#344

SOLAR WIND PLASMA DATA

SM-31A

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1. INTRODUCTION:

The documentation for this data set was originally on paper, kept in NSSDC's Data Set Catalogs (DSCs). The paper documentation in the Data Set Catalogs have been made into digital images, and then collected into a single PDF file for each Data Set Catalog. The inventory information in these DSCs is current as of July 1, 2004. This inventory information is now no longer maintained in the DSCs, but is now managed in the inventory part of the NSSDC information system. The information existing in the DSCs is now not needed for locating the data files, but we did not remove that inventory information.

The offline tape datasets have now been migrated from the original magnetic tape to Archival Information Packages (AIP's).

A prior restoration may have been done on data sets, if a requestor of this data set has questions; they should send an inquiry to the request office to see if additional information exists.

2. ERRATA/CHANGE LOG:

NOTE: Changes are made in a text box, and will show up that way when displayed on screen with a PDF reader.

When printing, special settings may be required to make the text box appear on the printed output.

Version	Date	Person	Page	Description of Change
01				
02				

3 LINKS TO RELEVANT INFORMATION IN THE ONLINE NSSDC INFORMATION SYSTEM:

http://nssdc.gsfc.nasa.gov/nmc/

[NOTE: This link will take you to the main page of the NSSDC Master Catalog. There you will be able to perform searches to find additional information]

4. CATALOG MATERIALS:

a. Associated Documents To find associated documents you will need to know the document ID number and then click here. http://nssdcftp.gsfc.nasa.gov/miscellaneous/documents/

b. Core Catalog Materials

REQ. AGENT	RAND NO.	ACQ. AGENT
VJP		JHK

SOLAR WIND PLASMA DATA

SM-31A

This data set catalog consists of 1 Solar Wind Plasma data tape. The tape is 1600 bpi. 9 track, binary and contains 1 file. The tape was created on an IBM 360/75 computer.

Time span and format to follow:

D#	C#	TIME SPAN
D-23730	C-17818	7/21/64 - 12/31/73

UNNORMALIZED COMPOSITE INTERPLANETARY PLASMA TAPE

This unnormalized composite solar wind tape contains data from numerous IMP/AIMP spacecraft, numerous VELA spacecraft, and from HEOS 1 and OGO 5. The data are in IBM 360 binary format. The tape is 9 track, 1600 bpi, with spanned variable-blocked record format. The logical record length is 64 bytes, including a 4 byte segment description word and fifteen 4 byte data words. The blocksize is 25604 bytes. The JCL used in creating the tape was:

```
//GO.FT10F001 DD UNIT=9TRACK,LABEL=(,NL),
// DCB=(RECFM=VBS,LRECL=64,BLKSIZE=25604,DEN=3),
```

LOGICAL RECORD FORMAT

DATA ITEM	DATA TYPE	COMMENT
1. Year	I*4	64,65,66
2. Decimal day of year	I*4	Jan 1 = day 0
3. Hour	I*4	0,1,2,...23
4. Spacecraft ID	I*4	1 = HEOS 1 3 = Vela 3A/Vela 3B 5 = OGO 5 33 = Explorer 33 34 = Explorer 34 (IMP F) 35 = Explorer 35 43 = Explorer 43 (IMP I) 99 = See following notes
5. #Fine time scale points	I*4	Points in hour averages
6. Temperature	R*4	^{o}K (blanks for ID = 1 and 99 records)
7. Ion density	R*4	$(cm)^{-3}$ (blanks for ID = 99 records)
8. Bulk speed	R*4	km/sec, aberration corrected
9. Flow longitude	R*4	In degrees; aberration corrected; positive for flow from west of sun; solar ecliptic coordinates; word contains blanks for ID = 1, 34, 43 and 99 records.
10. Flow latitude	R*4	In degrees; positive for flow from south of sun; solar ecliptic coord; word contains blanks for ID = 1, 3, 34, 43 and 99 records.
11. Standard Deviation in temp.	R*4	^{o}K; word contains blanks for ID = 1, 5, 43 and 99 records.
12. Standard Deviation in density	R*4	$(cm)^{-3}$; word contains blanks for ID = 1, 5, 43 and 99 records.
13. Standard Deviation in Bulk speed	R*4	km/sec; word contains blanks for ID = 1, 5, 43 and 99 records.
14. Standard Deviation in Flow longitude	R*4	Degrees; word contains blanks for ID = 1, 5, 34, 43 and 99 records
15. Standard Deviation in Flow latitude	R*4	Degrees; word is non-blank only for ID = 33 and 35

