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Title:Optics design and optimizations of the multi-color TES bolometer camera for the ASTE telescope
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Abstract:Wideband continuum observations at the millimeter and submillimeter wavelengths are of great importance to the understanding of the cosmic history of star-formation across the Hubble time, as well as the thermal and non-thermal aspects of clusters of galaxies through the Sunyaev-Zel'dovich effect. To promote such studies, a new TES bolometer camera for the ASTE telescope has been developed. In this article we present the study of the optics system that will couple the camera to the telescope's Cassegrain optics. Two-color simultaneous observation capability and 7.5′ diameter FoV are achieved. These two focal planes are used for the 270 and 350 GHz bands for Phase I, and the 350 and 670 GHz bands for Phase II configurations. The

numbers of pixels are 169, 271, and 919 pixels for 270, 350, and 670 GHz bands, respectively. The shape of the third ellipsoid mirror is optimized, and the designed optics is foreseen to be diffraction limited. The optics is also evaluated via physical optics calculations, and the diameter of the cold pupil is optimized to 85% of the geometrical design. Without filters and Ruze losses, the aperture efficiencies of each beam are ∼35 %, 35%, and 32%, and the beam sizes are ∼28′′, 22′′, and 12′′ , for the 270, 350, and 670 GHz bands, respectively. 

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