Optical modeling for the LiteBIRD Medium and High Frequency Telescope

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Abstract

LiteBIRD is the next-generation space mission for polarization-sensitive mapping of the Cosmic Microwave Background anisotropies, with observations covering the full sky in a wide frequency range (34-448 GHz) to ensure high-precision removal of polarized foregrounds. Its main goal is to constrain the contribution of primordial gravitational waves to the curly component of the CMB polarization pattern. The LiteBIRD Medium and High Frequency Telescope (MHFT) will observe the sky in the 89-448 GHz band. Its optical configuration features two separate dual-lens assemblies with 300mm and 200mm apertures, 28° fields of view and diffraction-limited imaging over the whole spectral range. Polarization modulation is achieved through the continuous spinning of a half-wave plate at the optical entrance of each system. The optical studies for MHFT focus on a refined modeling of the telescope elements (lenses, anti-reflection coatings, absorbers, interfaces) to assess their individual effects on the predicted optical behavior of the telescopes. Such studies will provide key inputs for end-to-end simulations and will inform the subsystem and system-level characterization to meet the stringent requirements set for the LiteBIRD success. We describe the progress in MHFT optical modeling and the ongoing efforts to reproduce full Medium Frequency Telescope (MFT) and High Frequency Telescope (HFT) beams for representative focal plane pixels down to the far-sidelobe angular region. Here, systematic effects due to challenging beam measurements and higher order optical coupling between the telescope and the surrounding structures are likely to affect the final level and shape of the beams and thus set compelling requirements for in-flight calibration and beam reconstruction.

Conference Presentation

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