Magnetic fields in interstellar clouds

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The Flame Nebula seen in infrared light. New far infrared observations of molecular gas motions around a young stellar core in this nebula support models in which magnetic fields play a key role. Credit: 2MASS, UMass, and IPAC

(PhysOrg.com) -- Magnetic fields play an important role in the formation and evolution of stars, as they stretch around a hot medium like a rubber band and help to determine the flow of material onto or away from the star.

One key uncertainty is the amount of energy in the magnetic field as compared with the energy in turbulent motions of the gas. Unfortunately, magnetic fields are poorly understood, in part because they are very difficult to measure directly.

Observations during the past few years have dramatically improved our ability to detect and study magnetic fields in star-forming clouds. Former CfA postdoc Hua-bai Li and CfA astronomers Ray Blundell, Abigail Hedden, Scott Paine, and Edward Tong, together with a colleague, used a new instrument working at far infrared wavelengths from a Chilean mountaintop to study the effects of magnetic fields.

This CfA Receiver Lab Telescope observed the emission from warm carbon monoxide gas with a velocity resolution able to categorize turbulent motions in the gas.

The scientists found evidence of magnetic fields in the molecular cloud around a young stellar core by examining the distribution of velocities of the gas: magnetic fields should constrain gas motions, and the team was able to measure the extent of this influence as they probed the region around the core.

Additional evidence for magnetic fields comes from the shape of the cloud core, which appears to be elongated rather than spherical (an asymmetrical shape is expected if magnetic fields are constraining the medium).

The new results represent an important advance both in measuring the effects of magnetic fields, and in supporting theoretical models of their influence on the birth of new stars.

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