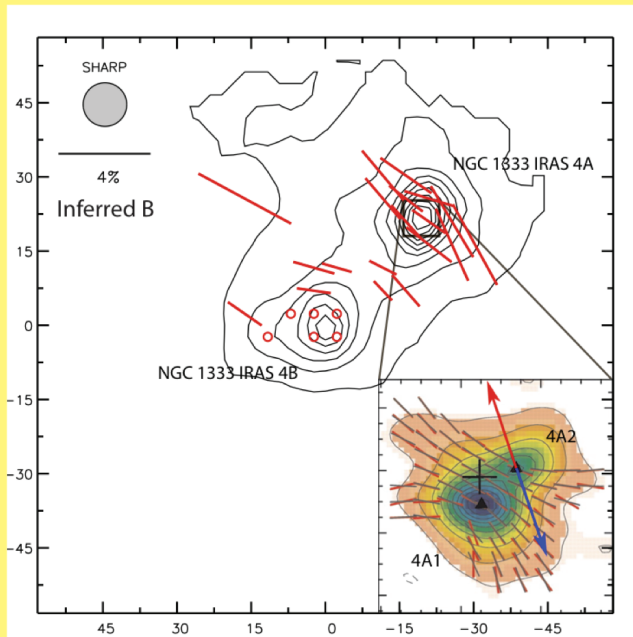


# Mapping Magnetic Fields near Low-Mass Protostars

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According to magnetically-controlled star formation models (e.g., Allen, Li, and Shu 2003), the flattened infall envelopes that are generally perpendicular to the bipolar outflows should have their minor axes parallel to the magnetic field in the inner cloud core. Such models also predict hourglass-shaped field lines within cores. We have initiated a study of B-fields near low-mass protostars, using the SHARP polarimeter at the CSO. Early results for NGC 1333 IRAS 4A, L1527, and IC348-SMM2 support the magnetically-controlled models.

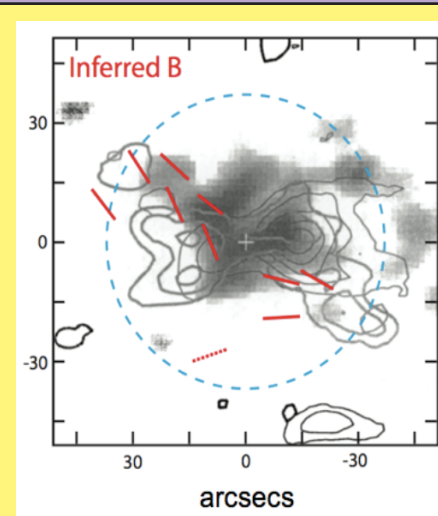


**NGC 1333 IRAS 4:** SHARP B-field pseudovectors (top and center), with SMA B-field pseudovectors shown as a "blow-up" at lower right. Results shown here for the protobinary NGC 1333 IRAS 4A represent the first case where a complete magnetic hourglass has been mapped in a low-mass star forming region: The SMA map reveals the pinched inner part while our SHARP data reveal the more uniform outer part.

SMA map is from Girart et al., 2006, Science  
 Figure shown above is from Attard et al., 2009, Ap J

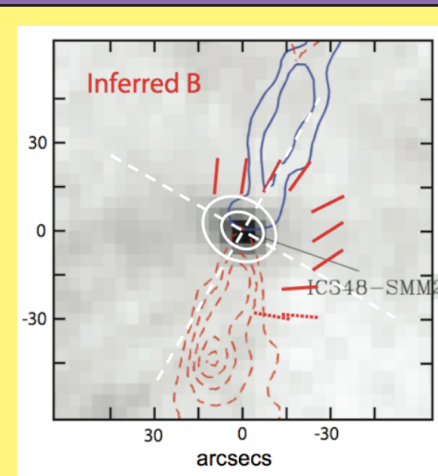
**Impact of SOFIA:** Detailed interpretation of submm polarimetry is limited by ignorance concerning the conditions which favor magnetic grain alignment: As we probe grains along a given sight-line, which densities/temperatures are we favoring? Far-IR and mid-IR polarization spectrum studies are a unique and promising avenue for resolving this issue.

Our results for L1527 and IC348-SMM2, two relatively isolated YSOs with outflows nearly orthogonal to the line-of-sight, suggest that in each source our B-field maps are tracing the pinched innermost portion of a magnetic hourglass that is aligned with the system consisting of outflow plus infall envelope. For a complete hourglass, see NGC1333 IRAS 4A (left panel).



**L1527:** SHARP B-field pseudovectors (in red), with contours of CO emission tracing the East-West outflow.

Dashed pseudo-vector indicates low submm flux (less than 25% of peak flux)



**IC348-SMM2:** SHARP results are superposed on contours of CO emission tracing the outflow. White ellipses show the flattened infall envelope. As in L1527 map, dashed pseudo-vectors indicate low-flux regions.