

Triggered Star Formation in W5



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INTRODUCTION

We report results combining *Spitzer* IRAC and MIPS (3-24 μ m) from our survey of the star forming region W5 in the Perseus spiral arm. We show evidence for a clear age separation between cavity and cloud in the HII region. We are investigating this age separation in terms of models of triggered star formation.

Step 1: Imaging, Source extraction and Classification:

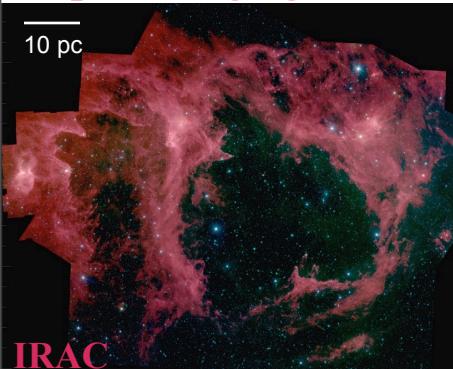


FIGURE 1: *Spitzer* IRAC 3-color composite image of W5 – 3.6 μ m blue, 4.5 μ m green, 8.0 μ m red.

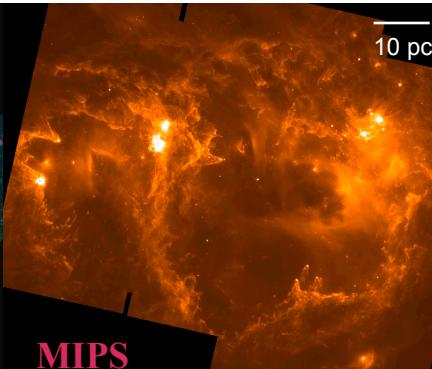


FIGURE 2: *Spitzer* MIPS 24 μ m image of W5.

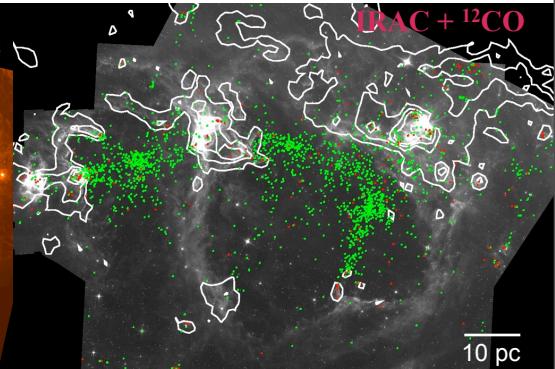


FIGURE 3: *Spitzer* IRAC 5.8 μ m image. Overlaid: ^{12}CO contours + RED class I (protostars), GREEN class II (star+disk) points.

CLASSIFICATION

Combined IRAC and MIPS photometry enables classification via mid-IR colors using automated scheme (Gutermuth et al. 2007).

Step 2: Map Class I:Class II ratio

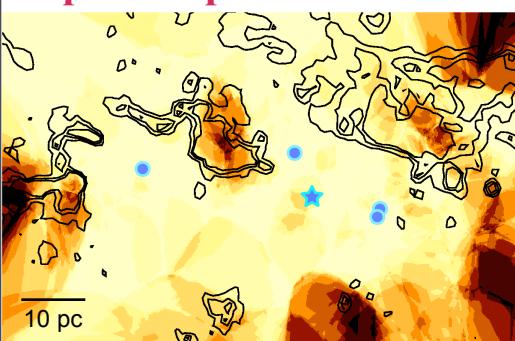


FIGURE 5: ^{12}CO contours overlaid on map of Class I to Class II ratio. **Darker** colors represent **higher** proportion of Class I (protostars) relative to Class II (stars with disks, e.g. T Tauri stars). O stars marked in **blue**; isolated O star marked with **star** point.

Spatial distributions of young stars suggestive of AGE SEQUENCE

1st Generation:

- Isolated O star, marked with **star** in Figure 5.

2nd Generation:

- The three dense clusters of Class II objects visible in Figure 3, centered on the remaining O stars (**●** in Figure 5).

3rd Generation:

- The ‘cloud’ regions, as identified by ^{12}CO emission in Figure 5 contain significantly higher fraction of Class I (protostars) relative to Class II (stars with disks) than in the HII region cavity.
- Within the lowest contour of Figure 5 (integrated $\int T^* A dv = 7.5 \text{ K km s}^{-1}$) $N_{\text{I}}/N_{\text{II}} = 0.29$. Outside, $N_{\text{I}}/N_{\text{II}} = 0.06$.

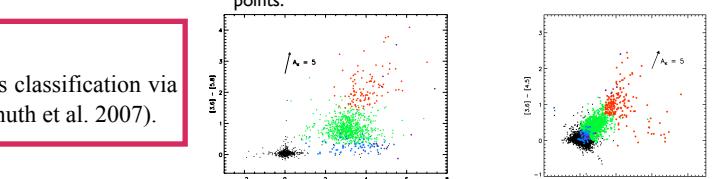


FIGURE 4: *Spitzer* color-magnitude diagrams showing classification scheme for young stars: black - photospheres, green - class II, red - class I, blue - ‘transition disks’.

Step 3: Models for Triggering

TRIGGERING

- Age estimates for W5 range from <1.4 Myr (from stellar wind expansion models, Vallée et al 1979) to 4.5 Myr (Kharchenko et al. 2005, from M-S fitting).
- In order for triggering to be applicable as a model for the W5 age sequence, it must proceed on a similar time-scale.
- We investigate the analytical model of Whitworth et al. (1994) for triggering initiated by expansion of stellar winds.
- Input: O star parameters and canonical ISM properties
- Output: time-scales and radii at which collapse to stars occurs:

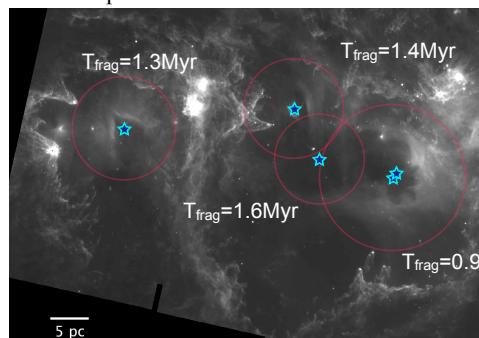


FIGURE 6: *Spitzer* MIPS image. Radii at which each new generation of triggered stars should form marked with circles. O stars marked with **star** points. Timescale for each triggering event shown on figure. We have begun a spectroscopic survey to characterise stellar ages across W5.

REFERENCES

- Kharchenko et al. (2005) A&A 438, 1163
 Vallée et al. (1979) A&A, 80, 186
 Whitworth et al. (1994) MNRAS 268, 291
 Hillwig et al. (2006) ApJ 639, 1069
 Gutermuth et al. (2007), submitted