Upcoming Polarimetry Opportunities with BLAST-TNG and TolTEC

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on behalf of the BLAST-TNG and TolTEC Science Collaborations

Motivation: Polarized emission from dust grains can be used to make detailed maps of magnetic field geometry in the interstellar medium. However ground-based polarimeters are limited by atmospheric loading and are therefore restricted to observe bright targets or small regions of the sky while Planck all-sky polarimetry cannot resolve magnetic fields within dense filaments and cores. In this poster I discuss the upcoming BLAST-TNG and TolTEC polarimeters, which will completely bridge the gap in spatial scales between Planck and ALMA polarimetry and provide important public legacy datasets for the study of magnetic fields in star-forming molecular clouds and the ISM.

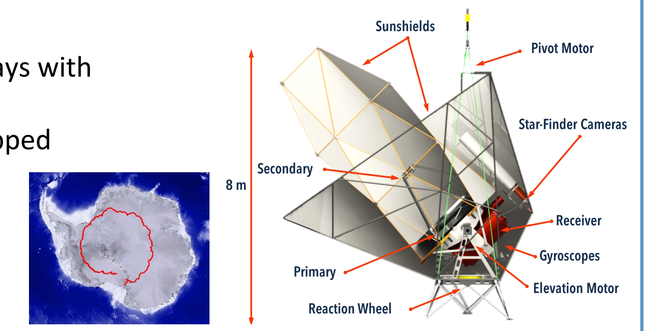
BLAST-TNG

The Next Generation BLAST polarimeter (PI Mark Devlin, Penn) operates from a stratospheric balloon platform above 99.5% of the atmosphere. BLAST-TNG observes simultaneously in three wide frequency bands that bracket the spectral peak of 10-20 K dust making detailed, high resolution maps of both dense clouds and the diffuse ISM.

Telescope Overview:

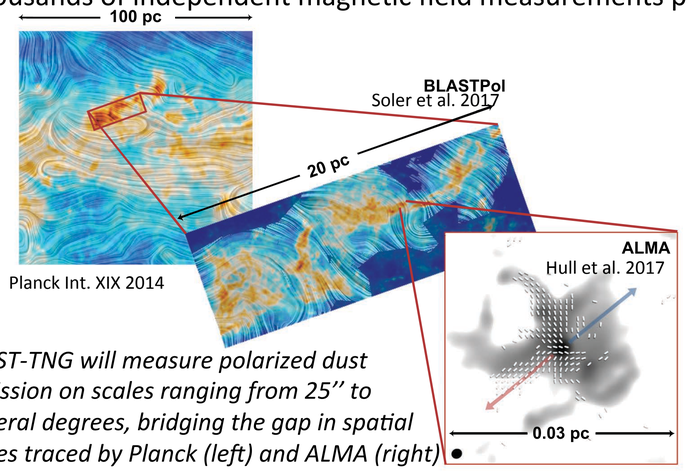
- 2.5 m on-axis mirror feeding focal plane arrays with 3200 MKIDs detectors cooled to <300mK
- Measures I, Q, U simultaneously, with a stepped half-wave plate for extra modulation.

Bands	250 μm	350 μm	500 μm
Beam FWHM	25''	35''	50''
N_{pixels}	900	463	230
I_{min} (σ_p<0.5%, 1deg^2, 5 hr)	220 MJy/Sr	140 MJy/Sr	44 MJy/Sr



Left: 2012 Antarctic flight path for the BLAST-TNG predecessor BLASTPol. Right: Schematic view of BLAST-TNG.

BLAST-TNG will create detailed magnetic field maps for dozens of molecular clouds with thousands of independent magnetic field measurements per cloud.



BLAST-TNG will measure polarized dust emission on scales ranging from 25'' to several degrees, bridging the gap in spatial scales traced by Planck (left) and ALMA (right)

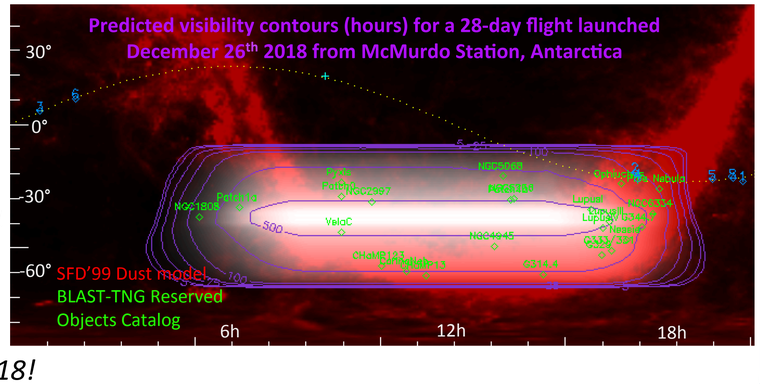
Science Goals:

