Space Sciences Laboratory
University of California
Berkeley, California 94720

Semi-Annual Report on

SOLAR RADIATION AND ATMOSPHERIC ABSORPTION IN THE MM WAVE REGION

Supported by

ONR Contract
Nonr 222(54)

For the period

April 1 through September 30, 1968

Principal Investigators : Professor Samuel Silver
Professor William J. Welch

Space Sciences Laboratory Series 9; Issue 51

September 30, 1968

LAR RADIATION AND ATMOSPHERIC ABSORPTION IN THE MM WAVE REGION*

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The objectives of this program are twofold: (1) to study absorption and emission of millimeter waves in the atmospheres of the earth and the nearby planets and (2) to develop radiometric techniques at millimeter wavelengths.

During the past interval much of the calibration of the 20-foot millimeter-wave antenna was completed and routine observations have been initiated. When all of the calibration is done, a report describing the antenna and its associated electronics in detail will be prepared.

The accuracy with which the antenna can be pointed has been measured with the 3-inch optical boresight telescope (which measures star positions) and also with the radio beam directed at the sun and the moon. From the star tracking studies a set of correction charts are being prepared for telescope pointing. Although these are not yet complete, the residual scatter about the correction curves suggests that the antenna can be pointed with an absolute accuracy of about 0.5 over most of the sky and with a somewhat better accuracy near the meridian.

The antenna gain has been measured accurately at four frequencies in K_a-band (26 GHz-40 GHz). The aperture efficiency is found to be generally above 60% and agrees quite well with theoretical estimates. We believe that

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the probable error in the measurements does not exceed 2 or 3%. Gain calibrations will be complete when the measurements at 3 frequencies in K-band (18-26 GHz) are done. The high gain measured at 36 GHz shows that the figure of the reflector is still consistent with the RMS roughness 0.006 inch that the reflector had when it was built. Extrapolating these results, we expect that the antenna aperture efficiency will be about 50% at 90 GHz. The beam efficiency is also high, lying between 70% and 80%, at the four frequencies in K_a-band. The patterns are also symmetric and show the expected beam widths, 5.6-6.6. Pattern ellipticity is not greater than 5%.

The programs for the PDP-8/S computer,* which were discussed in the last report, are now complete. These are the routines for measuring the flux of a point source either in the single channel or the 8-channel modes and the routines for measuring atmospheric extinction in either the single channel or the 8-channel modes. A program is now being written for raster scans. This latter program will be used primarily for solar studies.

During July a program of observations of the planets was carried out at 36 GHz. The fluxes of Venus, Jupiter, Saturn, and Uranus were measured. These studies are part of a larger program in which both the phase and wide-range spectral measurements of the planets will be carried out.

The K-band front end was completed during the past interval and, early in August, was installed on the antenna. The effective overall system temperature of this front end is about 2000°K. Preliminary

*Digital Equipment Company.

observations are in progress with this front end, and gain measurements in K-band should be completed by October 1.

Participating Personnel:

Professor Samuel Silver	)	Principal Investigators
Professor William J. Welch	)	
Douglas D. Thornton	-	Specialist
Stephen Keachie	-	Junior Development Engineer
Lynn Urry	-	Assistant Development Engineer
Gerard Wrixon	)	
Gayle Miner	)	Research Assistants
Kiran Shah	)	

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SOLAR RADIATION AND ATMOSPHERIC ABSORPTION

IN THE MM WAVE REGION*

Olle Castedo
Ilmar Abele(24)

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