With the follwing exceptions, the data are as submitted by the experimenters, with no normalizations performed at NSSDC for mutual consistency. The data are given in time sequence, with as may records (between 0 and 5) for a given hour as there were contributing data sets with data for that hour.

Vela 3 data were provided as three-hour averages with their associated standard deviations and with the number of measurements contributing to each 3-hr average. These values have been assigned to each of the three appropriate hours.

Explorer 33 and 35 temperature and associated standard deviations were not provided, but an equivalent parameter - most probable thermal speed w_o - and its standard deviation were provided. The relation $\frac{1}{2}M_p w_o^2 = kT$ (M_p = proton mass, k = Boltzman constant) was used to obtain T from the given info, and the relation $\sigma_T = (\partial T/\partial w_o)\sigma_{w_o}$ was used to obtain σ_T from the given w_o and σ_{w_o}.

To establish consistency in the sign conventions used for the flow longitude and latitude angles, Explorer 33 and 35 longitude and latitude angle values were multiplied by minus one, as were the OGO 5 longitude angle values.

The data associated with spacecraft ID = 99 were provided by the Los Alamos Scientific Laboratory solar wind plasma physics team. The data come from VELA's 2,3,4,5 and 6 and from IMPS 6,7 and 8 (Explorers 43, 47 and 50), although individual data values are not linked with specific spacecraft. The data supplied to NSSDC consisted of time, 3-hour averaged bulk speeds, and numbers of fine time scale values in the 3-hour average. The 3 hour averages have been distributed over individual hours (as for VELA 3 data discussed earlier).

The HEOS 1 data are as keypunched at NSSDC from Diodato et al, Astron. Astrophys. Suppl., 20, 313-362, 1975. These 3 hour averages have been distributed over individual hours.

5/04/76

COMPOSITE SOLAR WIND DATA TAPE

SPACECRAFT	P.I.	INST.	RES. TIME	1ST DAY	LAST DAY	NO. PTS	T	N	V	ϕ_V	θ_V		σ_T	σ_N	σ_V	σ_ϕ	σ_θ
VELA 3	BAME	LASL	3 HR	7/26/65	12/06/67	2232	✓	✓	✓	✓			✓	✓	✓	✓	
EXPLORER 33	BRIDGE	MIT	1 HR	7/06/66	09/23/69	6002	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓
EXPLORER 34	OGILVIE	GSFC	1 HR	6/03/67	12/16/67	3146	✓	✓	✓				✓	✓	✓		
EXPLORER 35	BRIDGE	MIT	1 HR	7/25/67	07/04/68	5546	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓
OGO 5	NEUGEBAUER	JPL	1 HR	3/06/68	04/30/71	3361	✓	✓	✓	✓	✓						
HEOS 1	BONETTI	CNR	3 HR	12/12/68	04/15/70	1362		✓	✓								
EXPLORER 43	BAME	LASL	1 HR	3/18/71	07/27/73	8428	✓	✓	✓								
MERGED VELA/IMP	BAME	LASL	3 HR	7/21/64	12/31/73	12814			✓								

On the Sources of Data Contributing to the NSSDC Composite Solar Wind Plasma Data Set

J. H. King, NSSDC, May 1976

The NSSDC composite solar wind plasma data set consists of one-hour-averaged and three-hour-averaged parameters as determined from the several experiments identified in Table 1. The purpose of this note is to briefly discuss the salient features of the spacecraft and experiments from which the original data were obtained, to identify the basic assumption made by each experimental group in deriving plasma parameters from sensor outputs, and to identify published sources of more detailed discussions of instrument characteristics and plasma parameter derivation techniques. In the following, series of data sources are treated in chronological sequence: Vela; Explorers 33 and 35; Explorer 34; OGO 5; HEOS 1; and Explorers 43, 47, and 50. Details on Explorer trajectory characteristics and phases are found in Behannon et al (1970), Fairfield et al (1973), and King and Teague (1976).

