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Ultra High Energy Cosmology with the POLARBEAR Telescope

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Recent studies of the temperature anisotropy of the Cosmic Microwave Background (CMB) lend support to an inflationary origin of the universe, yet no direct evidence verifying inflation exists. Current generation experiments now focus on the polarization anisotropy in the CMB, specifically the curl component of the CMB's polarization (called the "B-mode"), which is undetected to date. The theory of inflation predicts the existence of a primordial gravitational wave background that imprints a unique signature on the polarization B-mode at large angular scales. The CMB B-mode signal also encodes gravitational lensing information at smaller angular scales, which bears the imprint of large scale cosmological structures. The quest for detection of these signals; each of which is orders of magnitude smaller than the CMB temperature, has motivated the development of background-limited detectors with precise control of systematic effects.
The POLARBEAR experiment is designed to perform a deep search for the signature of gravitational waves from inflation and to characterize lensing of the CMB by large-scale structure. POLARBEAR is a 3.5 meter ground-based telescope with four arc-minute angular resolution at 150 GHz.
At the heart of the POLARBEAR's receiver is an array featuring 1274 antenna-coupled superconducting transition edge sensor bolometers (TESB) cooled to 0.25 Kelvin. POLARBEAR is designed to reach a tensor-to-scalar ratio of 0.025 after two years of observation – more than an order of magnitude improvement over the current best results, which would test physics at energies near the GUT scale.
POLARBEAR had an engineering run at Cedar Flat, California in 2010 and will begin observations in the Atacama Desert in Chile in 2011.

Summary

Overview of the POLARBEAR telescope, projected finding, and impact on the field of cosmology.

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