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DIFFRACTION-LIMITED NEAR-INFRARED TO NEAR-ULTRAVIOLET WIDE-FIELD BALLOON-BORNE OBSERVATORIES.

Abstract

The demand for high resolution space-based astronomical observations is much higher than what can be supplied by existing and planned space missions. This demand can be eased by utilizing scientific balloon-borne platforms that provide access to space-like seeing and transmission without the prohibitive cost and long development timescale of traditional space missions. The low cost and repeatability of a balloon launch enables a platform to fly yearly, or more often, in order to meet high demand. GigaBIT is a balloon-borne telescope, designed to exploit these space-like conditions to provide a stable diffraction limited resolution over a large field of view. GigaBIT achieves this resolution by tracking compound pendulations via a three-axis gimballed platform, which provides sky-fixed telescope stability at < 500 milliarcseconds. A high-bandwidth tip/tilt mirror is used to further stabilize the focal plane, achieving an effective 1 σ pointing stability of 48 milliarcseconds. The telescope is customized to ensure exceptional thermo- and opto-mechanical stability, as well as tight coupling between high-rate sensors and telescope optics. At the current level of flight performance, GigaBIT capabilities meet the specifications for a variety of science goals that include, but are not limited to, probing the nature of Dark Matter and Dark Energy (Λ); two of the biggest mysteries in modern science.