ALMA Observations of Magnetic Fields around Young Protostar NGC 1333 IRAS 4A

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Magnetic fields are believed to play a crucial role in the star formation process. However, MHD simulations suggest that turbulence may be the controling factor for the formation of clouds and cores, with cores either dissipating back into the interstellar medium or collapsing and forming stars. Therefore, detailed measurements of magnetic fields and turbulence power spectrum are crucial for evaluating the relative importance of magnetic fields and turbulence in star formation.

NGC 1333 IRAS 4A (hereafter IRAS 4A) is the most observed low-mass protostar with dust polarization due to its strong continuum flux. Girart et al. (2006) revealed that the magnetic structure of IRAS 4A has an hourglass morphology with a pinch of few hundred AU which is in agreement with the star formation models with strong magnetic support, and IRAS 4A has become a textbook example for low-mass star formation. We have recently obtained ALMA polarization observations toward IRAS 4A. The data will reveal whether the field structure remains consistent with the hourglass shape seen in the envelope or if the field is twisted around the protostars. Combining our previous SMA data, three-dimensional magnetic field structure around this binary system at Class 0 stage can be constructed reliably for the first time with amazingly high fidelity and sensitivity, which will allow high precision comparison with models of magnetized molecular cores.