
Mapping magnetic fields from kpc to core scales with FYST/PrimeCam large-area surveys of polarized dust emission

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Abstract

Polarized dust emission probes magnetism and dust grain properties over a wide range of ISM phases. The CCAT-Prime Collaboration is building the PrimeCam camera on the wide area 6-m Fred Young Submillimeter Telescope (FYST) in northern Chile. PrimeCam leverages an excellent observing site, a wide field of view, and large detector focal planes, to create wide-area, deep maps of the sub-mm dust polarization in 5 continuum bands with a best resolution of 15 arcsec at 850 GHz. PrimeCam will survey $\sim 60\%$ of the sky, with additional deep surveys planned for seven nearby molecular clouds, a nearby translucent cloud, and the Large Magellanic Cloud.

These observations will map the plane-of-sky magnetic field of hundreds of star-forming regions in different mass regimes and at different evolutionary stages and will provide wide frequency coverage extending to 850 GHz to test polarization spectra predictions from different models of dust grain composition. Additionally, we will combine our PrimeCam data with line-of-sight magnetic field observations made with large area radio polarimetry surveys of Australian Square Kilometer Array Pathfinder (ASKAP) and the Square Kilometer Array (SKA), to reconstruct the 3D morphology of magnetic fields in at least a dozen of star-forming clouds.

Polarization power spectra constructed from these maps will help constrain the properties of MHD turbulence in both molecular clouds and the diffuse ISM. The combination of these data will lead to significant advances in our understanding of role of magnetic fields in regulating ISM physics ranging from galactic scales down to the size of individual star-forming cores.

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