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CHARACTERIZING THE EMBEDDED YOUNG STELLAR OBJECTS IN THE GALACTIC STAR-FORMING REGION IRAS 18236-1205

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RESUMEN

Presentamos un estudio multibanda de candidatos a objetos jóvenes estelares (YSOs) embebidos en la nube molecular galáctica asociada con la fuente IRAS 18236-1205. Para identificar y clasificar a los YSOs embebidos en la nube molecular se usan los datos de 2MASS, Spitzer/IRAC, Spitzer/MIPS a 24 μm y gas molecular ^{13}CO(J=1-0). Se encuentran dos regiones con formación estelar activa, una localizada en la región central de la nube molecular asociada con la posición de la fuente IRAS y otra al Norte-Oeste de la fuente IRAS. Estas regiones están asociadas a su vez con nubes infrarrojas oscuras (IRDCs) y muestran una fenomenología que está de acuerdo con la fase temprana denominada "Hot Molecular Core", del proceso de la formación estelar de alta masa.

ABSTRACT

In this work, we carry out a multi-wavelength study of a sample of candidates to embedded young stellar objects (YSOs) in the galactic molecular cloud associated to IRAS 18236-1205 source. We used the Spitzer/MIPS 24 μm image to identify candidates to embedded YSOs in the molecular cloud defined by ^{13}CO(J=1-0) intensity maps, and compiled/carried out photometry of these sources in 2MASS, IRAC and MIPS bands. We defined two active star-forming sites in the molecular cloud: one at the location of the IRAS source, and other to the North-West of the IRAS source both associated to infrared dark couds (IRDCs). These regions shows a phenomenology according to the "Hot Molecular Core" early phase of the high mass star-formation scenario.

Key Words: ISM: clouds — stars: formation — stars: pre-main sequence

1. THE MOLECULAR CLOUD ASSOCIATED TO IRAS 18236-1205

The IRAS 18236-1205 source has typical IRAS colors of UCHII regions (Wood & Churchwell 1989), also detections of the OH and H_2O maser emission (Walsh et al. 2003), and of the high density tracer CS(J=2→1) emission (Bronfman et al. 1996). These features make it a good candidate of massive star formation region.

We selected and defined the molecular cloud (Retes et al. 2009) towards IRAS 18236-1205 source using the ^{13}CO data of the Galactic Ring Survey (Jackson et al. 2006). Calculation of the N(^{13}CO) is obtained by standar methods (Tools of Radio Astronomy). We computed the N(H_2) = 4.8×10^{22} cm^{-2}, and an estimation of $A_V \gtrsim 30$ mag for the molecular component in the visual line towards the molecular cloud. We also estimated it cloud Virial mass, $M_{\rm vir} \approx 1.0 \times 10^5\ M_\odot$.

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2. THE SELECTION OF THE EMBEDDED YOUNG STELLAR OBJECTS

We have defined a sample of 126 sources candidates to protostars and YSOs embedded into the molecular region with the following characteristics: bright FIR (from MIPS 24 μm data) point-like sources within 40σ contour of the integrated ^{13}CO molecular gas. All sources have a counterpart in the spectral range 3.6 μm to 24.0 μm, and 85% of the sources satisfied [3.6]-[8.0] > 0.6, a photometric criterion to identify candidates to YSOs with IR excess (Whitney et al. 2008).

3. IDENTIFICATION AND CLASSIFICATION OF YSOS

In order to classified the sample of candidates to YSOs, we have constructed their spectral energy distribution (SED). The evolutive star formation stage of YSOs candidates was following the Lada's criterion (Lada 1987), derived of the spectral index in the spectral range 3.6 μm to 24.0 μm.

We check out the likely evolutive stages of the YSOs using the [3.6]-[5.8] vs. [8.0]-[24] diagram (Robitaille et al. 2006). This diagnostic diagram has three well defined regions for objects in different evolutionary stages. We obtained 75% of class I objects