Near-Future Observations of the CMB: B2K2

Boomerang 2002

Instrument Crew

Caltech: Brendan Crill, Bill Jones, Andrew Lange
Cardiff: Peter Ade, Phil Mauskopf, Carole Tucker
Case Western (UCSB): Ted Kisner, Tom Montroy, John Ruhl, Eric Torbet
IROE: Andrea Boscaleri, Enzo Pascale
JPL: Jamie Bock
U. Rome: Paolo deBernardis, Silvia Masi, Francesco Piacentini, Giuseppe diStefano, Armando Iacoangelli
U. Toronto: Carrie MacTavish, Barth Netterfield, James Watt

ITP, 19 August 2002: John Ruhl, Case Western Reserve University.

Boomerang Basics…

1.2m diameter telescope
⇒ 10.5' fwhm at 2mm
3-color, 12 bolometer, 285mK,
polarization sensitive focal plane
Near-Future Observations of the CMB: B2K2

Boomerang’s 1998 Track
(1 lap in 10.6 days...)

Stratospheric vortex takes the payload around the continent
= 120,000 feet altitude

⇒ LOTS of integration time.

B2K2 Science Goals

CMB Polarization

• Pure Polarization: Make an ~80 sq. deg. map of polarization with ~7 uK/pixel sensitivity (Q and U), to measure raw CMB polarization signal. (5 days)

• Polarization-Temperature cross corellation: ~800 sq. deg. map of polarization and temperature with ~22 uK/pixel (Q and U) sensitivity. (5 days)

• Characterize polarized Galactic foreground emission.

Temperature Anisotropies

Smaller scales: Use better pointing and deeper coverage to make better measurements of 3rd, 4th, ... peaks in power spectrum.
Near-Future Observations of the CMB: B2K2

**How B2K2 will improve w.r.t. B98**

1. Polarization
2. Deeper map (for Pol and for high $l$)
3. Reduce beam uncertainty. ⇒ *better pointing reconstruction would help!*

So we now have a Pointed Star Camera.

**B2K2 Focal Plane Layout**

*(All feeds are corrugated and single-mode, to give symmetric beams…)*

150GHz PSB’s 10.5’ FWHM

250 & 350 GHz 6’ and 5’ FWHM

Azimuth Scan direction
Near-Future Observations of the CMB: B2K2

Polarization Sensitive Bolometers

- The absorber metallization is in one direction only, e.g. vertical.
- Two of these devices are mounted orthogonally in the same waveguide, in front of 1/4 wave backshort.

*Developed at Caltech/JPL*

(Jones, Bock, Bhatia & Lange, SPIE in preparation)
Near-Future Observations of the CMB: B2K2

Measured Polarization Efficiency of a PSB pair in Boomerang

(includes 2 reimaging mirrors)

**Black** and **Blue** are

The two back-to-back bolos in one PSB pair.

Polarization Efficiency $\sim 0.95$

(unpolarized would be a flat line at 0.5; perfect PSB would be sine-wave with amplitude = 1.)

---

Boomerang Map

Map from Netterfield et al.
Near-Future Observations of the CMB: B2K2

**Counting Chickens...** the B2K2 forecast.
(this is as good as it can possibly get, 150GHz only, optimistic noise)

![Graph showing multipole counts](image)

Multipole