The SCubA Massive Precluster Survey (SCAMPS)

Search for the earliest stages of high-mass star formation.

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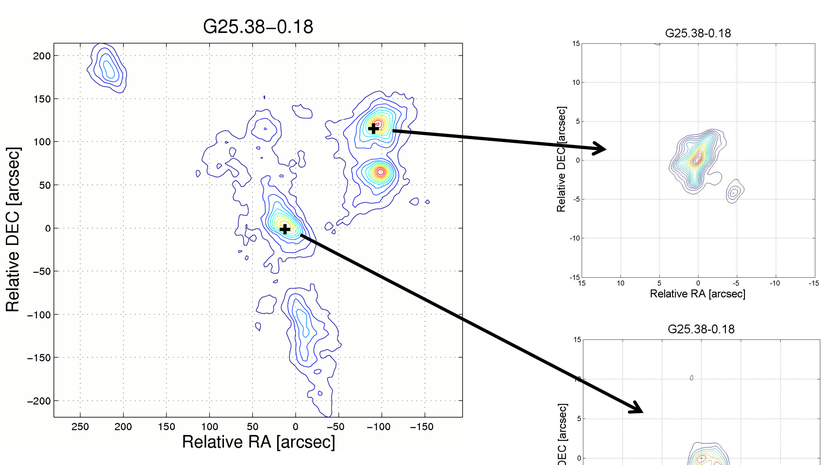
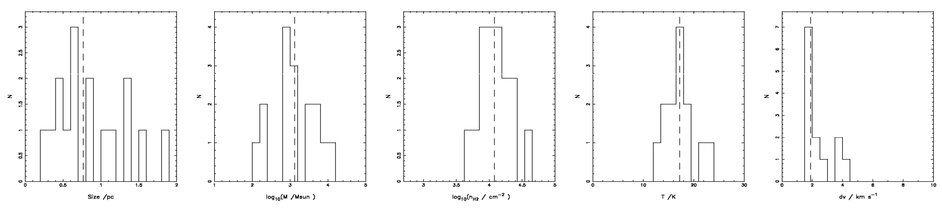
1. Introduction: what is SCAMPS?

The **SC**UB**A** **M**assive **P**recluster **S**urvey (SCAMPS) aims to detect and study the earliest stages of high-mass star formation. The fundamental idea is that high-mass stars are found in OB associations and clusters. Therefore one expects to find numerous high-mass star formation sites nearby one another. The search strategy is to use ultracompact (UC) HII regions as a signpost of current high-mass star formation and to make wide-field sub-mm continuum maps around these to search for nearby potentially less evolved massive precluster cores. Sub-mm continuum is an excellent tracer of both warm and cold dust and is not biased toward objects that have developed a hot infrared protostar (and are traced by IRAS or MSX).

This poster presents the progress of SCAMPS, highlighting some of the preliminary outcomes from the SCUBA and follow-up observations.



Example 2: Large panel: 850μm SCUBA colour contours in the region G25.38-0.18. The black crosses indicate the VLA 3.6cm detections, shown in detail in the small panels. The average rms in the VLA maps corresponds to stars of spectral type B1 or smaller, which excludes protostars of 13 solar masses upwards.

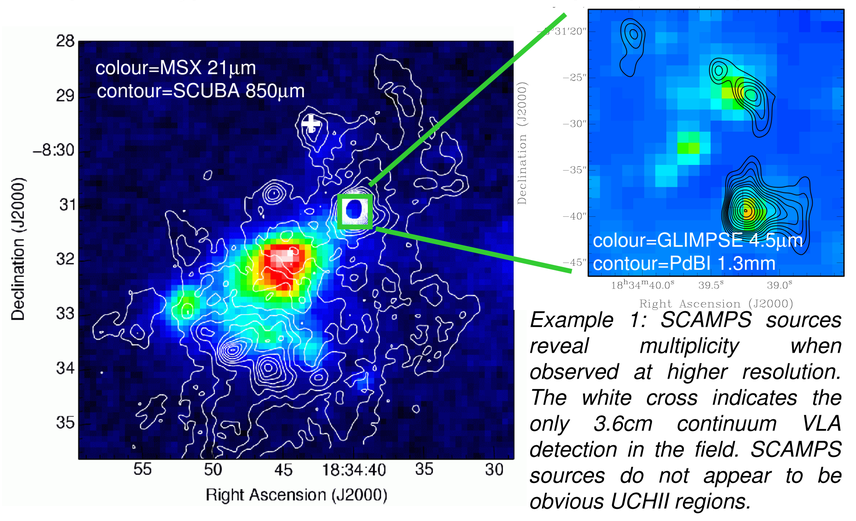


Summary Figure: Histograms of size, mass, mean density, temperature and NH_3 linewidth for a subsample of the SCAMPS (16 SCAMPS in regions G10.15-0.34, G13.19-0.04, G23.46-0.20). The dashed lines show the median values.

