Massive Star Formation in W49

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The process of massive star formation is not well understood yet and the vast majority of stars form in massive star forming regions with complicated star formation histories. We have undertaken a detailed study of massive and active star forming complexes to study the distributions of the Young Stellar Objects (YSOs) and the clusters of young stars. We aim to determine physical characteristics of these clusters and compare them to other star forming complexes. We will present our results on W49 region.

SOURCE CATALOG

✔ Mid-infrared *Spitzer*/IRAC observations are obtained with GLIMPSE and Deep GLIMPSE projects (**Fig 1a**).

✔ We merged the IRAC catalog with 2MASS & UKIDSS near-IR data and Spitzer/MIPS 24 μm data (more than 300,000 sources).

YSO CLASSIFICATION & CLUSTERS

✔ We applied color and magnitude criteria [1] to eliminate contaminants (AGNs, AGBs, etc.) and to identify and classify the YSO candidates. 46 embedded sources, 186 Class I, 907 Class II and 74 transition disk candidates are identified.

✔ 3 clusters and 7 subclusters shown in CO maps (**Fig 1b**) are identified using the Minimum Spanning Tree (MST) method [2].

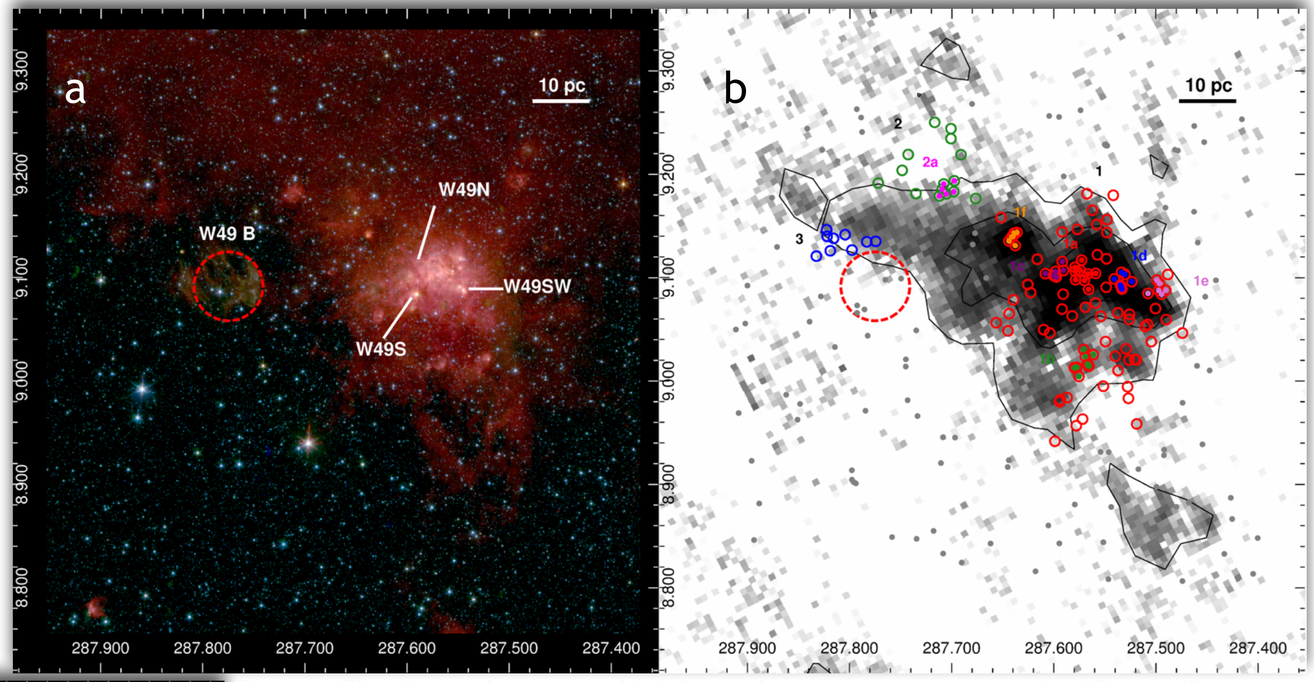


Fig 1a: The Central region of W49A and supernova remnant W49B are shown on RGB image. Red: 8.0 μm; green: 4.5 μm; blue: 3.6 μm. **Fig 1b:**The same region is showing the ^{13}CO(1-0) integrated intensity contours with our identified YSO clusters on CO map [3].