Vela

Six pairs of spin-stabilized Vela spacecraft have been launched into near-circular orbits near 18 R_E with orbital plane inclinations of 60^o relative to the ecliptic plane. Launch dates are 10/17/63, 7/17/64, 7/20/65, 4/28/67, 5/23/69, and 4/8/70. The two spacecraft in each pair were stationed 180^o out of phase relative to each other. Solar wind plasma data have been obtained on the last five spacecraft pairs, and continue to be obtained on Vela 5. (Generally we use the notation Vela X to refer to the two members of the Xth pair launched - these are sometimes referred to as Vela Xa and Xb elsewhere.)

TABLE I

5/04/76

COMPOSITE SOLAR WIND DATA TAPE

SPACECRAFT	P.I.	INST.	RES. TIME	1ST DAY	LAST DAY	NO. PTS	T	N	V	ϕ_V	θ_V		σ_T	σ_N	σ_V	σ_ϕ	σ_θ
VELA 3	BAME	LASL	3 HR	7/26/65	12/06/67	2232	✓	✓	✓	✓			✓	✓	✓	✓	
EXPLORER 33	BRIDGE	MIT	1 HR	7/06/66	09/23/69	6002	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓
EXPLORER 34	OGILVIE	GSFC	1 HR	6/03/67	12/16/67	3146	✓	✓	✓				✓	✓	✓		
EXPLORER 35	BRIDGE	MIT	1 HR	7/25/67	07/04/68	5546	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓
OGO 5	NEUGEBAUER	JPL	1 HR	3/06/68	04/30/71	336?	✓	✓	✓	✓	✓						
HEOS 1	BONETTI	CNR	3 HR	12/12/68	04/15/70	1362		✓	✓								
EXPLORER 43	BAME	LASL	1 HR	3/18/71	07/27/73	8428	✓	✓	✓								
MERGED VELA/IMP	BAME	LASL	3 HR	7/21/64	12/31/73	12814			✓								

The spin periods of Vela's 2 and 3 were 0.5 sec and of Vela's 4, 5, and 6 were 64 sec. The spin axis directions of Vela's 2 and 3 were inclined at 60° relative to the ecliptic plane, while for Velas 4, 5, and 6, they were maintained along the spacecraft-earth line.

The plasma detectors carried on the Vela spacecraft have been the responsibility of the Los Alamos Scientific Laboratory solar wind plasma physics team headed by S. J. Bame. The detectors on each spacecraft consisted of a hemispherical electrostatic analyzer (ESA) for energy per charge (E/Q) selection and an electron multiplier for particle counting. The ESA had a fan shaped aperture of typical dimension 3° (normal to spin axis) by 100° (parallel to spin axis). As the spacecraft spun and ESA plate voltages were swept through a series of discrete steps, an array of counts was built up in discrete E/Q and angle bins. Plasma parameters were then determined from these arrays of counts by performing least squares fits to an assumed convected bimaxwellian distribution. From such a procedure, bulk speed V, density N, flow direction ϕ, minimum and maximum temperatures T_{min} and T_{max} and the direction of the temperature maximum were obtained. A mean temperature, $T = 1/3\ (T_{max} + 2\ T_{min})$ was defined and is provided in the NSSDC composite data set.

Characteristics distinguishing the various Vela launches are given in Table 2. More detailed discussions of the Vela 2 and 3 instruments and data are found in Hundhausen et al (1967), Gosling et al (1967), Bame et al (1967), and Hundhausen et al (1970), of Vela 4 in Montgomery et al (1970) and Hones et al (1972), and of Vela 5 and 6 in Bame et al (1971).

