The Magnetic Field Morphology of the Class 0 Protostar L1157 and the TADPOL Project

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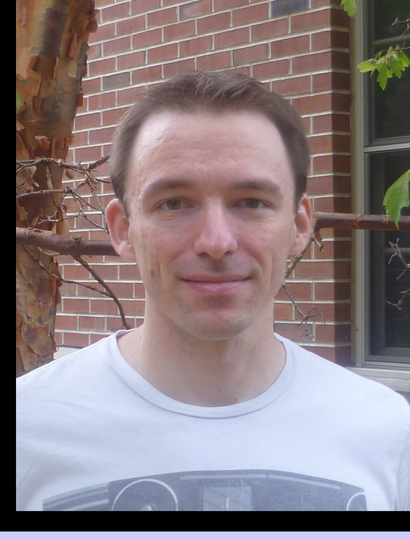
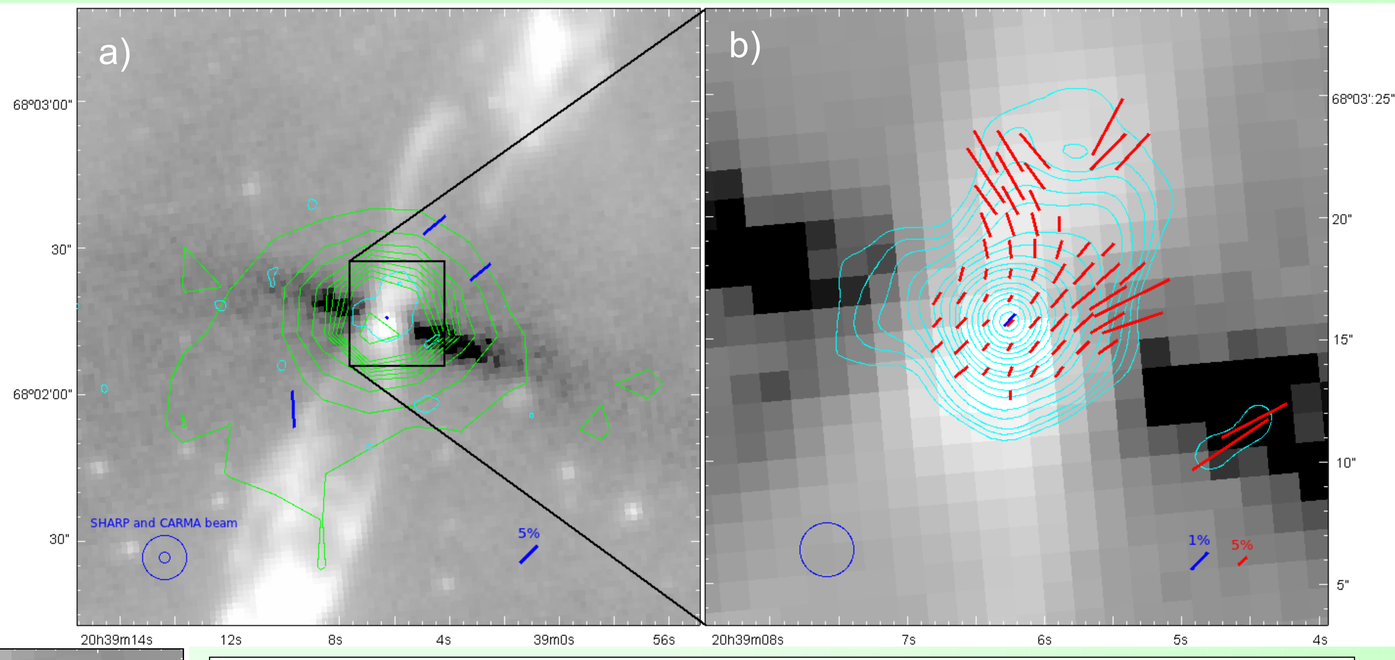
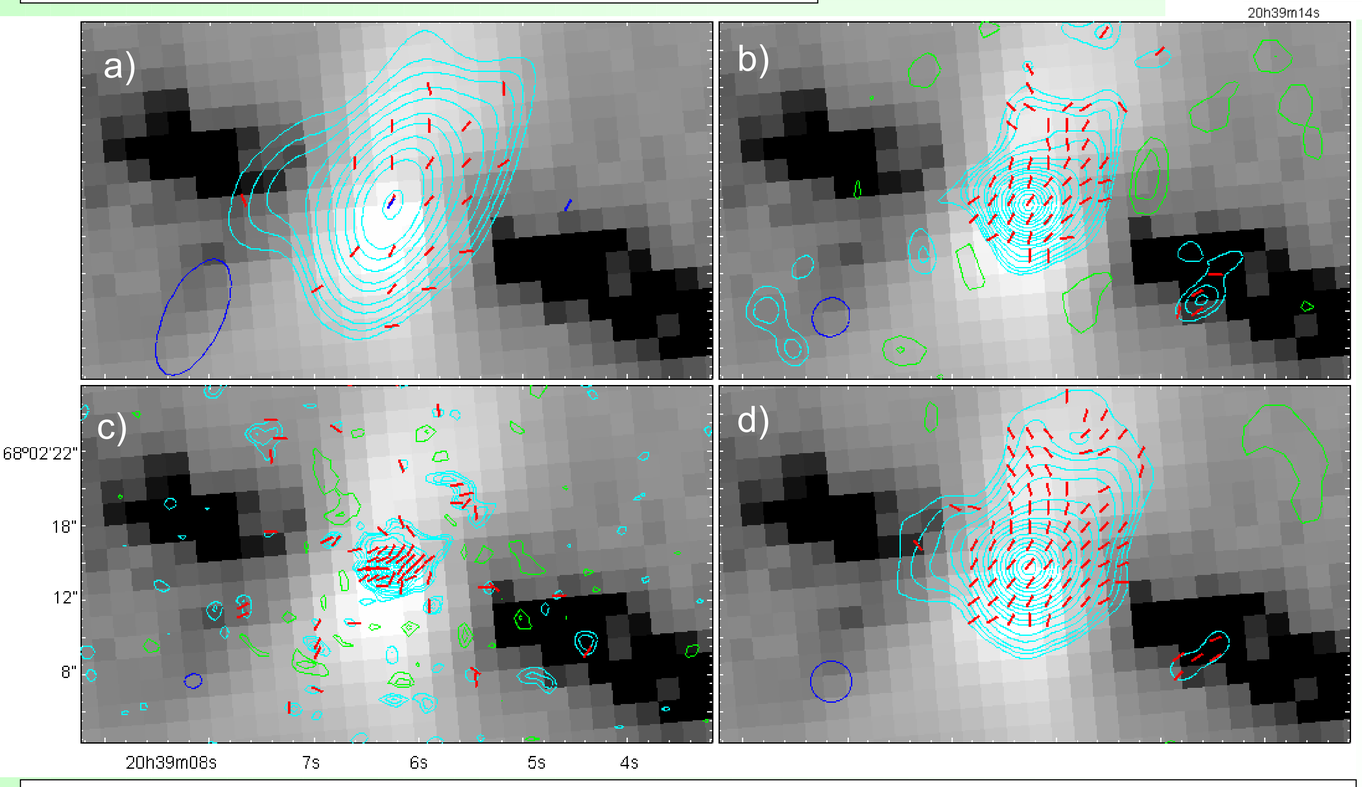