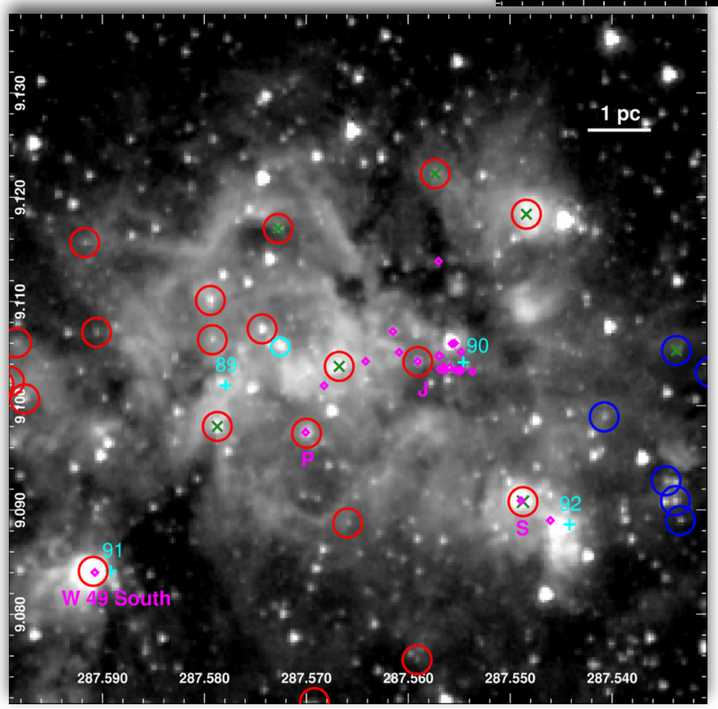


Fig 2: UCHII regions are shown with magenta diamonds [6]. Red circles are YSO candidates in Subcluster 1a, green crosses mark the massive YSO candidates and cyan crosses are massive dust clumps [7].

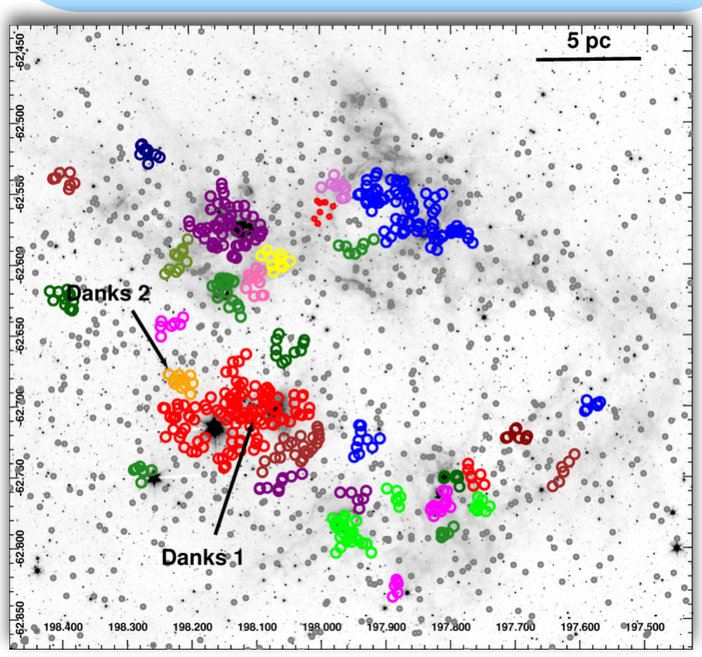
MASSIVE YSO CANDIDATES

✔ Spectral Energy Distribution (SED) fitting method [4,5] is applied to 231 YSO candidates in the MST clusters and 16 massive YSO candidates ($\geq 8 M_{\odot}$) are identified (those are in the center are shown on **Fig 2** with green Xs).

✔ Most of the massive YSO candidates are classified as Class I which shows they are recently formed and mostly located in or near the center which is supporting the mass segregation like observed in many other star clusters.

✔ Most of the UCHII regions are located within a 1 pc area around the Class I candidate where UCHII region J is located (**Fig 2**).

✔ We identified one massive Class I candidate where UCHII region S is located.



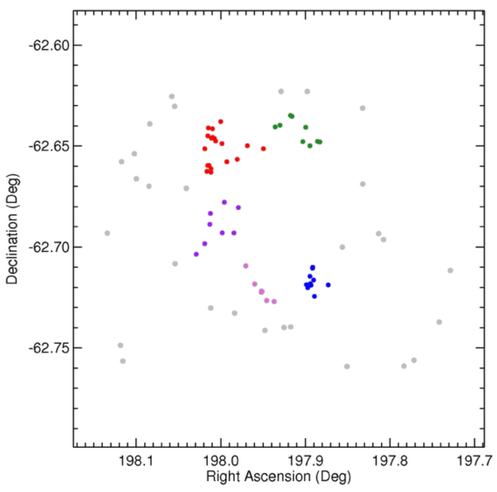


Fig 3. ***Left:*** Subclusters identified in the **G305**. Danks 1 and Danks 2 are open clusters in the region. ***Right*****:** Subclusters identified in the reprojected G305 at 11 kpc.

COMPARISON TO G305 STAR FORMING REGION

✔ Using the catalog from [8], we identified the YSO candidates and subclusters in G305 region (**Fig 3 left**).

✔ We determined the projected appearance of G305 by rescaling the source positions and magnitudes for a distance shift from 4 kpc to 11 kpc distance to W49 and reclassified YSOs and identified the clusters (**Fig 3 right**).

✔ We see more clusters in W49 than in G305 if projected to same distance, therefore; we concluded that W49 has a larger population of high luminosity YSOs than G305.

✔ **Results are submitted in [9].**

References:
[1] Gutermuth + 2009, ApJS, 184, 18, [2] Cartwright & Whitworth, 2003, MNRS, 348, 589, [3] Simon + 2001, ApJ, 551, 747, [4] Azimlu + 2015, arXiv:1507.02966, [5] Robitaille + 2007, ApJS, 169, 328, [6] De Pree + 1997, ApJ, 482, 307, [7] Matthews + 2009, ApJ, 138, 1380, [8] Willis + 2015, ApJ, in press.,**[9] Saral + 2015 ApJ, submitted**.

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