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Dust Continuum Observations of Massive Star Forming Regions

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Abstract. We have observed 51 high mass star forming cores associated with water masers at 350μm. The spectral energy distributions (SEDs) and dust continuum normalized radial intensity profiles were modeled for 28 sources using a one-dimensional dust radiative transfer code assuming a power law density distribution in the envelope $n = n_0(r/r_0)^{-p}$. The best fit density power law exponent, p, ranged from 1.0 to 2.5 with a mean value of $p = 1.73$. We determined the dust masses for the modeled cores and found a mean mass of 246 $M_\odot$.

1. Observations

More than fifty high mass star forming cores were observed with SHARC (Submillimeter High Angular Resolution Camera; Hunter, Benford, & Serabyn 1996) during 5 nights in 1997 (December 21 and 22) and 1998 (July 15, 23, and 25) on the 10.4m Caltech Submillimeter Telescope. SHARC is a 1D bolometer array with a FWHM beam size of $11''$. The objects were selected from the sample of Plume, Jaffe, & Evans (1992) of massive star forming cores associated with water masers. We have plotted the 350μm contour maps and normalized radial intensity profiles for each source. Figure 1 shows the 350μm map and the radial profile with the best-fit model for M8E.

2. Models

The radial intensity profiles and SEDs were modeled using a one-dimensional dust continuum radiative transfer code by Egan, Leung, and Spagna (1988) and an observation simulation code (Evans et al. 2001). We assumed a power law density distribution of the form $n \propto r^{-p}$, for $p = 0.5 - 2.5$. For each of our models, we normalized the input density so that the model flux at 350μm matched the observed flux and adjusted the internal luminosity to match the observed bolometric luminosity. We adopted dust opacities from Ossenkopf & Henning (1994, column 5) that are calculated for aggregated dust grains with ice mantles as our standard. The fit of the models with the observations was quantified by calculation of a reduced chi-squared, χ^2.

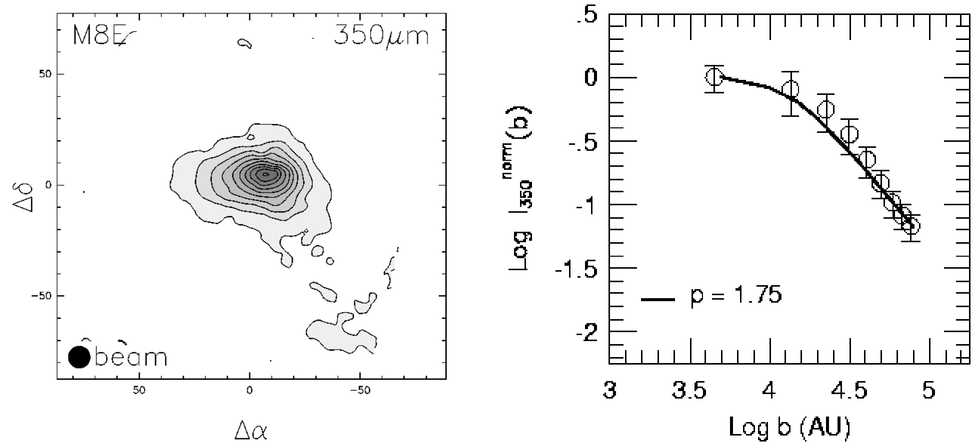

Figure 1. 350μm map (contours are 10% of the peak or 5.4σ) and normalized radial profile of M8E ($18^h01^m49.1^s$, $-24°26'\ 57''$). Solid line plotted with the radial profile is the best-fit model $p = 1.75$, $\chi^2 = 0.52$.

3. Results

The internal luminosities of our sources ranged from 10^3 to 10^6 $L_\odot$. For all the modeled sources, we have calculated an integrated mass using the best-fit density power law. The mean mass within the half-power radius is 246 $M_\odot$. (See Shirley et al. in these proceedings for the mean virial mass as determined from CS observations.)

Averaged over 28 sources with models, $\langle p \rangle = 1.73 \pm 0.35$. We were unable to reliably model sources with small angular sizes or double peaks, and those cores are not included in our statistics. The mean power law is significantly steeper (about 0.4) than the average density law exponent found by van der Tak et al. (2000) in a study of 14 massive star formation regions. Our models were convolved with the observed beam profile rather than a gaussian as used by van der Tak et al. (2000), accounting for the difference.

References

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