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DISTRIBUTION OF DUST IN W31 COMPLEX

S.K. Ghosh, K.V.K. Iyengar, T.N. Rengarajan, S.N. Tandon,
R.P. Verma and R.R. Daniel

Tata Institute of Fundamental Research
Homi Bhabha Road, Colaba
Bombay - 400005 INDIA

W31 is a HII region - molecular cloud complex in the galactic plane at a distance of 6 Kpc. This complex consists of two prominent radio continuum sources G10.2-0.3 and G10.3-0.1 representing HII regions. An extended region ($\sim$ 25' x 30') covering both these HII regions has been mapped in the far infrared (FIR) (120 - 300 μm) using the TIFR 1 m balloon-borne telescope with an angular resolution of $\sim$ 1' and a dynamic range of 100 (see Ghosh et al. 1988, for details). The resulting flux density distribution at an effective wavelength of 160 μm (for $\epsilon_\lambda \propto 1/\lambda$ & T = 30K) is presented in Fig. 1(c). The coadded IRAS survey scan data at 60 μm (1'.5 x 5' HPBW) and 100 μm (3' x 5' HPBW) have been deconvolved using a maximum entropy method to generate the flux density maps of the same region. These 60 μm and 100 μm maps are shown in Fig. 1(a) & (b) respectively.

Despite the dissimilar resolutions, the 60, 100 & 160 μm maps have striking structural similarities demonstrating the effectiveness of FIR radiation as dust tracer.

All three maps clearly show two regions (North & South) of extended FIR emission around the two prominent HII regions. These two HII regions are most likely physically associated as evident from their radio recombination line velocities (Downes et al. 1980). Because of the superior angular resolution at 160 μm, ten additional sources have been resolved in addition to the two HII regions (S1-S12, see Fig. 3(c)). Our sources S4, S6, S7 & S10 correspond to the IRAS Point Source Catalog sources 18060-2005, 18064-2008, 18064-2020 and 18065-2026 respectively and they are denoted by a + mark in Fig. 3(c). The corresponding 5 GHz radio continuum source positions (from Altenhoff et al. 1979) are depicted by a □ symbol. The dust temperatures of the 160 μm sources which have IRAS counterparts have been estimated to be in the range 30 - 38 K for a $\epsilon_\lambda \propto 1/\lambda$ emissivity law. The dust optical depth at 160 μm is 0.048 for the brightest source (S7); the same for S4, S9, S6 and S3 are 0.029, 0.027, 0.005 and 0.004 respectively. The logs of FIR luminosities (in units of $L_\odot$) of S1, S3, S4, S6, S7, S8, S10, S11 and S12 are 4.43, 4.49, 5.76, 4.65, 6.30, 5.32, 4.52, 4.23 and 4.71 respectively.

Large scale extended emission from cooler dust at as large a distance as ~ 9 pc (d = 6 Kpc) has been clearly detected. The diffuse 160 μm dust emission has been estimated by modelling the emission by a linear superposition of ten pointlike sources with their flux densities as parameters to be fitted; their positions chosen near the local maxima in the map. A comparison of the observed emission with that of the superposed pointlike sources of the best fit model leads to the conclusion that about 35 % of the emission in W31 complex (both the North and the South regions) is of diffuse origin.

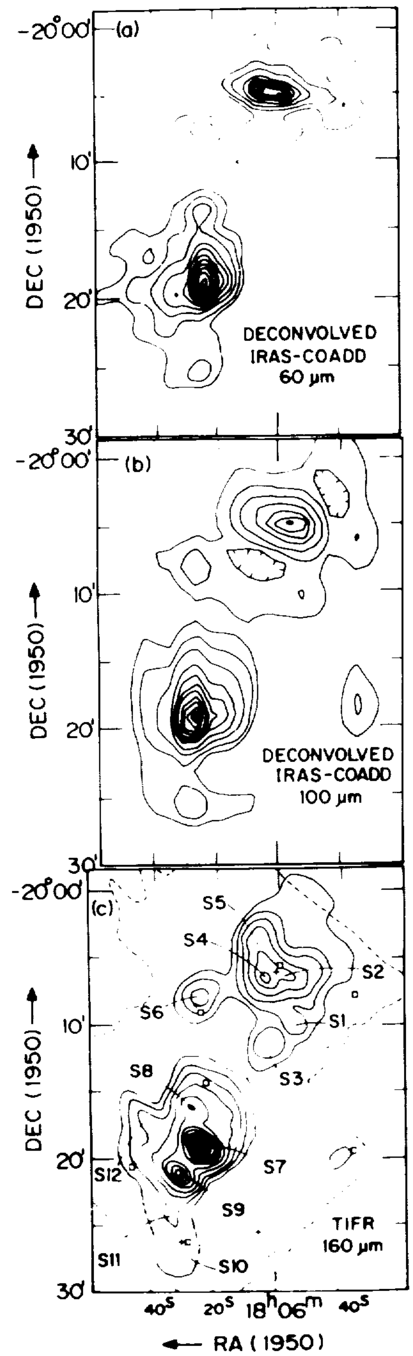

Figure 1.(a) Deconvolved IRAS survey coadd map of the W31 complex at 60 μm. The contour levels are 0.95, 0.9, 0.8, 0.7, 0.6, 0.5, 0.4, 0.3, 0.2, 0.1, 0.05 and 0.025 of the peak (3490 Jy / Sq. arc min.). (b) Same as (a) at 100 μm with peak = 5940 Jy / Sq. arc min. (c) TIFR map at 160 μm with peak = 3680 Jy / Sq. arc min. In addition to the contour levels of (a), 0.01 is also included here.

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