.8	-54:03.0	-56.0 (7)	86.6 $\pm$ 0.8
3	15:45.0	-54:03.4	-59.6 (7)	34.6 $\pm$ 0.8
4a	15:44.4	-54:06.0	-29.0 (4)	284.3 $\pm$ 2.0
4b	—	—	-17.2 (4)	39.2
5a	15:44.7	-54:05.7	-60.0 (7)	194.6 $\pm$ 1.4
5b	—	—	-53.2 (4)	62.5
6a	15:45.1	-54:08.0	-62.6 (6)	131.6 $\pm$ 2.4
6b	—	—	-59.0 (3)	58.6
6c	—	—	-51.6 (4)	127.5
7	15:44.7	-54:07.5	-57.1 (4)	62.5 $\pm$ 1.6

List of maser lines shown in the map on the right. Lines labeled with the same numbers correspond to co-spatial spectral features with different LSR velocities. The spatial resolution of the H<sub>2</sub>O survey is of 1 arcmin.



The water maser survey conducted at 22 GHz was made using a 1' gridding of 26 different observing positions around the IRAS sources. We detected 11 lines at 7 different positions with a sensitivity  $\sim$  10 Jy at the 3 $\sigma$  limit (see table 1 and Panel 2). All lines are associated to one of the IRAS sources in the cloud, including IRAS 15411-5352 where a previous survey (Braz et al. 1989) has reported negative detection; in all cases where other observations were available, the discovery of a water line could be related to the presence of other maser species such as OH and CH<sub>3</sub>OH.

### 2. Radio Continuum Sources

Source	$\theta$ (arcmin)	diam. (pc)	Flux (Jy)	Spec. Type*
IRAS 15408-5356	< beam	—	7.1 $\pm$ 0.1	O7 V
IRAS 15411-5352	< beam	—	3.8 $\pm$ 0.5	O8 V
IRS 10 & IRS 14 <sup>†</sup>	< beam	—	3.2 $\pm$ 0.3	O8 V
IRAS 15412-5359	$\sim$ 1'	$\sim$ 1.0	< 2.5	O8.5 V
CH <sub>3</sub> OH (E+96) <sup>†</sup>	< 1'	< 0.8	< 1.5	O9.5 V

\*derived from Hanson, M. et al. 1997, ApJ, 489, 698;

## STELLAR POPULATION OF IRAS 15412-5359

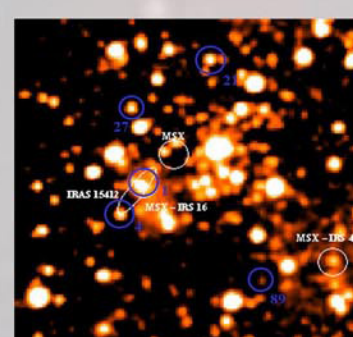
### 3. Ionizing stars in IRAS 15412-5356

IRS	mag J	mag H	mag K	Sp. Type
16*	16.2 $\pm$ 0.2	14.0 $\pm$ 0.1	11.9 $\pm$ 0.5	O7 V
21	14.5 $\pm$ 0.3	13.2 $\pm$ 0.2	12.4 $\pm$ 0.3	O9 V
27	15.5 $\pm$ 0.3	13.8 $\pm$ 0.5	12.8 $\pm$ 0.5	B0 V
43	15.1 $\pm$ 0.1	14.0 $\pm$ 0.1	13.3 $\pm$ 0.2	B0 V
89	16.1 $\pm$ 0.1	15.0 $\pm$ 0.1	14.2 $\pm$ 0.1	B0 V

\*near-IR counterpart of the IRAS source 15412-5359 and the MSX source G 326.66+0.52.

The spectral types of the ionizing stars were determined using a J vs (J-H) diagram. A Planck curve fit was used to differentiate between field objects from non-excess luminous cluster members. The derived number of Lyman photons from the objects listed in table 3 is about  $1.9 \times 10^{48} \text{ s}^{-1}$ , able to explain the observed radio flux.

The IRAS source 15412-5359 was studied using data from the 2MASS and SPITZER catalogues. The detection of massive objects in the region are the ultimate result of a process that combined several galactic surveys in the radio and IR bands to search for star-formation tracers and attests the efficiency of large scale studies of molecular and maser lines in combination to IR data such as the IRAS colours criteria of Wood & Churchwell (1989) to detect new SFRs in the Galaxy.



Panel 3  
2MASS K-band image showing the position of massive objects associated to IRAS 15412-5359.

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