We analyze the magnetic field morphology around the Class 0 protostar L1157-mm located at a distance of ~250 pc. Using SHARP[1] (350 μm) and CARMA[2] (1 mm), we observed the magnetic field at four different size scales (~200 AU to 2300 AU). The morphology shows an hourglass pinch centered about the protostar and the outflow.

[1]SHARC-II Polarimeter at the Caltech Submillimeter Observatory
[2]Combined Array for Research in Millimeter-wave Astronomy



↑ **Figure 1:** Spitzer 8 μm image of L1157 with fractional polarization (P) vectors rotated by 90 degrees to show the magnetic field orientation. 2σ detections are shown with lengths proportional to P. SHARP (resolution ~9") contours and vectors are in green and blue while CARMA (~2.2") contours and vectors are in cyan and red.



↑ **Figure 2:** The magnetic field morphology and contours (with negatives in green) as measured by CARMA on a Spitzer 8 μm image. We show vectors for $P>1.44\sigma_P$ and $I>2\sigma_I$ to determine the size-scale at which we see the hourglass. a) SHARP (9" resolution) and CARMA E-array configuration (~4"), b) D-array (~2"), c) C-array (0.8"), and d) combined weighted-image (~2.2"). The hourglass pinch is apparent at all CARMA size scales, but most prevalent at ~2"

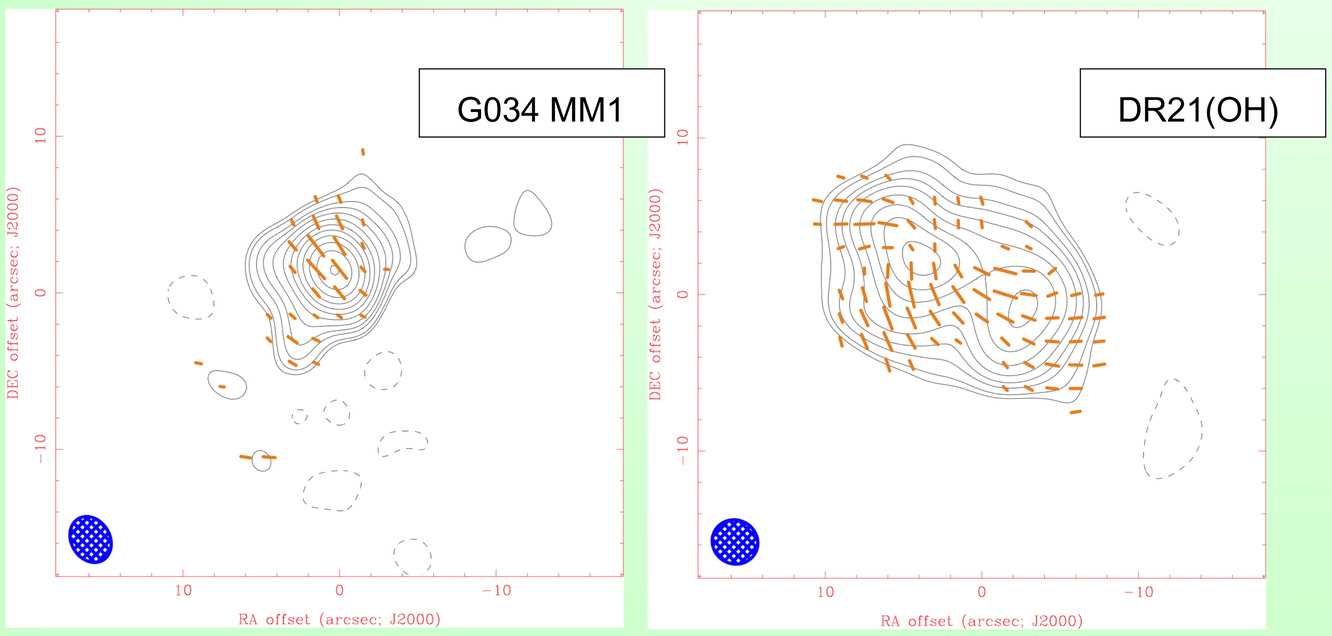
Summary

- There is an hourglass pinch around L1157-mm
  - -Seen at all CARMA size-scales
  - -Most prevalent at 2" (size-scale of ~500AU)
- The magnetic field orientation as inferred by SHARP and CARMA agree
- The symmetry axis of the magnetic field lines up very well with the outflow
- The continuum stretches west toward the flattened envelope and north toward the bipolar outflow

