Bull. Astr. Soc. India (2003) **31**, 399–401

Infrared and Radio Observations of IRAS 16571-4029 (RCW 116B)

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Abstract. Southern HII region RCW 116B (IRAS 16571–4029) has been mapped simultaneously at two far infrared wavelengths (at 150 and 210 μm) with a resolution of $\sim 1'$ using the TIFR 1 m balloon-borne telescope. High angular resolution radio continuum observations at 325, 610 and 1280 MHz have been carried out using GMRT. In addition, IRAS survey data for this region in the four IRAS bands (processed using the HIRES routine) have been used. In the far infrared maps, as well as mid infrared maps, multiple embedded sources have been resolved. IRAS 16571–4029 has also been resolved in radio.

1. Introduction

As part of a programme to obtain far infrared images of star forming regions we have mapped IRAS 16571–4029, an HII region in the southern hemisphere, simultaneously in two far infrared bands using the 1 m balloon-borne telescope of the Tata Institute of Fundamental Research (TIFR). The effective wavelengths of the two bands are ~ 150 μm and ~ 210 μm and the angular resolution achieved is $\sim 1'$ at both wavelengths. We have also imaged this region in radio (at 325, 610 and 1280 MHz) using GMRT with a resolution of $\sim 5'' - 15''$. In addition, we have IRAS maps for these sources in all the four IRAS bands.

2. Observations and Results

Balloon-borne far infrared observations were made with the TIFR 1 m telescope during a balloon flight made on February 20, 1994 from Hyderabad (lat. 17.47 N, long. 78.57 E), India. The details of the telescope and the observational procedures have been described by Ghosh et al. (1988). The telescope is 100 cm aperture f/8 Cassegrain system with an rms pointing stability

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of better than ~ 0.'3. The detectors consist of two arrays (each 2x3) of composite Si bolometers cooled to 0.3 K by a closed cycle ^{3}He refrigerator (Verma et al. 1993). The field of view for each detector is 1.'6. The observations were made simultaneously in two bands with effective wavelengths of ~150 μm and 210 μm. The two bands are separated by the use of cool restrahlen beam-splitter.

An area of ~ 24′ x 30′ around IRAS 16571−4029 was scanned. Data have been deconvolved using a Maximum Entropy Method. The resolution in the deconvolved maps is 1.'0 x 1.'3 in both the bands. Taking advantage of the simultaneous observations in the two bands, with almost identical field of view, we have generated maps of the dust temperature (T_d) and optical depth at 150 μm (τ_{150}). These maps are complex with multiple peaks which are shifted with respect to the main intensity peak.

The deconvolved maps in the two far infrared bands, of the area around IRAS 16571−4029, are shown in Fig. 1. Three sources are seen in both the maps. One of these (S1) corresponds to IRAS 16571−4029; the second one (S2) to IRAS 16575−4023; there is no IRAS PSC source corresponding to the third source (S3). A fourth source in the SW corner lies at the edge of observed area and has less reliability. All these sources are quite extended. Integrated flux densities for these sources (within 3′ dia. circles around the peaks) are given in Table 1.

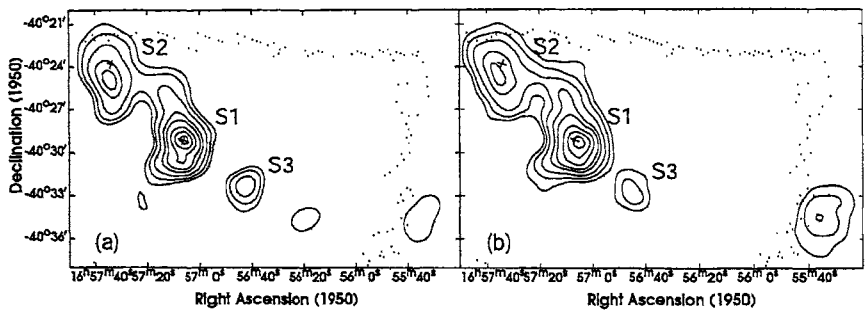

Figure 1. Intensity maps of the region around IRAS 16571−4029 at (a) 150 μm and (b) 210 μm. The dotted boundary marks the area scanned. Crosses mark the positions of IRAS PSC sources. The contour levels are at 0.90, 0.70, 0.50, 0.30, 0.20, 0.10, 0.05 and 0.025 of the peak intensity. The peak intensities are 723 Jy arcmin^{-2} at 150 μm and 390 Jy arcmin^{-2} at 210 μm.

Table 1. Flux densities of the sources

Source	IRAS PSC	R.A.	Dec.	Flux Density in Jy					
				HIRES-IRAS				TIFR	
		(1950)	(1950)	12 μm	25 μm	60 μm	100 μm	150 μm	210 μm
S1	16571−4029	16 57 07.0	−40 29 04	408	2159	11660	10390	6170	3508
S2	16575−4023	16 57 32.8	−40 24 07	138	291	3479	4230	2574	1153
S3	–	16 56 46.4	−40 33 03	–	–	–	343	725	218

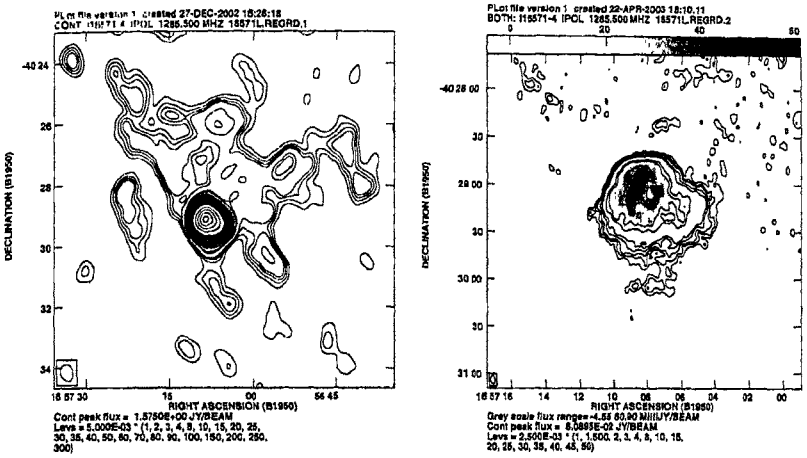

Figure 2. Radio map of the region around IRAS 16571−4029 at 1280 MHz. (a) Left - map of full area, here the resolution is 34″ × 26″; (b) Right - full resolution map of the central region, here the resolution is 5.″4 × 3.″3.

Radio observations have been made using the Giant Meterwave Radio Telescope (GMRT) array (Swarup et al., 1991) on May 21, 2002 (610 MHz), September 29, 2002 (1280 MHz) and February 1, 2003 (325 MHz). Interferometric data were analyzed using AIPS. Radio map of the region around IRAS 16571−4029 at 1280 MHz is shown in Fig. 2a. Here the resolution is 36″ × 26″. The high resolution (synthesized beam 5.″4 × 3.″3) radio map of IRAS 16571−4029 at 1280 MHz is shown in Fig. 2b. The source is well resolved. The integrated flux density is 4.17 Jy.

IRAS survey data for this region were processed using the HIRES routine (Aumann et al., 1990) at the Infrared Processing and Analysis Center (IPAC), Caltech, to obtain high resolution images in all the four IRAS bands. In HIRES maps also, the sources are resolved at all the four wavelengths. The HIRES maps have been used to obtain flux densities (given in Table 1).

References

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Verma, R.P., Rengarajan, T.N., Ghosh, S.K., 1993, *Bull. Astron. Soc. Ind.*, **21**, 489.