Circular Polarimetry of the Orion Nebula by SIRPOL

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Near infrared imaging circular polarimetry of the Orion nebula were obtained with the SIRIUS camera [1] and its polarimeter (SIRPOL) on the 1.4-m IRSF telescope at the South African Astronomical Observatory. We present a deep circular polarization (CP) image of the Orion nebula in the K_s band (2.14 µm). Our results reveal that a high CP region is spatially extended (~0.4 pc) around the massive star-forming region, the Orion Becklin-Neugebauer(BN)/Kleinman-Low(KL) nebula [2]. The CP image clearly reveals the quadrupolar structure. On the other hand, other regions, including the linearly polarized Orion bar [3], show no significant CP. In the BN/KL region, we investigate the correlations of CP, linear polarization (LP), and $H - K_s$ color representing extinction [4]. $H - K_s$ color is well correlated with CP. We derive a simple relation between dichroic extinction, color excess, CP, and LP. The observed correlation between the Stokes parameters and the color excess agrees with the derived relation, and suggests a major contribution of dichroic extinction to the production of CP in this region, indicating the wide existence of aligned (nonspherical) grains.

Keywords: Polarization; dust; dichroic extinction.

References

- [1] T. Nagayama et al., Proc. SPIE, 4841, 459 (2003).
- [2] T. Fukue et al., accepted for publication in Orig Life Evol Biosph, arXiv:1001.2608.
- [3] M. Tamura et al., *ApJ*, **649**, 29 (2006).
- [4] T. Fukue et al., ApJ, 692, 88 (2009).