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 $23 \ {\rm October} \ 2017$

Dr. Buell Jannuzi Chair, Astronomy and Astrophysics Advisory Committee

Dear Buell:

I am pleased to transmit to you the report of the CMB-S4 Concept Design Task Force.

The report presents a concept for implementing a ground-based "Stage-4" CMB experiment (CMB-S4), designed to tackle questions about fundamental physics from the earliest moments of the Universe through the epoch of dark energy domination.

The Report identifies three transformative science goals for CMB-S4:

- To measure the imprint of primordial gravitational waves on the CMB polarization anisotropy;
- To detect or strongly constrain departures from the thermal history of the Universe predicted by the standard model of particle physics; and
- To provide a legacy survey of nearly half the sky at centimeter to millimeter wavelengths.

We translate the first two goals into Science Requirements for CMB-S4, which we flow down to Measurement Requirements, Instrument Requirements, and Experiment Requirements. The third goal can be achieved with the same hardware required for the first two.

We develop a Strawperson Concept that meets the requirements, including operations and data handling and analysis, with schedule and cost including contingency appropriate for a concept design. This Strawperson is based on existing technology and computation and data-management models. We recommend investments to improve the reliability and production throughput of detector and readout components, and the continued development of a simulation framework to evaluate instrument designs and systematics.

On behalf of the CMB-S4 Concept Design Task Force,

Charles R. Lawrence Chair