16th International Workshop on Low Temperature Detectors
20 24 July 2015

Design and Fabrication of TES Detector Modules for the TIME-Pilot [CII] Intensity Mapping Experiment

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We are developing a series of close-packed modular detector arrays for TIME-Pilot, a new mm-wavelength grating spectrometer array that will map the intensity fluctuations of the redshifted 157.7 μm emission line of singly ionized carbon ([CII]) from z ~ 5 to 9. TIME-Pilot's two banks of 16 parallel-plate waveguide spectrometers (one bank per polarization) will have a spectral range of 183 to 326 GHz and a resolving power of R ~ 100. The spectrometers use a curved diffraction grating to disperse and focus the light on a series of output arcs, each read out by 60 transition edge sensor (TES) bolometers coupled to gold mesh absorbers. These low-noise detectors will be operated from a 250 mK base temperature and are designed to have a background-limited NEP of ~1e-17

W/Hz^1/2. The gold absorbers sit on a released silicon nitride web suspended over an etched silicon substrate. A quarter-wavelength backshort is defined by etching away and metalizing the back layer of a double SOI wafer. A series of flex-cables with superconducting traces will connect the detector modules to a multiplexing SQUID readout system. In this poster, we will describe some of the detector design challenges faced with an instrument of this type as well as our solutions to some of these issues. Finally, we will describe the current status of TIME-Pilot detector prototypes being produced at the Microdevices Laboratory (MDL) at JPL.