8452-69, Poster Session

RF characterization of a cold-electron bolometer integrated with a unilateral finline

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The Cold-Electron Bolometer (CEB) is a very sensitive millimetre-wave detector with high saturation power, fast response and is easy to integrate with planar circuits. We have designed, fabricated and tested CEB detectors integrated across the slot of a unilateral finline on silicon substrate. Bolometers were fabricated using e-beam direct-write trilayer technology. The CEB performance was tested in a He3 sorption cryostat HELIOX-AC-V at a bath temperature of 310 mK. DC IV curves were measured in a current bias mode and optical response was measured by irradiating samples with signals from a black body source mounted inside the cryostat. The finline chip with CEB device was mounted in a waveguide block and connected to the readout system by bond-wires. The RF signal was focused onto the waveguide input using a horn. The signal response was measured by comparing different IV curves in current-biased mode at different RF source temperatures. The voltage response obtained from the IV curves was about 155 uV for 15 K RF source temperature difference, which corresponds to the voltage to power response of dV/dP = 1.52x10^7 V/W. The measured total votage noise is Vn = 15 V/Hz^1/2. In this paper we shall report details of the experimental measurements and through analysis of the experimental results.

8452-70, Poster Session

Phase-controlled polarization modulators

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We report technology development of millimeter/submillimeter polarization modulators that operate by introducing a a variable, controlled phase delay between two orthogonal polarization states. The variable-delay polarization modulator (VPM) operates via the introduction of a variable phase delay between two linear orthogonal polarization states, resulting in a variable mapping of a single linear polarization into a combination of that Stokes parameter and circular (Stokes V) polarization. Characterization of a prototype VPM is presented at 350 and 3000 microns. We also describe a modulator in which a variable phase delay is introduced between right- and left- circular polarization states. In this architecture, linear polarization is fully modulated. Each of these devices consists of a polarization diplexer parallel to and in front of a movable mirror. Modulation involves sub-wavelength translations of the mirror that change the magnitude of the phase delay.

8452-71, Poster Session

Water vapour radiometers for the Australia Telescope compact array

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We have developed Water Vapour Radiometers (WVRs) for the Australia Telescope Compact Array that are capable of determining excess path fluctuations by virtue of measuring small temperature fluctuations in the atmosphere using the 22.2 GHz water vapour line for each of the six antennae. By measuring the line of sight variations of the water vapour, the induced path excess and thus the phase delay can be estimated and corrections can then be applied during data reduction. This reduces decorrelation of the source signal. In this presentation, we discuss the design of the WVRs, an uncooled quadruple filter radiometer capable of detecting water line temperature fluctuations to a sensitivity of 12 mK. The design process of the WVRs is discussed with an emphasis on the modelled sensitivity requirements, filter placement, radio frequency interference mitigation and we conclude by demonstrating how this water vapour radiometry system recovers the telescope's efficiency and image quality as well as how this improves the telescope's ability to use longer baselines at higher frequencies, thereby resulting in higher spatial resolution.

8452-72, Poster Session

The cosmology large angular scale surveyor (CLASS): 40 GHz optical design

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The Cosmology Large Angular Scale Surveyor (CLASS) instrument will measure the polarization of the Cosmic Microwave Background at 40, 90, and 150 GHz from Cerro Toco in the Atacama Desert of northern Chile. In this paper, we describe the optical design of the 40 GHz telescope. The telescope is a diffraction limited catadioptric design consisting of a front-end Variable-delay Polarization Modulator (VPM), two ambient temperature mirrors, two cryogenic dielectric lenses, thermal blocking filters, and an array of 36 smooth wall scalar feed horn antennas. The feed horns guide the signal to antenna-coupled transition-edge sensor(TES) bolometers. Polarization diplexing and bandpass definition are handled on the same microchip as the TES. The feed horn beams are truncated at 10 dB edge taper by a 4 K Lyot-stop to limit detector loading from stray light and control the edge illumination of the front-end VPM. The field-of-view is 18 deg in diameter with a resolution for each beam on the sky of 1.5 deg FWHM.

8452-73, Poster Session

ALMA nutator design and preliminary performances

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We report the past two years of collaboration between the different actors on the ALMA nutator. Building on previous developments, the nutator had seen changes in most of the design. A high modulus carbon fiber structure had been added on the back of the mirror in order to transfer the voice coils efforts without deformations, thus eliminating delay problems. The controller is now an off the shelf NI-cRIO, and the amplifier a class D drive from Advanced motion controls, with high peak power able to drive the coils at 300VDC. The stow mechanism had been totally redesign to improve on the repeatability and precision of the stow position, which is also the reference for the 26 bits Heidenhain encoders. This also improve on wind load capability. Finally, the software, written largely with NI LabView's, had been extensively developed. We will discuss these changes and the preliminary performances achieved.