

THE MAGNETIC FIELD IN THE PERSEUS MOLECULAR CLOUD COMPLEX

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1. Field Structure (B_{\perp})

In Figure 1, we present a map of the polarization of background starlight in the Perseus region (Goodman, Bastien, Myers, and Ménard 1989) superposed on contours of integrated ^{13}CO emission (Bachiller and Cernicharo 1986). The polarization vectors map the plane-of-the-sky field (B_{\perp}), assuming as usual that the observed polarization is the result of selective extinction by magnetically aligned dust grains associated with the molecular clouds between the observer and background stars (e.g. Dolginov 1989).

The distribution of polarizations observed is bimodal. The first peak, centered at 71° E of N corresponds to a pattern of small ($\sim 1\%$) vectors observed to be almost aligned with the overall projected cloud axis, at $\sim 65^{\circ}$. The second peak, at $\sim 145^{\circ}$, is comprised of larger polarizations oriented almost perpendicular to the cloud axis. Thus there may be two distinct clouds, with different fields, along the line of sight to Perseus. Molecular line maps of OH and ^{13}CO emission (Bally, private communication) show significant velocity discontinuities between neighboring clouds, which also suggests multiple clouds.

2. Field Strength Measurements (B_{\parallel})

We have carried out a series of OH and HI Zeeman observations. The results obtained in the region near the dark cloud Barnard 1 (B1) are summarized in Figure 2. The line-of-sight field strength (B_{\parallel}) as measured by OH Zeeman observations is strongest at the (0,0) position of the map, which is also associated with the peak of an NH_3 core (Bachiller *et al.* 1989), and with an IRAS source whose spectrum is typical of an embedded protostar (Beichman *et al.* 1986).

The measurements illustrated in Figure 2 are consistent with models of equipartition among magnetic, kinetic, and gravitational energy in self-gravitating molecular clouds (see Goodman *et al.* 1989; Myers and Goodman 1989; and references therein).

References

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Figure 1: An optical polarization map of the Perseus dark cloud complex superposed on ^{13}CO ($J = 1 - 0$) integrated intensity contours of 2, 6, and 10 K km s^{-1} from Bachiller and Cernicharo 1986. Note: The length scale shown assumes a cloud distance of 350 pc.

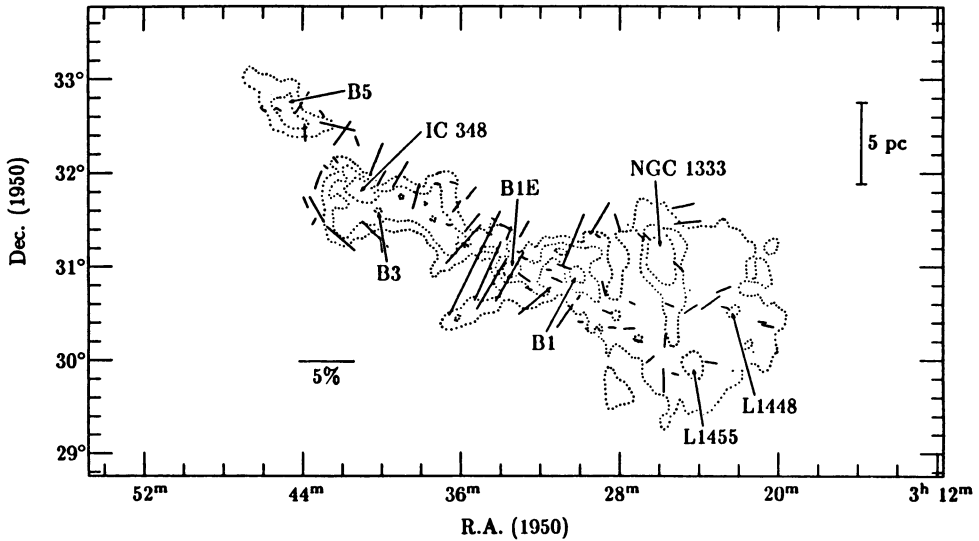


Figure 2: Contour Map of OH 1667 MHz Emission in the region near Barnard 1 (B1). (Crosses indicate positions observed; FWHM beamsize for the mapping observations is 3' (Arecibo 305-m telescope).) The results of five separate long-integration Zeeman observations are indicated; circles indicate the FWHM beam for each observation. Stars indicate IRAS sources present in the region whose spectra are typical of embedded protostars. The coordinates of the observed positions are as follows— B1: $\alpha_{1950} = 03^{\text{h}} 30^{\text{m}} 12.0^{\text{s}}$, $\delta_{1950} = 30^{\circ} 57' 26''$ ($= (0,0)$); P9: $\alpha_{1950} = 03^{\text{h}} 30^{\text{m}} 12.0^{\text{s}}$, $\delta_{1950} = 31^{\circ} 08' 57''$; B1SW: $\alpha_{1950} = 03^{\text{h}} 29^{\text{m}} 58.0^{\text{s}}$, $\delta_{1950} = 30^{\circ} 54' 26''$.

