

FAR INFRARED SPECTROMETRY OF THE
COSMIC BACKGROUND RADIATION

John Crowwell Mather

Inorganic Materials Research Division, Lawrence Berkeley Laboratory
and Department of Physics; University of California
Berkeley, California 94720

ABSTRACT

I describe two experiments to measure the cosmic background radiation near 1 mm wavelength. The first was a ground-based search for spectral lines, made with a Fabry-Perot interferometer and an InSb detector. The second is a measurement of the spectrum from 3 to 18 cm^{-1} , made with a balloon-borne Fourier transform spectrometer. It is a polarizing Michelson interferometer, cooled in liquid helium, and operated with a germanium bolometer. I give the theory of operation, construction details, and experimental results. The first experiment was successfully completed but the second suffered equipment malfunction on its first flight.

I describe the theory of Fourier transformations and give a new understanding of convolutional phase correction computations.

I discuss far infrared bolometer calibration procedures, and tabulate test results on nine detectors. I describe methods of improving bolometer sensitivity with immersion optics and with conductive film blackening.