FABRICATION, ALIGNMENT, AND MEASUREMENT OF THE SZA REFLECTOR SURFACE

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We describe the techniques required to provide the eight telescopes of the Sunyaev Zeldovich Array (SZA) with a 3.5m reflecting surface capable of precision measurements of the Cosmic Microwave Background. The SZA operates at 1 cm and 3 mm wavelengths, with a planned expansion for 1 mm observations. The design goal is a surface accuracy of 25 microns. The surface consists of 27 panels machined from custom castings. The average RMS surface error for the machined panels is 8 microns. We describe the fabrication process and quality control measures. To preserve this high level of surface accuracy during telescope mounting, we implemented a series of leveling fixtures which permitted the alignment of panels to better than 2 arcseconds. By aligning each panel individually and then assuring that the continuity between adjacent panel heights is better than 25 micron, we infer a global surface roughness better than 50 micron. To ascertain the validity of this assumption, a rigorous assessment of the SZAs aperture and beam efficiencies will be performed using the holographic method. Observations at 1 cm wavelengths will be made during the 2004 winter using an astronomical source to probe the far-field radiation pattern and custom software to back-transform to the aperture electric field distribution. This technique will be used to produce amplitude and phase maps of the primary reflector surface. Amplitude maps will be used to optimize the alignment of the tertiary and subreflector surfaces. Phase maps will be used to fit a physical model of the 9 three-point mount and 18 four-point mount panels used on each telescope. Successive iterations of panel adjustments and the resultant phase maps will be used to produce primary mirrors with surface roughness better than 50 micron RMS. We discuss the unique challenges of the holographic technique for small-aperture, close-packed interferometric arrays.

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