LiteBIRD: A Small Satellite for the Studies of B-mode Polarization and Inflation from Cosmic Background Radiation Detection

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Abstract—LiteBIRD [Lite (Light) satellite for the studies of B-mode polarization and Inflation from cosmic background Radiation Detection is a small satellite to map the polarization of the cosmic microwave background (CMB) radiation over the full sky at large angular scales with unprecedented precision. Cosmic inflation, which is the leading hypothesis to resolve the problems in the Big Bang theory, predicts that primordial gravitational waves were created during the inflationary era. Measurements of polarization of the CMB radiation are known as the best probe to detect the primordial gravitational waves. The LiteBIRD working group was authorized by JAXA and has more than 50 members from Japan, USA and Canada. The scientific objective of LiteBIRD is to test all the representative inflation models that satisfy single-field slowroll conditions and lie in the large-field regime. To this end, the requirement on the precision of the tensor-toscalar ratio, r, at LiteBIRD is equal to or less than 0.001. The LiteBIRD plans to scan the full sky from L2 or LEO with an optics based on a 0.6m crossed Mizuguchi-Dragone telescope and a rotating half-wave plate at the sky side. Our baseline design of the focal plane adopts multi-chroic antenna-coupled superconducting detector arrays that are read out with high multiplexing factors in the frequency domain for a compact focal plane. We need about 2000 TES bolometers at 100mK to achieve the target sensitivity of 2uKarcmin. The cryogenic system is based on the JT/Stirling technology developed for SPICA, and the ADR system shares the design with future X-ray satellites. With the multi-chroic focal plane, the compact refractive telescope and the cryogen-free cooling system, LiteBIRD is light enough to fit multiple launch options.