Abstract Submitted
for the APR21 Meeting of
The American Physical Society

Forecasting the Impact of Atmosphere and Foregrounds on Future Rayleigh Scattering Measurements KARIA DIBERT, THOMAS CRAWFORD, BRADFORD BENSON, University of Chicago — In recent decades, measurements of the CMB angular power spectra have yielded ever-narrowing constraints on cosmological parameters. As measurements of the CMB signal approach the cosmic variance limit, a new source of information will become necessary to further improve constraints. The Rayleigh scattering of CMB photons off of the neutral hydrogen produced during recombination is a promising option. Rayleigh scattering effectively creates an additional scattering surface after recombination that encodes new cosmological information, including the expansion and ionization history of the universe. Thus a first detection of Rayleigh scattering is a tantalizing target for next-generation CMB experiments. We have developed a Rayleigh scattering forecasting pipeline that includes instrumental effects (e.g., atmospheric noise) and astrophysical foregrounds (e.g., Galactic cirrus, CIB, thermal Sunyaev-Zel'dovich effect). We forecast the Rayleigh scattering detection significance for several upcoming ground-based experiments, including SPT4, Simons Observatory, and CMB-S4, and examine the limitations from different astrophysical foregrounds and potential mitigation techniques. We further discuss how to optimize the detection significance in future experiments.

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Date submitted: 08 Jan 2021 Electronic form version 1.4