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# STAR FORMING REGIONS TOWARDS STELLAR WIND BUBBLES: RCW 52 AND RCW 78

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RESUMEN

Hemos llevado a cabo observaciones de la emisión en el continuo infrarrojo en 870 $\mu$m y de la línea molecular $^{13}$CO(2-1) hacia regiones de formación estelar en las burbujas interestelares RCW 52 and RCW 78 utilizando el telescopio APEX. Las observaciones moleculares revelaron los densos grumos en los que están embebidos los candidatos a objetos estelares jóvenes, mientras que las observaciones de continuo en el infrarrojo nos permitieron detectar el polvo frío asociado.

ABSTRACT

We carried out observations of the continuum emission at 870 $\mu$m and the $^{13}$CO(2-1) line towards star forming regions in the stellar wind bubbles RCW 52 and RCW 78 using the APEX telescope. The molecular observations revealed the dense clumps in which the young stellar object candidates are enshrouded, while the IR continuum emission allowed to find the associated cold dust.

*Key Words:* ISM: bubbles — ISM: individual (RCW 52, RCW 78) — stars: formation

## 1. INTRODUCTION

Similarly to the expanding envelopes around HII regions, the dense shells surrounding stellar wind bubbles are potential sites for the formation of new stars (Zavagno et al. 2007; Deharveng et al. 2008) through the *Collect and collapse* and the *RDI* processes.

With the aim of detecting the cold dust and the molecular clumps linked to regions of active stellar formation in the dense envelopes around the ring nebulae RCW 52 and RCW 78, we carried out observations of the continuum emission at 870 $\mu$m and the $^{13}$CO(2-1) line.

## 2. OBSERVATIONS

The data at 870 $\mu$m (345 GHz) were obtained with the Atacama Pathfinder Experiment (APEX), located in the north of Chile, in a region of $12' \times 12'$ in size towards RCW 52 and of $8' \times 8'$ in size towards RCW 78, using the LABOCA bolometer array (Siringo et al. 2009). The data have an r.m.s. noise of 15 mJy beam$^{-1}$ and an angular resolution of $18\farcs2$.

The APEX-1 SHFI instrument was used to perform the $^{13}$CO(2-1) observations at 220.4 GHz. The data were obtained with an angular resolution of $30''$, a velocity resolution of 0.33 km s$^{-1}$, and an r.m.s. noise of 0.1 K.

## 3. THE RING NEBULA RCW 52

RCW 52 is a partial ring of $6'$ in size linked to LSS 1887 (O7V), a member of the Car OB1 association located at 2.5 kpc. The optical appearance of the nebula suggests the action of the stellar winds of the massive star onto its local interestellar medium. The velocity of the ionized gas is $-18$ km s$^{-1}$. The fact that RCW 52 is bordered by MSX-Band A emission along with the existence of molecular gas with velocities of $\approx -20$ km s$^{-1}$ linked to the nebula (Cappa et al. 2005) indicates the presence of photodissociation regions.

Figure 1 displays an overlay of the DSS-R image of the nebula in grayscale and the emission at 870 $\mu$m in contours. The dust emission is clumpy. Some of the dust clumps coincide with young stellar object (YSO) candidates and with the PDR.

The dust clumps match in position with $^{13}$CO(2-1) emission within the range $[-23, -13]$ km s$^{-1}$, indicating that both the molecular and dust clumps are linked to the nebula.

Adopting dust color temperatures in the range 20–30 K, a gas-to-dust ratio of 100, and a dust opacity at 870 $\mu$m of 1.8 cm$^2$ g$^{-1}$ (Deharveng et al. 2009), the total mass is 150–300 $M_\odot$.

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