Status of the 1.4 meter Telescope for the Q/U Imaging Experiment

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This paper describes the status of the 1.4 meter telescope for the Q/U Imaging ExperimenT (QUIET) intended to image the polarization of the cosmic microwave background (CMB) with detectors at two frequencies with unprecedented sensitivity. Observing the polarization of the CMB demands exquisite sensitivity to both Q and U Stokes parameters and freedom from systematic errors. QUIET makes use of recent breakthroughs in millimeter-wave circuit packaging to enable large arrays of radiometers or polarimeters for modest cost. Modules based on IC-style packaging with waveguide inputs provide fully functional pseudo correlation polarimeters capable of detecting Q and U simultaneously. The feeds themselves are corrugated horns built up from stacked platelets, each with an array of holes, defining one grove in each feed.

This paper is follow-on to Imbriale, “The 1.4 meter Telescope Design for the Q/U Imaging Experiment”, URSI 2006, which described the RF optics of the side fed Cassegrainian antenna whose design was selected because of its excellent cross-polarization and wide angle scan performance. An extremely large and flat field of view was realized with an angular extent of over 12º on the sky. At W-band the beam size is 0.22 degrees and at Q-band the beam size is 0.5 degrees.

Two platelet arrays have been fabricated: A 19 element array covering 38 to 46 GHz a 91 element array covering 85 to 105 GHz. The corrugated horn feeds have a 3 inch (7.62cm) outer diameter at Q-band and a 1.4 inch (3.55 cm) outer diameter at W-band.

The mirrors have also been fabricated and are mounted on a sled type structure which supports both the mirrors and the cryostat. The assembly will be integrated with the feeds and tested on the JPL antenna range. Test data should be available at the time of the meeting.