The Simons Observatory (SO) will include a 6 m Cross-Dragone large aperture telescope (LAT) coupled to the large aperture telescope receiver (LATR), which will be the largest CMB receiver to date. The LAT is designed to have a large field of view capable of supporting a cryostat with up to 19 optics tubes having an aperture of 35 cm. To reduce the development risk of a 3+ meter cryostat, the LATR is being designed to accommodate 13 optics tubes. During the initial deployment, we plan to deploy seven optics tubes with three detector wafers in each, for a total of approximately 35,000 detectors (primarily at 90/150 GHz). It should be noted that each optics tube could be upgraded to support about ~50% more detectors. With this upgrade and the deployment of 19 optics tubes, the LAT could field approximately 145,000 detectors at 90/150 GHz. In this paper, we present the current design of the LATR. Manufacture of this exciting, yet challenging, instrument is expected to commence this calendar year.

The LATR bolometers are coupled to either feedhorns or lenslets. To maximize the sensitivity of the detector arrays and achieve photon-limited noise over all optical frequency bands, we cool down the array modules to ~100 mK. To achieve our science goals, our transition edge sensor bolometers are split into three categories: LF (27 GHz & 39 GHz), MF (93 GHz & 145 GHz), and UHF (225 GHz & 280 GHz), with each optics tube housing one dichroic pair for ease of filter and lens optimization.

Cross-section showing how the LATR couples to the SO 6-m telescope. In the orientation shown, light enters the telescope from the top, reflects off of the 6 m primary (M1) and 6 m secondary (M2) mirrors, and is then directed to the LATR receiver. A separate mechanism is used to rotate the receiver about its long axis as the telescope elevation structure, which is independent, rotates M1 and M2.

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