

IAF SYMPOSIUM ON ONGOING AND NEAR FUTURE SPACE ASTRONOMY AND
SOLAR-SYSTEM SCIENCE MISSIONS (A7)

Technology Needs for Future Missions, Systems, and Instruments (3)

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EXCLAIM, THE EXPERIMENT FOR CRYOGENIC LARGE-APERTURE INTENSITY MAPPING:
OVERVIEW AND LATEST DEVELOPMENTS**Abstract**

The EXperiment for Cryogenic Large-Aperture Intensity Mapping (EXCLAIM) is a balloon-borne far-infrared telescope that will survey star formation history over cosmological time scales to improve our understanding of why the star formation rate declined at redshift $z < 2$, despite continued clustering of dark matter. Specifically, EXCLAIM will map the emission of redshifted carbon monoxide and singly ionized carbon lines in windows over a redshift range $0 < z < 3.5$, following an approach known as intensity mapping. Intensity mapping allows measuring the statistics of brightness fluctuations of cumulative line emissions, as opposed to detecting individual galaxies, thus enabling a blind, complete census of the emitting gas. To detect this emission unambiguously, EXCLAIM will cross-correlate with a rich archival spectroscopic galaxy catalog.

The EXCLAIM mission will use a cryogenic design to cool the telescope optics to approximately 1.5 K. The telescope will feature a 90-cm primary mirror to probe spatial scales on the sky from the linear regime up to shot-noise-dominated scales. The telescope optical elements will couple to six μ -Spec integrated silicon spectrometer modules, operating over a 420-540-GHz frequency band with a resolving power of 512 and featuring microwave kinetic inductance detectors (MKIDs). In the baseline design, the warm electronics architecture employs a Radio Frequency System on Chip (RFSoc) to read out the MKID

array. The cryogenic telescope and the sensitive MKID detectors will allow EXCLAIM to reach high sensitivity in spectral windows of low emission in the upper atmosphere.

The EXCLAIM mission recently passed its Preliminary Design Review, marking the end of its preliminary design and technology completion phase. Here, we present an overview of the mission design and the most recent development status since the start of the EXCLAIM project in early 2019. Particular emphasis will be given to the technology developed to allow the mission to meet its science requirements.