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# Properties of the HCO+ sources in the Census of High- and Medium-mass Protostars (CHAMP) Survey

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## Introduction

The Census of High- and Medium-mass Protostars (CHaMP) is the first large-scale, unbiased, uniform mapping survey at ~parsec-scale resolution of 90GHz line emission from massive molecular clumps in the Milky Way (See Peter Barnes in this proceedings). We present the luminosity, mass, spectral temperature distribution for all the molecular clumps detected using HCO+ observations in this survey. From the luminosity/mass ratio we find that this sample could be divided into two groups according to the luminosity/mass ratio, one is called "cold group" and the other is "warm group".

## Method

We used the archived Spitzer, MSX and IRAS data (when ever available) to derive the flux for all the molecular clumps found in our HCO+ survey. Then we fitted a two-temperature greybody model to the spectra energy distribution (SED). The bolometric luminosity is calculated by integrating over SED. As an example, we present Spitzer, MSX and IRAS images for one of our HCO+ source (named 'BYF 7') in figure 1. We also showed its SED and the best fitting greybody model.

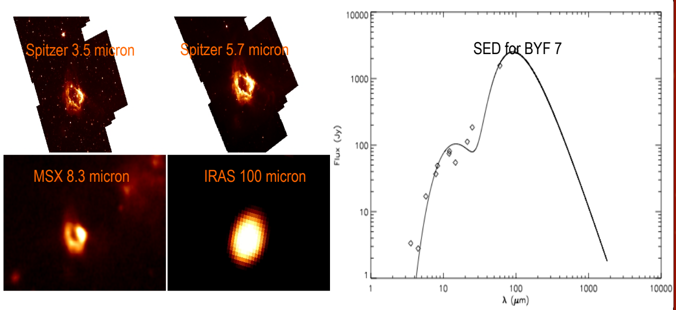


Fig.1 Left panel: The Spitzer IRAC 3.5 micron, 5.7 micron, MSX 8.3 micron and IRAS 100 micron images with the same coordinate scale of BYF 7 in our survey sample. Right panel : The SED of BYF 7 from Spitzer IRAC four bands, MSX four bands and IRAS 4 bands images.

## Results

In figure 2 we present the distribution of the luminosity, mass, luminosity-to-mass ratio and the spectral temperature of the cool component in our SED fitting. From the histogram of luminosity-to-mass ratio we could divide our sample into two parts, one with small luminosity-mass ratio and the other verse. We plot the distribution of mass, luminosity and temperature for these two groups separately in Fig. 2. We found that the mass distribution are similar in both groups, while the luminosity and spectral temperature are quite distinctive. So we call them as "cold group" and "warm group" respectively. The ratio of these two groups is 1:5. The "warm group" has a mean temperature 30±6k. In our SED fitting, we set a lower limit of the spectral temperature to 10K. That's why we found that there is a pile up at 10K in the temperature distribution. The mean luminosity, mass, luminosity-to-mass ratio of the "warm group" are 1.4d4 Lsun, 950 Msun and 19 Lsun/Msun.

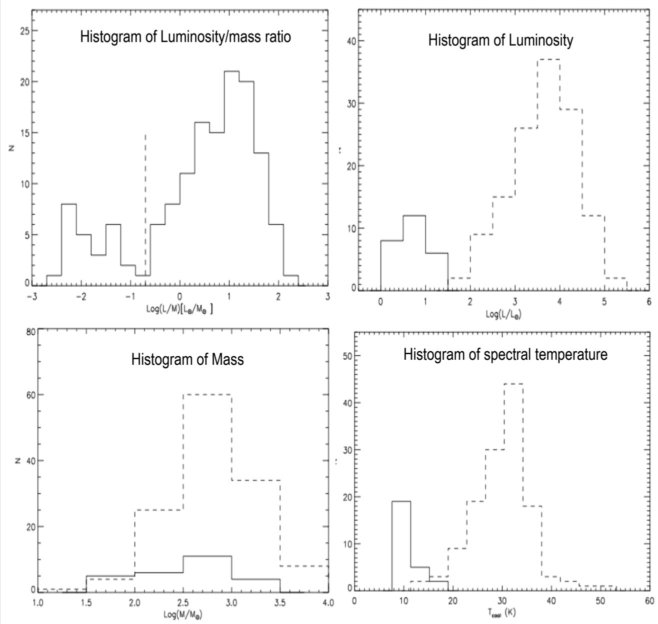


Fig.2 Upper Left panel: Distribution of the luminosity/mass ratio for the HCO+ sources in our sample. The dashed line cut our sample into two groups. These two groups are denoted as solid line and dashed line in the remaining figures. Upper Right panel: Distribution of the luminosity for the HCO+ sources. Lower Left: Distribution of the mass of the HCO+ sources estimated from HCO+ emission. Lower Right: Distribution of the spectral temperature for the HCO+ sources from SED fitting.

## Comparison with Previous results

The dust temperatures of our HCO+ sources (30±6K) are very similar to those derived in other large scale surveys (Mueller et al. (2002), T=29±9 K). Faundez et al. (2004) have selected 146 bright IRAS sources based on CS line survey, which are thought to be massive star formation region. Their dust temperature distribution (32±5k) is very similar to our results, while their sample sources are generally more luminous, more massive and have higher luminosity-to-mass ratio (71Lsun/Msun) than our sample. This is because they selected bright IRAS sources, while our selection is based on an un-biased HCO+ survey, not based on far infrared emission.

## Conclusion

We have presented the physical parameters (mass, luminosity, spectral temperature) for all the molecular clumps detected using HCO+ observations in the CHaMP survey.

## Acknowledgement

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## References

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