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The L 1157 protostellar outflow imaged with the Submillimeter Array *(Corrigendum)*

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An error occurred during the production process. The text of Sect. 4.1.1 was missing. This whole section is displayed here.

4.1.1. SiO high-velocity clumps

Using the line ratio between the SiO (5–4) and the SiO (2–1) observed by Zhang et al. (2000) with a synthesized beam of $9\farcs5 \times 8\farcs0$, we derived the physical conditions of the gas in the high-velocity clumps. For our analysis we selected the portion of the high-velocity range that is less affected by the missing flux. The analysis was performed at the B0i and B1a positions, at which the SiO (5–4) emission was detected above the 5σ level. We note that an analysis using several SiO lines observed with a single-dish telescope has been made by Nisini et al. (2007). However, they used single-pointing observations, which means that the data were taken with different beam sizes, for instance $\sim27''$for SiO (2–1) and $\sim11''$for SiO (5–4). In addition, the line ratios used the total integrated intensity, including the low-velocity component, where as we used higher-resolution data and focused on the high-velocity component.

Since the interferometric SiO (2–1) observations agreed to better than 20% with the single-dish results, Zhang et al. (2000) concluded that most of the SiO (2–1) flux was recovered with the interferometer. Therefore we did not take into account the effect of the missing flux in this transition. Our SiO (5–4) observations were convolved to the angular resolution of the SiO (2–1) data (i.e. $9\farcs5\times8\farcs0$). In Fig. 10 we show the SiO (5–4) and (2–1) spectra at the position of clumps B0i and B1a in a brightness-temperature scale. The portion of the high-velocity range in which most of the single-dish SiO (5–4) emission at the B1a position is recovered by our SMA observations is –16.0 to –10.8 km s^{-1}. We assumed the velocity range for the B0i clump to be the same as that of the B1a clump. The linewidth was assumed to be 5 km s^{-1} for both B1a and B0i. Since smoothing the SMA maps to $\sim9''$ beam averaged the emission of adjacent clumps, the spectrum at B1a includes the emission from B1g, B1h, B1c, and B1f. However, the emission from adjacent clumps appears only in the low-velocity range and does not affect the analysis. The integrated line intensities of SiO (2–1) and (5–4) in this velocity range are 1.5 ± 0.6 and 1.5 ± 0.1 K km s^{-1} at B0i, and 7.7 ± 0.6 and 4.4 ± 0.1 K km s^{-1} at B1a. The derived (2–1)/(5–4) ratios are therefore 1.0 ± 0.4 for B0i and 1.7 ± 0.1 for B1a.

We used the non-local thermodynamic equilibrium program RADEX (Van der Tak et al. 2007) in the large velocity gradient (LVG) approximation and plane-parallel geometry to model the (2–1)/(5–4) ratios. Using the RADEX offline distribution[1], we estimated the kinetic temperature ($T_{\rm kin}$) and/or the volume density (n) from the observed line ratio. The input parameters were the background radiation field (the CMB temperature of 2.73 K) and the line width (5 km s^{-1}). To constrain the SiO column density, N(SiO), we used the observed integrated line intensity of the SiO (5–4) emission (1.5 and 4.4 K km s^{-1} for B0i and B1a, respectively). Then, by running the LVG for different N(SiO), we found the best N(SiO) that matches better the SiO (5–4) brightness temperature and the (2–1)/(5–4) ratio.

In Fig. 11 we show the LVG results for the two cases of interest. The LVG results show that the (2–1)/(5–4) ratio depends on the density and is less sensitive to the temperature if the density is lower than $10^{6.5}$ cm^{-3}. On the other hand, the (2–1)/(5–4) ratio becomes sensitive to the temperature if the density is higher than $10^{6.5}$ cm^{-3}. We found that the observed ratios yield similar solutions for the two positions, with a density of $n \sim 10^5$ to 10^6 cm^{-3}. Although the uncertainties on the line intensity and ratio are larger at B0i, these uncertainties do not affect the solution significantly (less than a factor of three). It should be noted that the N(SiO) at B1a is twice as high as that at B0i. The density obtained here is similar to the 3×10^5 cm^{-3} derived by Nisini et al. (2007) as an averaged density that included the low-velocity component. Nisini et al. also found that the physical parameters of the high-velocity component are different from those averaged over all the emitting gas; the (8–7)/(5–4) ratio at $V_{\rm LSR} \sim -15$ km s^{-1} required either a

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higher density of ~5×10^6 cm^{-3} or a higher temperature of $T_K > 500$ K. Although our results do not support the high density of $>10^{6.5}$ cm^{-3}, they do not exclude the high-temperature solution. The kinetic temperatures derived from other warm gas tracers such as high$-J$ transitions of CO, H_2, and H_2O also support the presence of a warm gas component with ~500 K (e.g. Nisini et al. 2007, 2010). We note that the density and temperature of the high-velocity clump are similar to those of the EHV bullets in highly collimated outflows such as HH211 and L1448C, $n \sim 10^5$–10^6 cm^{-3}, and $T_K \geq 300$ K (Nisini et al. 2002; Nisini et al. 2007; Hirano et al. 2006; Palau et al. 2006). This implies that the high-velocity emission in the B1a and B0i clumps has an origin common with that of the EHV bullets.