3. Summary: what kind of sources are SCAMPS?

The mid-IR dark SCAMPS typically have sizes of order 1pc and masses of 1000 Msun, with mean density of 10^4 H_2/cm^{-3}, similar to massive protostellar cores containing UCHII, CH_3OH or H_2O masers. With temperatures between 13 and 33K, most SCAMPS are too warm to be starless cores (which have internal temperatures of 10K or less), which suggests that they already contain stellar heating sources. Many are highly deuterated, similar to low-mass prestellar cores (Pillai et al. 2007). Their masses are sufficient to form clusters containing early type B or O stars, assuming a star formation efficiency in the core of 10%. However, bolometric luminosity limits of less than 5000 $L_\odot$ based on limits from Spitzer GLIMPSE, and radio non-detections (see example 3), limit the earliest spectral type to B2 or later in the majority of cases. **Therefore SCAMPS have not yet formed massive stars, but clearly have the capacity to do so.**

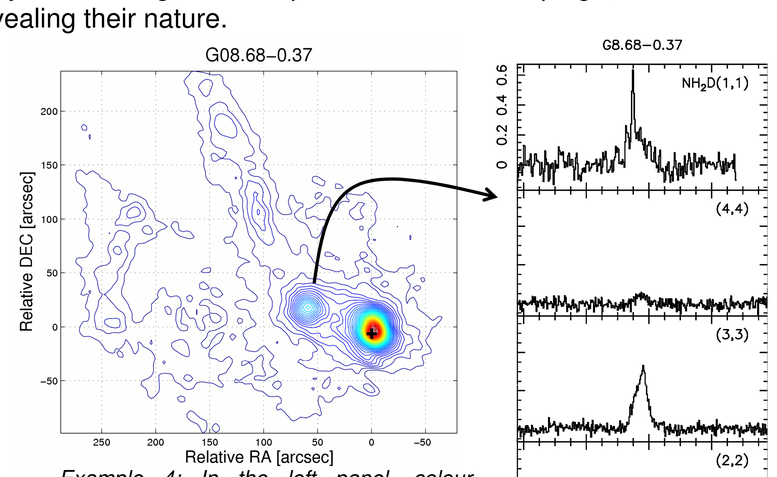
References: Thompson, et al., 2005, ESASP, 577, 425; Thompson et al., 2006, A&A, 453, 1003; Pillai et al., 2006, A&A, 450, 569; Pillai et al., 2007, A&A, 467, 207; Hatchell et al. 2008 (in prep);



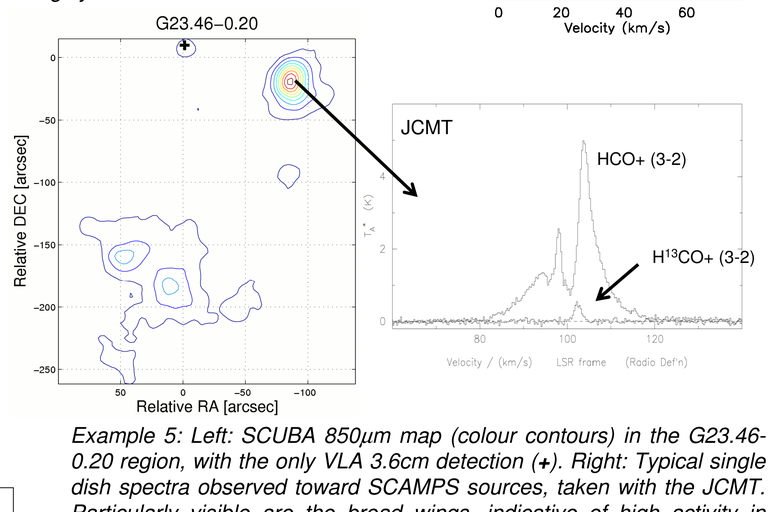
Example 1: SCAMPS sources reveal multiplicity when observed at higher resolution. The white cross indicates the only 3.6cm continuum VLA detection in the field. SCAMPS sources do not appear to be obvious UCHII regions.

2. SCUBA observations and catalogue creation

Maps of the surroundings of 31 UC HII regions (~13x13 arcmin) at 850 and 450 μm were performed using SCUBA on the JCMT. These maps are background corrected and run through the source finding algorithm *clumpfind* with a set of suited parameters. The sources found in this way have recently been granted the name *SCAMPS G.* The 850μm catalogue counts 703 clumps, the 450μm catalogue 412. A number of these sub-mm objects are massive enough to potentially form high-mass stars, but show no obvious signs of high-mass star formation such as mid-IR emission or UC HII regions. These are the subject of a large follow-up observational campaign, with the aim of revealing their nature.



Example 4: In the left panel, colour contours are 850μm SCUBA dust emission in the G08.68-0.37 region. The black cross indicates the VLA cm detection. The right panel shows the ammonia spectra used to determine the temperature of the SCAMPS sources. In general, SCAMPS show a temperature between 13 and 33 K and are highly deuterated.



Example 5: Left: SCUBA 850μm map (colour contours) in the G23.46-0.20 region, with the only VLA 3.6cm detection (+). Right: Typical single dish spectra observed toward SCAMPS sources, taken with the JCMT. Particularly visible are the broad wings, indicative of high activity in these cores. Star formation is ongoing, probably at the very early stages.