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The Hot Molecular Core of G12.21–0.10: NH_3(4,4) Observations

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Abstract. In de la Fuente (2007; Ph. D. Thesis), the molecular clump associated with the ultracompact HII region G12.21–0.10 was confirmed as a large, hot, dense Hot Molecular Core nearby to the ionized gas. The density was confirmed by comparing low resolution NH_3(2,2) and (4,4) VLA observations, with other molecular lines and radio–continuum observations. These results will be presented in detail in a forthcoming paper (de la Fuente *et al.* in preparation). In these works, for the first time, the spatial location of the Hot Molecular Core is presented. Here we present the NH_3(4,4) observations from de la Fuente (2007; Ph. D. Thesis), confirming that the hotter and denser gas in the molecular core lies in a compact structure, of smaller scale than the NH_3(2,2) emission.

Keywords. stars: formation, ISM: molecules, radio continuum: ISM

1. Introduction

Hot Molecular Cores (HMC′s) are thought to represent the birthplace of massive stars (e.g. Kurtz *et al.* 2000). They are often associated with Ultracompact HII regions. Due to the lack of free–free radio continuum (RC) emission toward the HMC′s, they can be only detected by emission of high excitation molecular lines (e.g., NH_3) and by millimeter continuum emission from warm dust.

G12.21–0.10 is an ultracompact HII region with extended emission (e.g., de la Fuente 2007, F07 hereafter; de la Fuente *et al.* 2009 for a brief review). A chemically rich molecular clump is found near to the UC emission, coinciding with water and methanol maser emission (F07). Using the VLA in D-configuration, NH_3(2,2) and (4,4) observations were made, showing that the molecular clump is a large (diameter $\sim$ 0.22 pc), dense (n[H_2] = 5.3×10^5 cm^{-3}) and hot (T_k=86$\pm$ 12 K) molecular core with a velocity gradient of 25−30 km s^{-1} pc^{-1} in the SE−NW direction (de la Fuente *et al.*,in preparation; F10 hereafter). F10 will present the NH_3(2,2) map and the spatial location of coinciding water and methanol masers. Here, we present the corresponding NH_3(4,4) map (Fig. 1).

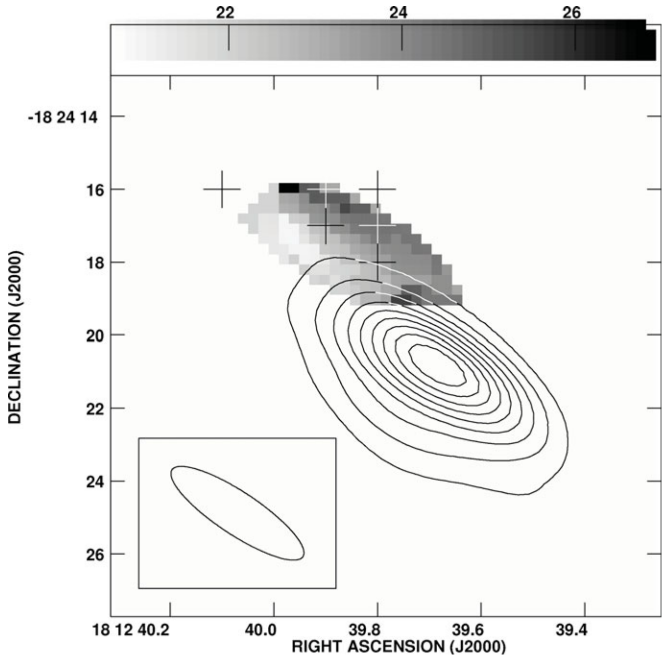

Figure 1. NH_3(4,4) moment 1 map (gray scale) superimposed on the radio-continuum emission at 1.3 cm (contours; UC HII region) obtained from the channel 0 of the line data. Gray scale are 21–27 km s^{-1}. Contours are –10, 10, 20, 30, 40, 50, 60, 70, 80, 90, 100 × 0.86 mJy $beam^{-1}$ (rms noise). The synthesized beam $3.50'' \times 1.36''$ (corresponding to a linear scale ∼ 0.23 pc × 0.09 pc at distance of 13.5 kpc) is shown at the bottom left. The crosses mark the positions of the water masers (Hofner & Churchwell 1996).

2. NH_3(4,4) Results

Figure 1 presents the first moment map (velocity field map) of the integrated NH_3 (4,4) emission superimposed on the 1.3 cm continuum emission of the UC HII region, which was obtained from the channel 0 line data. The NH_3 emission clearly coincides with the molecular clump and the water masers (Hofner & Churchwell 1996). The (4,4) emission is slightly more compact than the NH_3(2,2) emission reported in F07 and F10, suggesting that the hotter and denser gas is confined in a smaller-scale structure. A more detailed study, including both NH_3 (2,2) and (4,4) emission, and comparison with other molecular lines and RC observations will be presented in F10.

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