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PRESENTACION ORAL

Molecular gas linked to the IR bubble S 24

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Abstract. We investigate the presence of molecular gas associated with the infrared dust bubble S 24 based on ^{13}CO(3-2) line observations obtained with the APEX telescope. This study allowed us to detect a molecular shell linked to the bubble. In this presentation we analyze the emission distribution of the molecular gas and estimate its mass and the ambient density.

Resumen. Investigamos la existencia de gas molecular asociado a la burbuja infrarroja de polvo S 24 utilizando observaciones de las líneas ^{13}CO(3-2) obtenidas con el telescopio APEX. Este estudio nos permitió detectar una cáscara de gas molecular asociada a la burbuja. En esta presentación analizamos la distribución de la emisión molecular y estimamos la masa molecular y la densidad ambiental.

1. The IR dust bubble S 24

S 24 is one out of the more than 300 bubbles dentified by Churchwell et al. (2006) in the GLIMPSE images at 8 μm. **Along with S 21, S 22, and S 23, the bubble S 24 belongs to a complex of IR dust bubbles. S 24** coincides with the IR source IRAS 16487-4423. Molecular studies performed towards the IRAS source allowed to detect CO and CS(2-1) emission with velocities in the range –44 to –37 km s^{-1} (Bronfman et al. 1996; Russeil & Castets 2004, indicating a kinematical distance of about 3.7 kpc.

The IRAC image of S 24 at 8 μm is displayed in Fig. 1. The bubble presents a full filamentary shell of about 24″ in radius or 0.44 pc at 3.7 kpc. Two additional small regions of extended emission can be identified in the image, named G341.21-0.21 and G341.22-0.24. The former one is located to the north of S 24, while the second one is close to its **eastern** border.

Here, we report on a **intermediate** angular resolution molecular line study towards S 24 aimed at determining the distribution of the molecular gas linked to the bubble and estimating its mass and the ambient density.

Figure 1. IRAC image at 8 μm of the S 24 region. The IR bubble is shown in the center of the image. G341.21-0.21 is seen to the north of the bubble and G341.22-0.24 to the east. Grayscale is from 100 to 800 MJy ster^{-1}. Contour lines are 300, 500, 700, 1000, and 2000 MJy ster^{-1}.

2. Molecular line observations

As part of a study of the S 21-S 24 complex, we mapped the molecular emission in the ^{13}CO(3-2) line (at 330 GHz) in a region of 5$'$ in size centered at RA.,Dec.(J2000) = ($16^h52^m20^s$, –$44^o28'00''$), using the Atacama Pathfinder EXperiment (APEX), located in the north of Chile. The data were taken in the *on the fly* mode **with a space between dumps in the scanning direction of 9$''$** and an angular resolution of about 20$''$, a velocity resolution of 0.33 km s^{-1}, and an rms noise of 0.3 K. The data cube was analyzed using AIPS.

3. Main results

The upper panel of Fig. 2 shows the distribution of the ^{13}CO(3-2) emission at –43.2 km s^{-1} in contours and grayscale, while the bottom panel displays an overlay of the ^{13}CO(3-2) contours and the emission at 8 μm.

The images show that the IR bubble is almost completely encircled by molecular emission. This molecular shell is present in the velocity interval

[–46.0,–42.3] km s^{-1}. The molecular structure around S 24 has a radius of 54″ (or 1.0 pc at 3.7 kpc) and a systemic velocity of –44 km s^{-1}. The molecular mass linked to the bubble amounts to $M_{H2} \simeq 1.4{\times}10^4$ $M_\odot$. We estimated an H_2 ambient density of $1.2{\times}10^4$ cm^{-3}. Thus, this region seems to be the densest one, and probably the less evolved, in the S 21-S 24 complex Cappa et al. (2012).

Fig. 2 also shows the existence of molecular gas linked to both G341.21-0.21 and G341.22-0.24. Molecular emission linked to G341.21-0.21 can be followed in the interval [–44,–40.5] km s^{-1}. The gas distribution reveals an arc-like feature with maxima to the west and north of the IR emission, thus bordering the bright IR emission region and suggesting that the **source** expanded towards the area with the lowest ambient density. The molecular mass and the H_2 ambient density are $\simeq$ 7200 $M_\odot$ and $1.4{\times}10^4$ cm^{-3}, respectively.

G341.22-0.24 coincides with a molecular clump. The sharp IR **eastern** border of S 24 close to G341.22-0.24 **and its agreement with the western border of the molecular clump (see the bottom panel of Fig. 2) suggests that S 24 is interacting with the clump.**

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Figure 2. *Upper panel:* ^{13}CO(3-2) line emission at –43.2 km s^{-1} showing the molecular gas linked to S 24. Intensities are expressed as main-beam