Magnetic Fields in Star-Forming Molecular Clouds I. The First Polarimetry of OMC-3 in Orion A

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ABSTRACT

The first polarimetric images of the OMC-3 region of the Orion A filamentary molecular cloud are presented. Using the new imaging polarimeter on the JCMT, we have detected polarized thermal emission at 850 μm from dust along a $6'$ length of the dense filament. The polarization pattern is highly ordered and is aligned with the long axis of the filament throughout most of the region, diverging only near the southern boundary by $30 - 50°$. This configuration indicates a plane-of-sky magnetic field which is normal to the filament along most of its length, if the polarization arises from thermal emission of dust grains aligned by the magnetic field via the Davis-Greenstein mechanism. The mean percentage polarization is 4.2% with a 1σ dispersion of 1%. This region is part of the integral-shaped filament, and active star formation is ongoing along its length, with only two of nine dust condensations in our field lacking evidence of outflow activity. The outflow directions do not appear to be consistently correlated with the direction of the plane-of-sky field or the filament structure itself. Depolarization toward the filament center, previously detected in many other star forming cores and protostars, is also evident in our data.

Subject headings: ISM: clouds, magnetic fields, molecules — polarization —- stars: formation — submillimeter

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