MAGNETIC FIELD STRUCTURE IN THE SMALL MAGELLANIC CLOUD

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ABSTRACT. The present status of an ongoing observational program to study the magnetic field structure of the SMC by means of optical polarimetry is presented. Being the SMC more distant than the LMC, the observed optical polarization would mainly originate in the distorted outer layers in the front side of the SMC. Highly sensitive data obtained up to now show a magnetic field aligned with the HI bridge connecting the SMC with the LMC, revealing one of the few detected intergalactic magnetic fields associated with interacting galaxies.

1. INTRODUCTION

The first surveys of starlight polarization in the direction of the Magellanic Clouds showed polarized vectors parallel to the line connecting the two Clouds. Later Schmidt (1976) noticed that the Galactic magnetic field has the same direction, and that the foreground polarization at that latitude, though being small, is of the same order as the SMC intrinsic polarization. After correcting for this effect the errors increased very much and the polarized vectors of the SMC did not show a clear trend any more.

We present new high sensitivity observations aimed to investigate the influence of the interaction with the LMC on the geometry of the magnetic field of the SMC.

2. OBSERVATIONS

The sample of OB stars to be observed has been selected from the catalogue of Azzopardi and Vigneau (1982) according to the following criteria: not to belong to emission regions, and not to have emission line spectra.

Of the selected stars 103 have been observed between 1986 and 1988 with the new 2.15 m telescope of El Leoncito, Argentina. The observations were made with the VATPOL polarimeter (Magalhães et al., 1984) in series of 2 minutes integration time using the V filter. The

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instrumental polarization was verified to be less than 0.02%, thus no correction was applied to the data.

3. RESULTS

The intrinsic SMC polarization vectors were obtained correcting for the observational error, for the foreground, and also for the bias introduced by the fact that the polarization is a positive definite quantity. This correction (see Simmons and Stewart, 1985) is significant especially for weak polarization. The Galactic foreground polarization was estimated in five different regions averaging data of Schmidt's sample at distances larger than 400 pc and data of stars of the present sample with polarizations lower than 0.4%.

On the other hand the data obtained by Schmidt (1976) were reanalyzed by subtracting our less noisy estimate of the foreground and correcting for the positive definite bias.

The obtained polarization vectors are shown in Figure 1. The more polarized stars indicate a magnetic field almost perpendicular to the main body of the SMC, rather aligned with the HI tidal distortion of the SMC produced by the interaction with the LMC (see Mc Gee and Newton, 1981). Given that the SMC is more distant than the LMC, the "bridge" points to the observer, then the observed optical polarization mainly originates in the distorted outer layers in the front side of the SMC.

On the other hand radio polarization vectors (Haynes et al., this volume) are concentrated to the main body of the SMC and almost perpendicular to the optical ones. This can be understood because there is no significant continuum radio emission associated with the tidal bridge, indicating that the radio polarization originates in the main body of the Cloud where the electron densities are high enough.

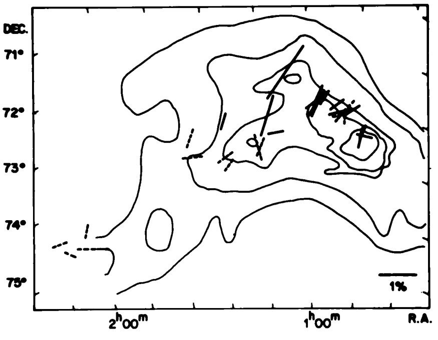

Figure 1. Intrinsic SMC polarization vectors for stars with polarization greater than 0.4%. Full lines, present work stars; broken lines, Schmidt stars. Superimposed are HI contours (7.8, 15.6, 39.0, 58.5 and 78.0 H atm cm^{-2}) from McGee and Newton (1981).

4. REFERENCES

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