



## Overview of the Design, Fabrication and Performance Requirements of $\mu$ -Spec, an Integrated Submillimeter Spectrometer

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$\mu$ -Spec is a compact submillimeter (350-700 GHz) spectrometer which uses low loss superconducting niobium microstrip transmission lines and a single-crystal silicon dielectric to integrate all of the components of a grating-analog spectrometer onto a single chip. Here we present details of the fabrication and design of a prototype  $\mu$ -Spec spectrometer with resolution,  $R=64$ , where we use a high-yield single-flip wafer bonding process to realize instrument components on a  $0.45 \mu\text{m}$  single-crystal silicon dielectric. We discuss some of the electromagnetic design concerns (such as loss, stray-light, cross-talk, and fabrication tolerances) for each of the spectrometer components and their integration into the instrument as a whole. These components include a slot antenna with a silicon lens for optical coupling, a phase delay transmission line network, parallel plate waveguide interference region, and aluminum microstrip transmission line kinetic inductance detectors with extremely low cross-talk and immunity to stray light. We have demonstrated this prototype spectrometer with design resolution of  $R=64$ . Given the optical performance of this prototype, we will also discuss the extension of this design to higher resolutions suitable for balloon-flight.