We have drawn spectral energy distribution (SED) diagrams for 162 of the 405 sources reported in our SIMBA survey (Hill et al., 2005). The fits reveal six parameters; the luminosity, mass, temperature, $H_\alpha$ number density, the surface density and the luminosity-to-mass ratio. Including source sizes and distances from our earlier work, eight parameters are known.

Analysis reveals a clear temperature and luminosity distinction amongst the four classes of source. Intriguingly, the mm-only cores (without methanol maser & UC HII) are of comparable mass to sources with a methanol association, whilst collectively these two classes are slightly less massive than cores with UC HII. The mm-only cores are smaller, less luminous, and cooler than the other sources, with a less probable mid-infrared MSX emission. This has led us to propose that the mm-only cores are a precursor to the methanol maser in the formation of massive stars.

The mm-only cores comprise two distinct populations distinguished by temperature. The cool-mm are distinctly different from the warm-mm and those sources with methanol masers and UC HII regions. The cool-mm sources have smaller radii, are less luminous with lower luminosity-to-mass ratios, and are more dense, with higher $H_\alpha$ number and surface densities. The warm-mm sources on the other hand display similar characteristics to sources with a methanol maser and/or radio continuum source.

These results suggest that the warm-mm cores are the precursors to the methanol maser sources, whilst the cool-mm sources are examples of failed cores.

**Massive Star Formation**

The very nature of massive star formation (MSF) (i.e. rare, rapid clustered and distant) impedes the study of their formation, particularly the earliest stages which are not easily distinguished.

Observations (Walsh et al., 1998) suggest that the methanol maser source is the first readily detectable tracer of massive star formation prior to the development of an UC HII region. Hill et al. (2005; hereafter Paper I) undertook a millimetre continuum survey of MSF regions associated with methanol maser and radio continuum emission in search of deeply embedded cores, which would mark the earliest stages of MSF.

This 1.2 mm SIMBA survey revealed evidence of star formation clearly separate from the targeted source and devoid of both methanol maser and radio continuum emission. Follow-up submillimetre observations of these 'mm-only' cores (Hill et al., 2006; hereafter Paper II) revealed each of them to be associated with submillimetre continuum emission and hence deeply embedded objects.

**Spectral Energy Distributions (SEDs)**

By combining exiting archival data (IRAS & MSX) together with the sub-mm data from Papers I and II, we have fitted a least squares Leverberg–Marquardt least squares SED fit to 162 of the 404 sources in the SIMBA sample (Paper II).

The SED reveals the temperature, luminosity and dust mass of the source, which give rise to the hydrogen number density ($n_\text{H}$), the surface density ($\Sigma$) and the luminosity-to-mass ratio ($L/M$).

**Results**

- mm-only less luminous than sources with methanol maser and radio continuum emission (classes M, MR & R).
- All sources in sample fit comparable mass, although mm-only and maser sources less massive (i.e. sources with no UC HII region).
- mm-only slightly more dense ($n_\text{H}$ & $\Sigma$) than class M, MR & R.
- mm-only have bimodal temperature population.

KS tests and cumulative distributions indicate that the mm-only distinct from the other populations in terms of luminosity, temperature and $L/M$. No distinction can be discerned for the mass.

The mm-only sources dominate the cooler portion of the plots, but are just as prolific as the other classes of sources at higher temperatures.

**Conclusions**

There is little distinction between the warm-mm and sources with a methanol maser and/or radio continuum source for all parameters tested.

The cool-mm sources are distinctly different from the warm-mm sources and those with a methanol maser and/or radio continuum source.

The cool-mm are less luminous, have lower L/M, as well as higher $H_\alpha$ number and surface densities ($\Sigma$). They have smaller radii than those sources with an UC HII region.

The warm-mm display similar characteristics to those known to be forming massive stars (M, MR & R sources).

**References**

- Walsh et al. (1998) MNRAS, 301, 640

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