ABSTRACT

The B-mode Foreground Experiment (BFORE) is a proposed NASA balloon designed to make optimal use of the sub-orbital platform by concentrating on three dust foreground bands (270, 350, and 600 GHz) that complement ground-based cosmic microwave background (CMB) programs. BFORE will survey ~1/4 of the sky with 1.7 - 3.7 arcminute resolution, enabling precise characterization of the galactic dust that now limits constraints on inflation from CMB B-mode polarization measurements. In addition, BFORE’s combination of frequency coverage, large survey area, and angular resolution enables science far beyond the critical goal of measuring foregrounds, including velocity measurements or constraints on thousands of galaxy clusters, a new window on the cosmic infrared background, and probes of magnetic fields in the interstellar medium. We review the science case, timeline, and instrument design, which is based on a compact off-axis telescope coupled to >10,000 superconducting detectors.

INSTRUMENT OVERVIEW

- Aperture: 1.35 meters
- 1.7’ to 3.7’ resolution
- 3 degree field-of-view
- Secondary cooled to 4K
- Cold reflective HWP
- Compound silicon lens isolates AR coatings
- He fridge cools detectors to 0.3K
- Antarctic flight (28+ days)

DETECTOR ARRAYS

- Feedhorn-Coupled Superconducting Polarimeters
- Transition-Edge Sensor (TES) bolometers based on ACTPol multichroics [6,7] at 270/350 GHz
- Kinetic Inductance Detectors (KIDs) from BLASTPol [8] at 600 GHz
- Detector technologies selected based on demonstrated performance and optimization for different wavelengths
- Microwave readout of all detectors; microwave SQUIDs for TESes [9,10]
- Approximately 4,000 detectors at each frequency \(\sim 12,000\) detectors total (~6,000 dual polarization pixels)

REFERENCES


OBSERVATIONS AND SCIENCE

- Goal: Improve Inflation constraints by characterizing foregrounds
- Optimized to complement ground-based observations
- > 5x deeper than Planck across 10,000 deg
- Overlap with Advanced ACTPol, SPT-3G, BICEP/Keck, Polarbear, CLASS...
- 10,000 deg² observing area
- Break degeneracies from spatially varying dust
- Enable new measurements of galactic magnetic fields & CIB
- Kinematic Sunyaev-Zel’dovich (kSZ) measurements of individual clusters
- kSZ figure-of-merit is tripled compared to Advanced ACTPol alone (based on [3])

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TIMELINE AND ACKNOWLEDGEMENTS

First Antarctic flight target is 2018, enabled by reusing BLAST systems. Proposal in review at NASA during summer of 2015.

Background Image from the Planck satellite team and the ESA.