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Telescope Back-reflection and Space-based Gravitational Wave Observatories AARON SPECTOR, GUIDO MUELLER, Univ of Florida - Gainesville — The Laser Interferometer Space Antenna (LISA) represents a class of proposed space-based gravitational wave observatories that will operate in the frequency band between 0.1 mHz and 1 Hz. These missions are characterized by a triangular constellation of three spacecraft (SC), separated by gigameters, in a heliocentric orbit. A reflecting telescope transfers the laser signals between the SC, and laser interferometry is used to measure length changes between proof masses housed on adjacent SC with $\mathrm{pm}/\sqrt{\mathrm{Hz}}$ sensitivity. One of the proposed telescope designs is an on-axis 'quadpod' in which the secondary mirror is axially aligned to the primary mirror. Back-reflected (BR) light from the secondary can introduce phase noise to the measurement signal due to length changes between the telescope structure and the optical bench. We derived a set of requirements for the mode-matched power in the BR field that scale with these length changes. Simulations have demonstrated that the BR power can be sufficiently attenuated by using a specifically patterned anti-reflective region at the center of the secondary mirror. An experimental testbed was built and is currently being used to evaluate the BR light from several secondary prototypes.

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