TABLE 1

MAIN PHYSICAL PARAMETERS OF THE IONIZED AND MOLECULAR GAS

| | |
|---|---|
| $d$ (kpc) | $2.0 \pm 0.5$ |
| $\nu$ (GHz) | 1.465 |
| $S_\nu$ (Jy) | 7.4 |
| Size ($'$, pc) | 3.8, 1.63 |
| $n_e$ (cm$^{-3}$) | 120 |
| $M_{\rm HII}$ ($M_\odot$) | 60 |
| $\Delta v$ (km s$^{-1}$) | 22–36 |
| $N_{\rm H_2}$ (cm$^{-2}$) | $2.40 \times 10^{21}$ |
| $M_{\rm H_2}$ ($M_\odot$) | 2300 |

panel of Figure 1), suggests that the expansion of Sh2-54 has perturbed the molecular gas. However, the angular resolution of our CO data do not allow us to identify clumps in the cloud. Thus, better angular resolution data are needed to detect the molecular clumps linked to the YSO candidates.

The ambient density derived by distributing the ionized and molecular masses over a sphere of $r = 1.63$ pc in radius is $n_0 = 5200 \pm 3200$ cm$^{-3}$.

Considering the simple expansion model for an HII region in a uniform medium given by Dyson & Williams (1997), we estimate a dynamical age $t_{\rm dyn} = 1.3 \pm 0.4$ Myr for Sh2-54. The "collect and collapse" mechanism predicts a fragmentation time given by $t_{\rm frag} = v^{7/11}\ N_{\rm lym}^{-1/11}\ n_0^{-5/11}$ (Whitworth et al. 1994), where $v$ is the sound velocity and $N_{\rm lym}$ is the number of Lyman photons emitted by the ionizing stars. To discern if this mechanism could have been triggered the YSOs in the region, we estimate the lowest ambient density value for the fragmentation process to take place. Adopting $v = 0.2$ km s$^{-1}$, and log $N_{\rm lym} = 48.3$ (which is the minimum number of ionizing photons needed to keep a region with $S_{1.465\ \rm GHz} = 7.4$ Jy ionized), an ambient density larger than 3500 cm$^{-3}$, is required for $t_{\rm frag}$ to be lower than $t_{\rm dyn}$. Taking into account that our estimation for $n_0$ is about 5200 cm$^{-3}$, we suggest that the fragmentation of the molecular cloud could have been occured. In this case, a scenario where the stellar formation activity was triggered by the expansion of Sh2-54 is plausible.

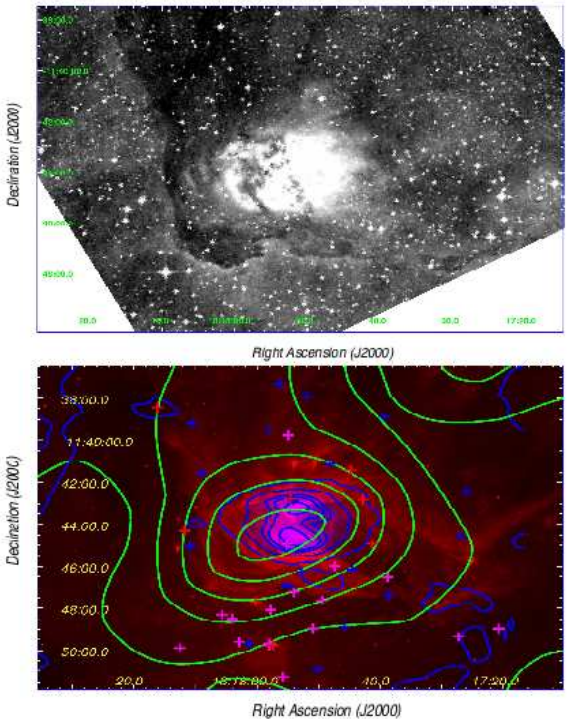


Fig. 1. Upper panel: DSS2 R image of Sh2-54. Lower panel: Mid-IR emission distribution at 8.0 $\mu$m overlaid with the radio continuum at 1465 MHz (blue contours), and the averaged $^{12}$CO(J=1-0) emission (green contours). The crosses indicate the position of the YSO candidates.

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REFERENCES

Allen, L. E., et al. 2004, ApJS, 154, 363
Cappa, C., Niemela, V. S., Amorín, R., & Vasquez, J. 2008, A&A, 477, 173
Deharveng, L., Zavagno, A., Schuller, F., Caplan, J., Pomarés, M., & De Breuck, C. 2009, A&A, 496, 177
Dyson, J. E., & Williams, D. A. 1997, The physics of the interstellar medium (2nd ed.; Bristol: IOP)
Elmegreen, B. G. 1998, ASP Conf. Ser. 148, Origins, ed. C. E. Woodward, J. M. Shull, & H. A. Thronson, Jr. (San Francisco: ASP), 150
Lefloch, B., & Lazareff, B. 1994, A&A, 289, 559
Urquhart, J. S., Thompson, M. A., Morgan, L. K., & White, G. J. 2004, A&A, 428, 723
Whitworth, A. P., Bhattal, A. S., Chapman, S. J., Disney, M. J., & Turner, J. A. 1994, MNRAS, 268, 291