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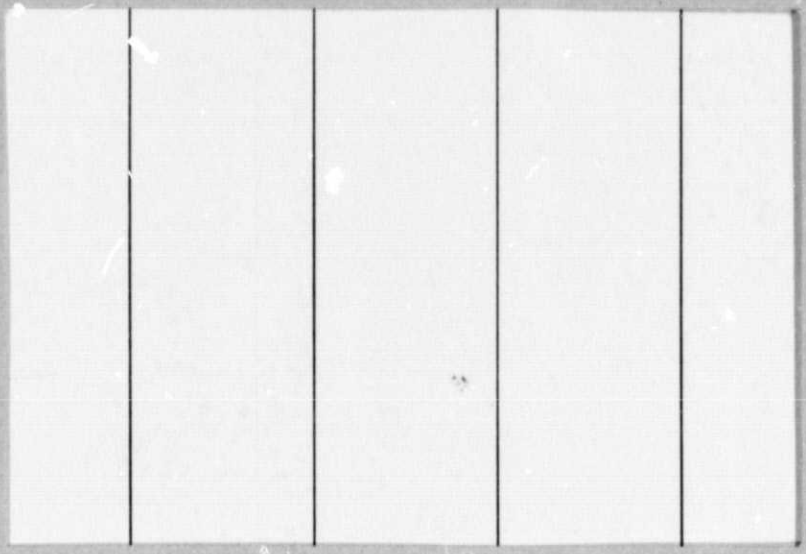
THE UNIVERSITY OF MICHIGAN
RADIO ASTRONOMY OBSERVATORY



DEPARTMENT OF ASTRONOMY

UM/RAO Report 75-2

IMP-I Satellite

Final Scientific Report

NASA Contract NAS5-11174

Submitted by:

Fred T. Haddock
Project Director

Written by: Hector Alvarez

February 1975

The University of Michigan
Radio Astronomy Observatory
Department of Astronomy

The IMP-6 satellite was launched on March 13, 1971. Since then and through November, 1973 the University of Michigan Radio Astronomy Experiment acquired data of high quality almost continuously. The instrument consists of a stepping frequency radiometer connected to a dipole antenna. The frequencies are: 3500, 900, 600, 350, 230, 130, 80 and 50 kHz. The dipole is 171 ft, tip-to-tip, and it rotates in a plane close to the ecliptic.

Computer programs were written to process the data in the form of 35-mm monitoring film and of Calcomp plots. All data through August 6, 1973, were processed into film and selected events were processed into Calcomp plots. The data came in the form of intensity versus time plots modulated in amplitude (burst profiles). The modulation was produced by the antenna rotation and it allowed the determination of the direction of arrival of the radiation. Computer programms were written to demodulate the burst profiles and also obtain the direction of arrival of the radio waves.

A technique based on models was developed to analyze type-III bursts contained in the data. Graphical methods were devised to fit models to the data. The analysis was concentrated on type-III bursts that drifted down to 130 kHz or lower. We started a catalogue of these bursts and until 31 August, 1973 we had catalogued 953 of such events.

Two papers were published. The first was "Heliographic Longitude Distribution of the Flares Associated with Type-III Bursts Observed at Kilometric Wavelengths", by Hector Alvarez, Fred T. Haddock and William H. Potter, Solar Physics, 31, 49, 1973. In this work we grouped observed type-III bursts according to the observed radio frequencies in the kilometric wavelength

range for each group we obtained the frequency of occurrence as a function of the heliographic longitude of the associated optical flares. We found that flares occurring east of a certain cut-off longitude do no produce bursts observable near the earth below a given radio frequency. The cut-off on the west is determined by observational limitation for flares beyond the limb. The mean longitude and the extreme eastern end of the longitude distribution both shift to the west as the radio frequency decreases. We interpreted these findings in terms of radio wave propagation effects and curved trajectories of the burst exciter.

The second paper was "Kilometer-wave Type-III Burst: Harmonic Emission revealed by Direction and Time of Arrival, by Hector Alvarez, Fred T. Haddock and William H. Potter, Solar Physics, 34, 413, 1973. Here we presented the results of the analysis of a type-III burst observed between 3.5 MHz and 80 kHz. We determined the time of arrival as well as the direction of arrival of the burst at seven frequencies. The fit of simple models to the observations indicated that between 3.5 MHz and 230 kHz the observed radiation was emitted at the fundamental of the local plasma frequency of the solar corona, while below 230 kHz it was emitted at the second harmonic. The result supported previous findings of the OGO-5 data analysis. The results also showed that the burst exciter was guided by the interplanetary magnetic field and that the exciter velocity was of 0.27c or more (c = velocity of light).

KILOMETER WAVE-TYPE III BURST HARMONIC EMISSION REVEALED BY DIRECTION AND TIME OF ARRIVAL

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