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QUARTERLY PROGRESS REPORT

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MAGNETOSPHERIC RESEARCH

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by

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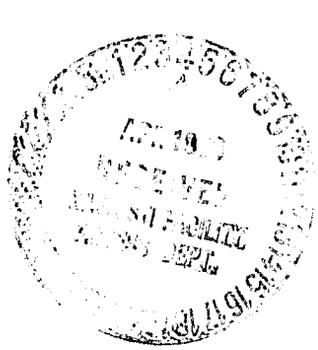

SATALLITE DATA ANALYSIS

During this reporting period the paper presenting ATS-6 warm plasma observations (Ref. 1) appeared in the Journal of Geophysical Research (JGR). A second paper on ATS-6 observations of conical pitch angle distributions (Ref. 2) was accepted by JGR. A third on occurence frequencies of ion pitch angle distributions observed by ATS-6 is undergoing revision in the JGR review process. In addition, a paper on initial ISEE-1 thermal plasma observations has been accepted by Geophysical Research Letters (Ref. 4).

In the analysis of ISEE data, several interesting new features of pancake pitch angle distributions have been found. Probably most important is the discovery that pancake distributions occur far more frequently near the equator than at high latitudes; hence, the equatorial regions are the likely site of their creation. This and other features of the pancake distributions are presented in a paper, undergoing co-author review, to be submitted to JGR (Ref. 5).

Other activity has involved continuing development of computer routines for analyzing distribution functions from ISEE data. Routines for contouring the distribution functions in the spin plane have been completed. Routines to transform these contours to a magnetic-field-based coordinate system, $V_{||}$ and $V_{\perp}$, are almost complete. Efforts are also being made to fit these distributions with various analytic representations, for example, representing pancake distributions as a bi-Maxwellian, with $T_{\perp} > T_{||}$. An abstract (Ref. 6) on this work has been submitted for the Spring Meeting of the American Geophysical

Union in Toronto.

Further efforts have been directed toward automating the procedure for obtaining plasma parmeters (N, T, V) and spacecraft potential from the data. The successful comparison of spin curve data with curves predicted by the thin sheath or neutral planar approximation for cold plasmasphere data (Ref. 7) suggests that this approximation provides an adequate basis for such a procedure. Recent calculations by N. Singh (private communication) indicate that because of the limited aperture of the ISEE instrument, flux to the aperture is virtually independent of Debye length. So the thin sheath approximation should provide good results, insofar as sheath effects are concerned, for a much broader range of conditions than previously anticipated. On this basis a procedure for the parameter determination has been worked out. After testing with data, software development will begin. One possible problem area may be a spin modulation of the spacecraft potential, suggested by Mozer's group from the electric field experiment data.

Ion temperatures are presently being added to the density information in the number density comparision study (Ref. 8) and to the density and Mach number information in the study of ISEE spin data (Ref. 7). If electron temperatures cannot be obtained, they will be approximated by ion temperatures; this is probably adequate within a factor of two (Julian Johnson, private communication.) Spacecraft potential will also be determined to allow a complete analysis.

INSTRUMENT STUDIES AND DEVELOPMENT

Software development for analysis of future Differential Ion Flux (DIF) Probe Laboratory and space flight data has continued. The deflection curve analysis routine was modified to generalize its application. Also, noise fluctuations were added to a set of simulated Retarding Potential Analyzer (RPA) data to assess the accuracy of the RPA analysis routine.

For the DIF Probe being built for Spacelab 2, assistance was provided in the laboratory checkout of the instrument flight electronics. Manufacture of the head was completed when the deflection system was found to require modification. Several design modifications of the deflection system were analyzed by means of computer simulation of particle tratectories through the instrument. A new head is now being built with the redesigned deflection system.

Engine design for the proposed Solar Electric Propulsion Satellite (SEPS) were analyzed briefly. Contour plots of the magnetic field resulting from the dipole magnet of the engine were generated to help assess problems of contamination of scientific instrument payloads.

In addition, the following items were worked on or completed:

- Flanges for a new vacuum system were designed.
- A carriage for the new vacuum system is being designed.
- The RPA head for the Plasma Diagnostics Package was built, following design completion.
- Design of the electronics package for the Plasma Diagnostics Package is underway.

SOLAR TERRESTRIAL STUDIES

The second meeting of the Solar Terrestrial Observatory Science Study Group was held on February 20-22, 1980 in Boulder, Colorado. Approved and prospective NASA programs in the solar terrestrial area were reviewed; and substantial progress was made in formulating the scientific objectives identified at the first meeting. Further assignments have been given to group members for the interim. The next meeting will be held in Los Angeles on July 9-11, 1980. A revised membership list is attached, indicating those who attended the second meeting.

MEETINGS

Dr. Comfort attended the Fall Meeting of the American Geophysical Union in San Francisco, California, December 3-7, 1979, where he presented a paper comparing ISEE spin curves with those predicted by the thin sheath approximation (Ref.7). Although Dr. Horwitz was unable to attend, he was principal author and co-author of two papers which were presented at the meeting (Ref. 9 and Ref. 10).

CONSULTANTS

Dr. James L. Green, University of Iowa, visited on December 12-16, 1979 to discuss collaborative studies using low energy ion and wave observations made with instruments on the ISEE-1 Spacecraft. These studies should enhance our ability to make effective use of available data in activities under this contract.

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