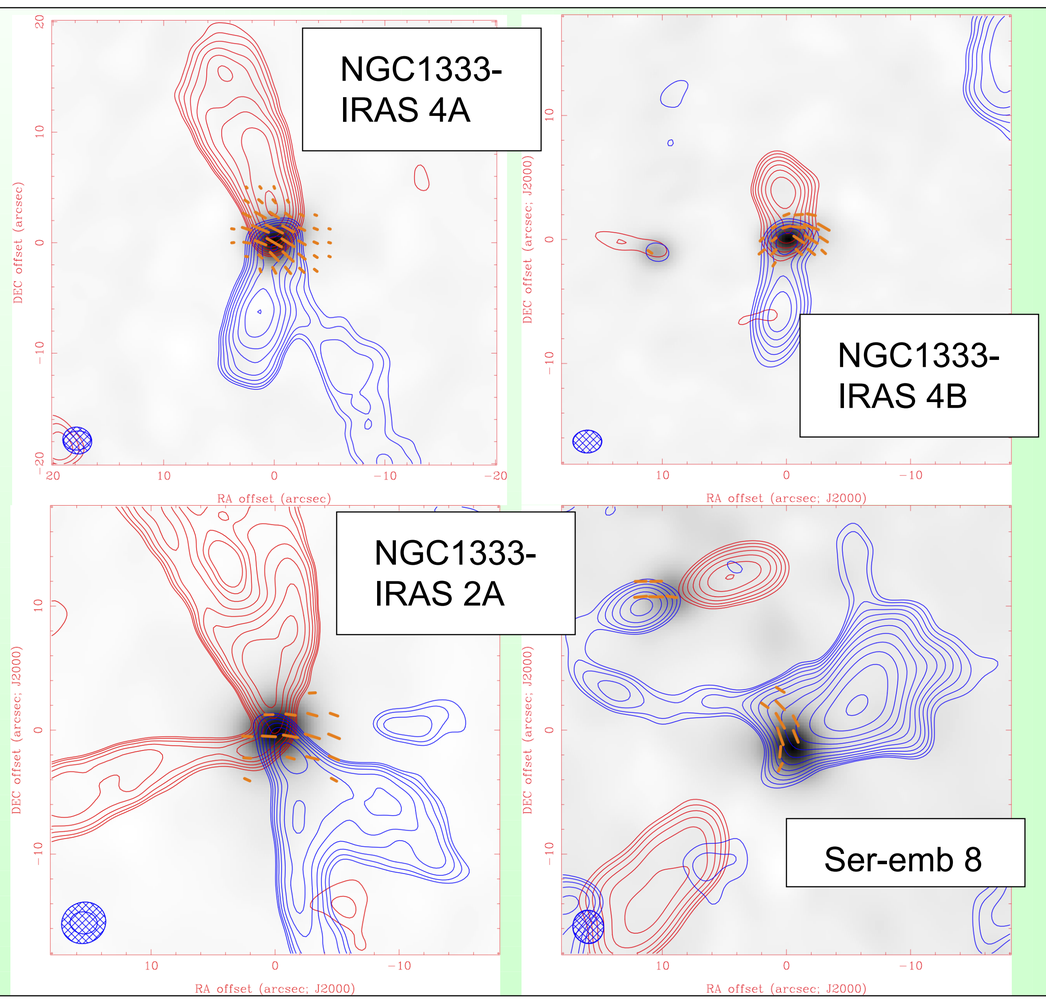
Telescope Array Doing Polarization (TADPOL)

L1157 is part of the TADPOL survey, which uses the 1mm dual-polarization system at CARMA to probe the morphology of magnetic fields in dense, star-forming cores. Literature shows that magnetic fields are typically well ordered on molecular clouds scales (~10 pc) to the dense-core scale (~0.1 pc). TADPOL will observe ~30 cores at scales of ~0.05-0.001 pc to show the importance of magnetic fields at small scales.

Magnetic Fields in Massive Star-forming Regions



Magnetic Fields in Isolated, Low Mass Protostars



Red and blue CARMA contours show the CO(2-1) line wings. Preliminary results show magnetic field both parallel and perpendicular to outflows.