The Cosmic Microwave Background: An Adventure in Instrumentation

NSF



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"Standard Model" of Cosmology



Physics at an energy scale of ~10¹⁶ GeV!

λCDM describes current observations CMB SN1a **BAO BBN Requires Strange** Components **Dark Matter** Dark Energy Inflation

Cosmic Microwave Background

Background radiation left over from the time of recombination

Electrons combined with nuclei

Allowed photons to finally escape in the IR

Roughly 2.7K in all directions

Anisotropies observed

ISOTROPY OF THE COSMIC MICROWAVE BACKGROUND

UKP350004

Temperature Fluctuations -Anisotropies

Many small scale Used to detect initial variations detected conditions of universe



Power Spectra



BB Mode

Divergence-free component of the polarization

Vector-dependent

Holds potential information about inflation



ACTPol Project Goals



Summer Goals

Make a Calibrator to measure detector time constants and beams

Personal Goals:

Increase understanding of electronics and machining

Gain hands-on experience in a real lab setting



Instrumentation



Instrumentation

Designed and built several copies of my circuits Designed to power 90GHz amplifiers in an emitter source.



Instrumentation

Designed and built two copies of a circuit to pulse the emitter output

Engineered and manufactured the calibrator casing



Future Uses of Instrument

Prototype 150 GHz Single Pixel

Map and calibrate time Relieved 5 mm OD TES island (X-pol) constants of detectors 1.6 mm OMT Measurement of beam Relieved TES island (Dark) shapes Relieved TES island (Y-pol) Could be used for field CPW-to-MS transition DC line testing of detectors as filters (TES, heaters) MS stub filters well

References

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