From Interstellar Clouds to Star-Forming Galaxies: Universal Processes?, E44, 1 of 2
Proceedings IAU Symposium No. 315, 2016
P. Jablonka, Ph. André, & F. van der Tak, eds.

doi:10.1017/S174392131600805X

A Study of Magnetic Fields on Bright-Rimmed Clouds

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Abstract. We have made near-infrared (JHK_s) imaging polarimetry toward 24 bright-rimmed clouds in the southern hemisphere in order to reveal their magnetic field structures. The obtained polarization vector maps show that the magnetic field directions inside the bright rim are different from its ambient magnetic field direction, implying that magnetic field structures just inside the ionized front of the clouds are due to the gas compression by UV radiation from nearby massive star. Our investigation into the relation between the magnetic field configuration and the shape of the cloud suggests that the magnetic field configuration affects the evolution of the cloud shape.

Keywords. ISM: clouds, ISM: magnetic fields, HII regions, infrared: stars, polarization, ISM: structure

1. Introduction

Bright-rimmed clouds (BRCs), which exist in relative isolation at the periphery of H_{II} regions, are considered to be ideal sites for studying the UV impact on molecular clouds from nearby massive stars. A lot of theoretical models have been developed to reveal the formation mechanism of various BRCs (e.g., Kessel-Deynet & Burkert 2003; Miao *et al.* 2006). However, most simulation did not always include the magnetic field effects because of a small number of observational results showing the magnetic field structure on BRCs. It is crucially important to obtain information on magnetic fields in and around BRCs.

Forty-five BRCs associated with IRAS point sources were cataloged by Sugitani & Ogura (1994) in the southern hemisphere. Urquhart *et al.* (2009) identified 24 out of them as those showing strong interaction with H_{II} regions. Thus, we have carried out near-infrared polarimetry toward these 24 BRCs in order to examine their magnetic field structures.

2. Observations

We used the imaging polarimeter SIRPOL (polarimetry mode of the SIRIUS camera: Kandori *et al.* 2006) mounted on the IRSF (Infrared Survey Facility) 1.4 m telescope at the South African Astronomical Observatory. The SIRIUS camera has three 1024×1024 HgCdTe (HAWAII) arrays, JHK_s filters, and dichroic mirrors, which enable simultaneous JHK_s observations (Nagashima *et al.* 1999; Nagayama *et al.* 2003). The field of view at each band is $\sim 7.'7 \times 7.'7$ with a pixel scale of $0.''45$.

3. Results

Figure 1 shows H- and K_s-band polarization vector maps superposed on the optical images of SFO 75 and SFO 68. As shown Figure 1, it is found that the polarization vectors just inside the tip bright rim of the cloud, i.e., the magnetic field direction, follow the curved bright rim. This implies that the layer just inside the ionized front (bright rim) was compressed by the UV radiation and then the magnetic field in that layer became nearly perpendicular to the UV direction.

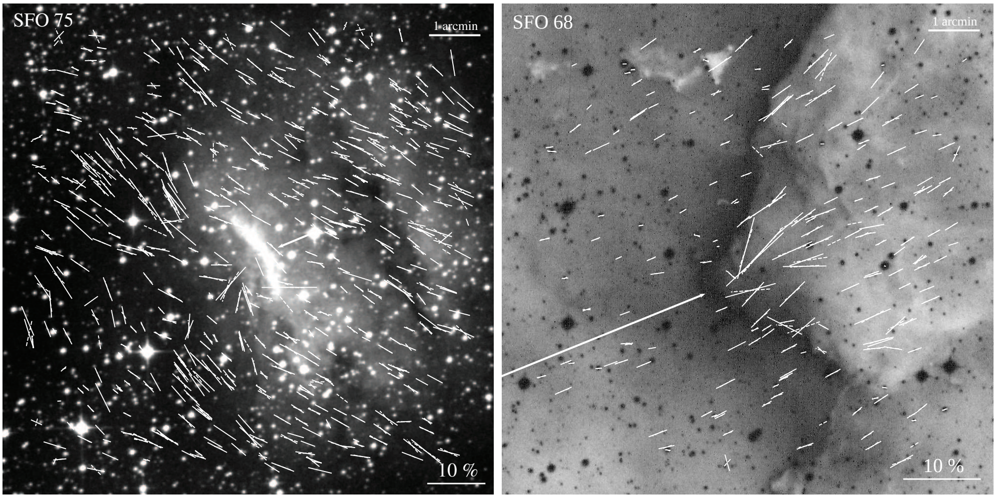

Figure 1. Polarization vector maps of SFO 75 (left panel) and SFO 68 (right panel) superposed on DSS-red and SuperCOSMOS Hα image, respectively. H- and K_s-band polarization vectors are shown with white solid lines and dashed lines, respectively. A 10% vector is shown at the bottom right. The direction of the incident UV radiation from the massive star is shown with a white arrow.

We investigated the relation between the magnetic field configuration and the cloud shape. Our investigation suggests a following tendency. In the case that the ambient magnetic field is nearly perpendicular to the direction of incident UV radiation (e.g., the left panel of Figure 1), BRCs are likely to have bright rims with small curvatures (flat rims). On the other hand, in the case that the ambient field is nearly parallel to the UV radiation (e.g., the right panel of Figure 1), they would have those with more larger curvatures (curved rims).

References

Kandori, R., Kusukabe, N., Tamura, M., Nakajima, Y., Nagayama, T., Nagashima, C., Hashimoto, J., Hough, J., Sato, S., Nagata, T., Ishihara, A., Lucas, P., & Fukagawa, M. 2006, Proc. *SPIE*, 6269, 159

Kessel-Deynet, O., & Burkert, A. 2003, *MNRAS*, 338, 545

Miao, J., White, G. J., Nelson, R., Thompson, M., & Morgan, L. 2006, *MNRAS*, 369

Nagashima, C., Nagayama, T., Nakajima, Y., Tamura, M., Sugitani, K., Nagata, T., Hirao, T., Nakaya, H., Yanagisawa, K., & Sato, S. 1999, *in Star Formation 1999*, ed. T. Nakamoto (Japan: Nobeyama Radio Observatory), 397

Nagayama, T., Nagashima, C., Nakjima, Y., Nagata, T., Sato, S., Nakaya, H., Yamamuro, T., Sugitani, K., & Tamura, M. Proc. *SPIE*, 4841, 459

Sugitani, K., & Ogura, K. 1994, *ApJS*, 92, 163

Urquhart, J., Morgan, L. K., & Thompson, M. A. 2009, *A&A*, 497, 789

https://doi.org/10.1017/S174392131600805X Published online by Cambridge University Press