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Star formation toward IRAS 10427-6032

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Abstract. We study a 5′× 5′ region surrounding a compact H II region IRAS 10427-6032 using multi-wavelength observations. We identified 29 Class II and 5 Class I young stellar object (YSO) candidates, most of which are oriented along the western rim of the bubble, and are spatially coincident with a cold dust clump that partially protrudes into the ionized region. The Lyman continuum luminosity of the ionized emission indicates the spectral type of the ionizing source to be earlier than B0.5–B1. The column density maps of the region, constructed using the *Herschel* data, show a lower density in the bubble than in the annular region. The peak values of the temperature and column density are found to be ∼21 K and 1.3 $\times 10^{22}$ cm^{-2}, respectively. Stars: mid-IR bubbles, H II region

1. Introduction

IRAS 10427-6032, first reported by Kerber et al. (2000) as a possible H II region based on imaging and spectroscopic observations, lies in the direction of the Carina Nebula, at an angular distance of ∼1.3 degree from η Carina. No radio line data are available for this H II region in the literature. A faint cluster was reported near IRAS 10427-6032 by Preibisch et al. (2014). This region shows a broken bubble morphology in the WISE and *Spitzer* IRAC images. A cold dense clump detected by the APEX Telescope Large Area Survey of the Galaxy (ATLASGAL) appears to be associated with this region. We analyzed the ionization continuum detected at 843 MHz in the Molonglo Galactic Plane Survey (Murphy et al. 2007) of IRAS 10427-6032 that shows a nearly spherical morphology where the emission fills the bubble interior almost completely. The angular extent of the nearly spherical source is 110″ which translates to a linear diameter of 1 pc assuming the cluster is located at the same distance as the Carina Nebula, i.e., 2.3 kpc (Walborn 1995). We determined the Lyman continuum luminosity of the source to be $10^{46.9}$ photons s^{-1} following the method by Kurtz et al. (1994). This suggests a spectral type of B0.5–B1 for the ionizing source. The dynamical age of the H II region is estimated to be 0.75 Myr. A candidate zero-age main-sequence massive star is found 9″ from the IRAS source, and 30″ from the peak of the ionized emission. The spectral type of the candidate massive star, based on the SED fitting, is B0–B0.5.

The column density and temperature maps of the region, derived by performing a pixel-to-pixel modified black-body fit to the 160, 250, 350, and 500 μm *Herschel* images, following the procedure outlined in Mallick et al. (2015) are shown in Figure 1a and Figure 1b. The tem-

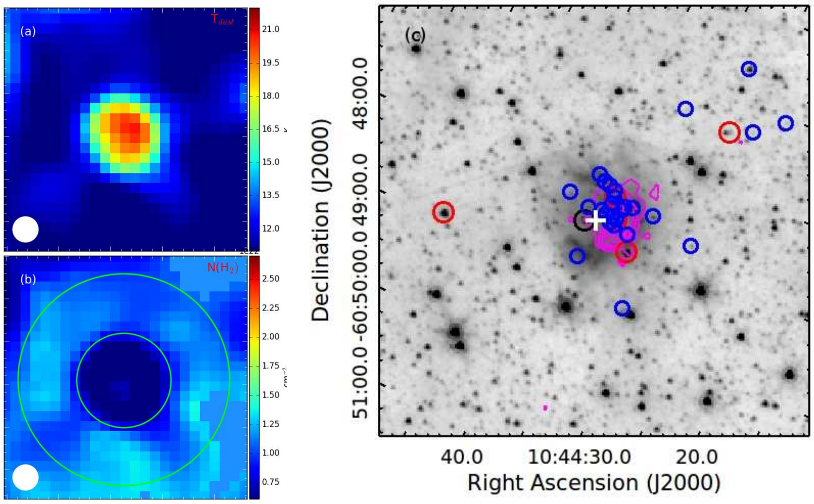

Fig. 1. (a) Dust temperature map, and (b) column density map, around IRAS10427-6032 for a 5.′5× 5.′5 field, derived from *Herschel* images in colour scale. The circles represent the approximate inner and outer boundaries of high column density regions around the H II region. (c) The 5′×5′ field around IRAS 10427-6032 in *Spitzer* IRAC 4.5 μm. The position of the IRAS source is marked with a plus symbol. The YSO candidates are marked as blue circles (Class II) and red circles (Class I). The candidate massive star is marked as a black circle. The 873 μm contours from ATLASGAL are overlaid on the image.

perature distribution ranges between 10 and 21 K, being higher near the infrared cluster. In contrast, the column density map shows a low column density towards the cluster center with an average value $\sim$0.6 $\times$ 10^{22}cm^{-2}, and relatively higher in the outskirts of the cluster, with an average $\sim$1.3 $\times10^{22}$cm^{-2}. A strong overall correlation is found between the 843 MHz emission and the temperature. The temperature gradient with temperature decreasing from northwest to southwest is consistent with the broken morphology of the H II region.

2. YSO candidates and star formation

YSO candidates are identified using near-IR data from the VISTA Carina Nebula Survey (Preibisch et al. 2014), and mid-IR data from *Spitzer*'s Deep Glimpse Survey (Whitney et al. 2011). There are 23 Class II YSO candidates identified based on near-IR colors (Lada & Adams 1992) alone, and 6 Class II and 5 Class I YSO candidates from the combined near- and mid-IR color-color diagram (Gutermuth et al. 2009). The moderately high ratio ($\sim$6) of Class II to Class I YSO candidates suggests a young age for the cluster. A majority of the YSO candidates are spatially coincident with the cold dust clump and the bubble rim (Figure 1c). Two of the five Class I YSO candidates are found outside of the bubble, in the dense annular region, whereas three are coincident with the bubble rim.

3. Conclusions

IRAS 10427-6032 appears to be a compact H II region driven by an early-B (B0–B1) type zero-age main-sequence star. A visibly enhanced star formation on the western rim of the bubble, spatially coincident with the cold dust clump suggests a pre-existing dust condensation that is being compressed by the ionized gas.

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