- Determine magnetic field strength on scales ranging from molecular cloud envelopes to dense filaments.
- Create <5' resolution maps of magnetic fields in the diffuse ISM, in order to measure the magnetized turbulence power spectrum.
- Create detailed maps of magnetic fields in nearby galaxies.

Observing Strategy:

Our first Antarctic flight is planned for December 2018:

- 75% of the science time will be spent on BLAST-TNG reserved targets. (*Maps will be released within 1 year of first look paper publication.*)
- 25% of our science time will be reserved for shared risk proposals.



Call for proposals expected in early 2018!

For more information see: http://sites.northwestern.edu/blast/

BLAST-TNG is funded by NASA.

TolTEC

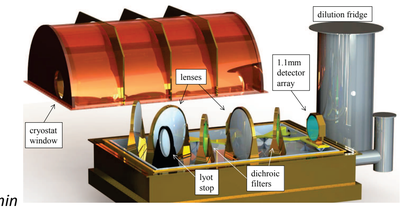
TolTEC (PI Grant Wilson, UMass) is a new polarization sensitive camera being constructed for the 50-meter Large Millimeter Telescope Alfonso Serrano (LMT). TolTEC observes simultaneously at 1.1, 1.4, and 2.1 mm and will be the highest resolution single dish millimeter polarimeter ever built.

Instrument Properties:

TolTEC utilizes polarization sensitive MKIDs detectors with modulation from a spinning half-wave plate.

Bands	1.1mm	1.4mm	2.1mm
Beam FWHM	5''	6.4''	9.5''
N_{pixels}	1800	900	450
Mapping Speed* Max/Min	12/2 deg^2/mJy^2/hr	20/3 deg^2/mJy^2/hr	69/10 deg^2/mJy^2/hr
I_{min} (σ_p<0.33%, 2deg^2, 100 hr)*	25/60 mJy/beam	19/50 mJy/beam	10/27 mJy/beam

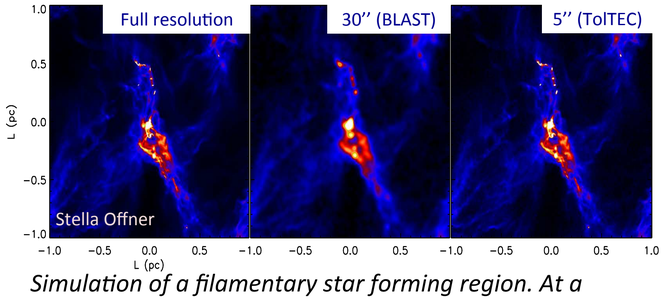
**Note: We list best case/worst case values for the mapping speed and I_{min}*



Left: LMT (4580 m elevation). Below: the TolTEC cryostat

The Fields in Filaments Legacy Survey:

A 100-hour legacy survey funded by the NSF-MSIP program, Fields in Filaments will create high resolution maps of magnetic fields within filaments and dense cores.



Simulation of a filamentary star forming region. At a distance of 300pc BLAST-TNG can barely resolve the 0.1 pc filament (center panel), while TolTEC (right panel) will have >10 resolution elements across such a filament.

Science Goals:

- Determine magnetic field morphology within cores and dense filaments.
- Test whether magnetic fields are strong enough to inhibit the collapse of star forming cores/ filaments.

A Community Driven Survey:

- Survey strategy and science targets will be decided in consultation with the Fields in Filaments Working Group.
- Working Group membership is open to all interested astronomers.
- Targets will be chosen by Summer 2018.
- All science data will be made public (see survey schedule).

Survey Schedule:

TolTEC Commissioning	Begins late 2018
First Look Data Release	Early 2019
FiF Observations	2019-2021
Data Release 1	1 year after survey starts (est. 11/01/2020)
Data Release 2	4 months after survey completion (est. 8/31/21)
Final Data Release	2022

For more information or to join the FiF working group see: http://toltec.astro.umass.edu

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