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First SCUBA Polarimetry of Two Candidate High-Mass Protostellar Objects

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Abstract. We present the first polarimetry towards two candidate high-mass protostellar objects — W48W and S152SE. The polarimetry across both candidate HMPOs is ordered with a high degree of polarization (6-8%) compared to that of the nearby HII regions. Plane-of-the-sky magnetic field strengths of 0.7mG for W48W and 0.2mG for S152SE have been calculated using the Chandrasekhar-Fermi (CF) method, and mass-to-magnetic flux ratios indicate that both of these clouds are close to the critical value.

1. High-Mass Protostellar Objects

Complete understanding of the theory of star formation requires comprehension of the role of magnetic fields in this process. One of the areas where magnetic fields are thought to be important is the support of molecular clouds. To understand this role it is necessary to study the earliest stages of star formation, where the support mechanism for the cloud starts to fail, and collapse begins. High-mass protostellar objects (HMPOs) are the high-mass equivalent to the previously studied (see Crutcher et al. in these Proceedings) low-mass prestellar cores/class 0 young stellar objects (YSOs) which are at this important stage in their evolution. We present the first submillimetre polarimetry data of HMPOs.

2. Comparisons with 8.28μm and 1.4GHz Emission

We have identified two candidate HMPOs in the vicinity of the W48 and S152 HII regions — W48W and S152SE. The submillimetre continuum emission from the candidate HMPOs is bright in comparison to the nearby HII regions. W48W and S152SE are cold, dense sources, with no radio or mid-infrared emission — the radio emission traces the HII regions and the mid-infrared traces the IR sources within the W48 main core (Figure 1) and the IRAS source IRAS 22566+5828 in the Southwestern part of S152SE (see Curran et al. 2004). This indicates that both W48W and S152SE are candidate HMPOs, at an early stage of evolution. The presence of water masers in these areas supports this hypothesis.

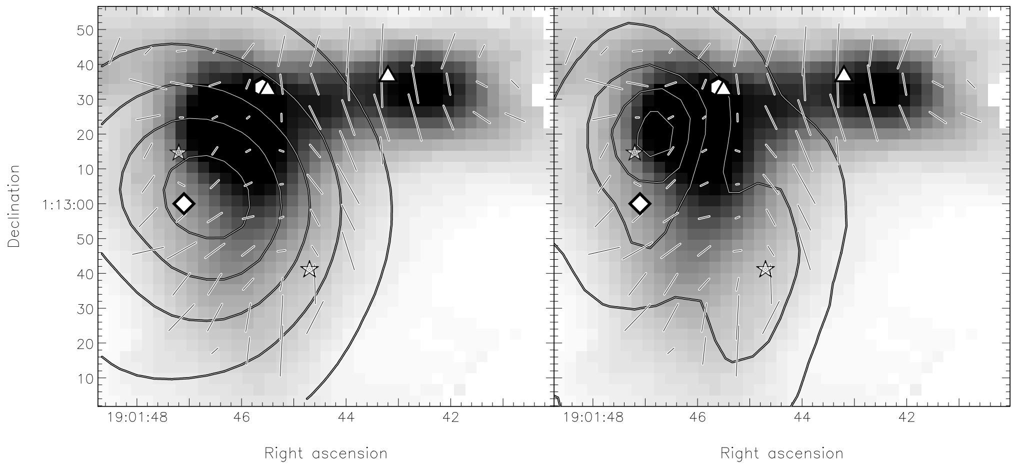

Figure 1. Polarimetry of W48. The greyscale is the 850μm continuum emission, the overlaid vectors have been rotated through 90° to represent the direction of the magnetic field lines projected onto the plane of the sky. W48W is the bright core to the right of the imaged region and has a radius of ~0.3pc. The stars represent the IRS sources (Zeilik & Lada 1978); the diamond marks the position of the HII region (SIMBAD database); the triangles represent water masers (Hofner & Churchwell 1996); and the hexagon represents OH masers (Caswell 2001). *Left panel:* Contours of 1.4GHz emission overlaid. *Right panel:* Contours of MSX A-band (8.28μm) emission overlaid.

3. The Polarimetry

Both candidate HMPOs exhibit high degrees of polarization (6-8%). The polarization vectors are well aligned across both HMPOs, with the magnetic field lines perpendicular to the direction of elongation of the clump, implying collapse along field lines. This polarimetry pattern is predicted by models of subcritical cores collapsing under the effect of gravity and ambipolar drift (see Padoan et al. 2001). CF calculations (Chandrasekhar & Fermi 1953) provide estimates of the plane-of-the-sky magnetic field strengths of ~0.7mG for W48W and ~0.2mG for S152SE. The mass-to-magnetic flux ratios indicate that these clouds are close to critical and as such we are unable to rule out either ambipolar diffusion or turbulence driven star formation models.

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