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The Design of The CCAT-Prime Epoch of Reionization Spectrometer Instrument

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The Epoch of Reionization Spectrometer (EoR-Spec) is an instrument for the Prime-Cam receiver of the 6 m aperture CCAT-Prime Telescope at 5600 m in Chile. EoR-Spec will perform 158 μm [CII] line intensity mapping of star-forming regions at redshifts between 3 and 8 (420 - 210 GHz), tracing the evolution of structure during early galaxy formation. At lower redshifts, EoR-Spec will observe galaxies during the period of peak star formation - when most stars in today's universe were formed. At higher redshifts, EoR-Spec will trace the late stages of reionization, the early stages of galaxy assembly, and the formation of large-scale three-dimensional clustering of star-forming galaxies. To achieve its science goals, EoR-Spec will utilize CCAT-Prime's exceptionally low water vapor site, large field of view (~5 degrees at 210 GHz), and narrow beam widths (~1 arcminute at 210 GHz). EoR-Spec will be outfitted with a cryogenic, metamaterial, silicon substrate-based Fabry-Perot Interferometer operating at a resolving power ($\lambda/\Delta\lambda$) of 100. Monolithic multichroic arrays of cryogenic, feedhorn-coupled transition edge sensor bolometers provide approximately 6000 detectors which are read out using a frequency division multiplexing system based on microwave SQUIDs. The novel design allows the measurement of the [CII] line at two redshifts simultaneously using dichroic pixels and two orders of the Fabry-Perot. Here we present the design and science goals of EoR-Spec, with emphasis on the spectrometer, detector array, and readout designs.

Less than 5 years of experience since completion of Ph.D

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Student (Ph.D., M.Sc. or B.Sc.)

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Primary authors: Mr COTHARD, Nicholas (Cornell University); CCAT-PRIME COLLABORATION, The

Presenter: Mr COTHARD, Nicholas (Cornell University)

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