

C - CONTRIBUTED PAPER

Huan T. Tran, Adrian T. Lee
University of California Berkeley, Dept of Physics

The Polarbear telescope is one of the next generation wide field polarimeters. It will be used to study the polarization of the Cosmic Microwave Background. It is specifically designed to have both the sensitivity and resolution to characterize the faint B-Mode signature of gravitational waves created during inflation. The goals of the optical design are to support 1000 resolution elements at 150 GHz and achieve a 4 arcmin beam. The large number of elements is required to achieve high enough sensitivity to measure B-mode polarization and the size of the beam is chosen to resolve a contaminant induced by gravitational lensing by intervening galaxy clusters. The telescope will feed a two dimensional array of antenna-coupled bolometers. This detector technology imposes additional constraints on the design. The planar nature of the array requires a flat field, with the chief rays of each element perpendicular to the plane. Antenna-coupled bolometers typically have large sidelobes, which must be intercepted by a cold aperture stop, or a Lyot stop. The design generically consists of a traditional 3-meter Dragone- Mizuguchi reflector with 3 reimaging lenses. The offset nature of the Dragone-Mizuguchi combined with the use of lenses leads to an unblocked aperture. The lenses form the cold stop and produce a telecentric focal plane. Special consideration must also be given to polarization performance, both in cross polarization and instrumental polarization. This design was chosen after considering many other designs, including on-axis designs like traditional Cassegrains. The need for a wide field, however, leads more naturally to offset designs. The reflector and three lens combination is generic enough to support many thousands of elements, and is suitable for future CMB polarization experiments.

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1. (a)
Huan Tran
UC Berkeley Dept of physics
366 LeConte Hall 7300
Berkeley, CA
94720 USA
huantran@cosmology.berkeley.edu
- (b) 510-643-5544
- (c) 510-643-5204
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