TABLE 2 - VELA INFORMATION

	NUMBER OF ENERGY STEPS*	PROTON ENERGY RANGE	NUMBER OF ANGULAR STEPS**	REPEAT TIME FOR COMPLETE ENERGY/ANGLE SCAN
VELA 2	14	.35-20. kev	8	128 sec
VELA 3	64	.10-18.	8	256
VELA 4	24	.08-19.	7 or 16	64
VELA 5	20	.13-5.	7 or 16	64
VELA 6	20	.13-5.	7 or 16	64

* Energy steps were logarithmically equispaced. On Velas 2 and 3 the energy channels had widths much less than the between-channel energy intervals. On Velas 4, 5, and 6 the energy channels were contiguous.

** On Velas 2 and 3 there were 5 sectors within $\pm 15^0$ of the sunward direction and one sector each in the dawn, midnight and dusk directions. On Velas 4, 5, and 6 for half the spacecraft spins spectra were obtained in 16 directions separated by 22.5^0 while for the remaining spins, spectra were obtained in 7 equispaced directions within $\pm 20^0$ of the sunward direction.

Explorers 33 and 35

Explorers 33 and 35 were similarly instrumented spacecraft launched on July 1, 1966 and July 19, 1967 respectively. Explorer 33 was placed into a geocentric orbit. Through 1968, its apogee ranged between 60 and 80 Earth radii and its orbital period between 12 and 18 days. In early 1969, due to a lunar perturbation, its apogee increased to near 140 Earth radii and its period to near 45 days. These parameters slowly relaxed back toward their pre-perturbation values. Explorer 35 was placed into a selenocentric orbit with apogee of about 5.5 lunar radii and period of about 11.5 hours. Both spacecraft were spin stabilized, with the Explorer 33 spin period varying between 2.2 and 3.4 seconds and the Explorer 35 spin period more nearly constant at about 2.4 seconds. Their spin axis directions lay in (33), and perpendicular to (35), the ecliptic plane. Explorer 33 data acquisition was continuous through 1969 and intermittent in 1970 and 1971; Explorer 35 data acquisition was nearly continuous through mid-1973.

Solar wind plasma was measured by MIT-supplied Faraday cups (FC) on both spacecraft (H. Bridge, principal investigator). The collector plate of the FC was split into two half-moon shaped sections. The separation line between the plate halves, the faraday cup symmetry axis, and the spacecraft spin axis formed three mutually orthogonal directions. Alternate measurements were made with currents from the two collector halves added and then subtracted.

Due to telemetry limitations, counts in 16 22.5^{o} sectors per spin period were not transmitted. Rather, the sum of these counts and the sum of squares of these counts (in compressed form) and identification of the sector of maximum flux were transmitted. For further details on the instrumentation and on the angle-of-flow information recoverable from the data transmitted, see Ogilvie et al (1968a), Ogilvie et al (1968b), and Schaeffer and Snively (1968).

Plasma parameters density, bulk speed and temperature were derived by taking moments of the observed distribution function. In this approach the distribution function between any two data points was assumed to be given by a convected isotropic Maxwellian function whose three parameters are exactly determined by those two data points and the immediately following data point. For details see Burlaga and Ogilvie (1968) and Ogilvie et al (1967).

OGO-5

This spacecraft was launched on March 4, 1968 into a high eccentricity orbit of 24 earth radius apogee and provided useful data until October 8, 1971. The local time of apogee varied with the earth's annual rotation around the sun such that the spacecraft was in the interplanetary medium very little between May and September of each year. The spacecraft was attitude stabilized in all 3 axes, and had variable telemetry bit rates (1, 8, or 64 kbps).

The plasma experiment from which data is available in the NSSDC composite data set is that of M. Neugebauer of Jet Propulsion Laboratory. A pair of instruments, a Faraday cup (FC) for total charge flux and flow direction determination and a curved plate electrostatic analyzer (ESA) for spectral data and hence bulk speed and ion density and temperature determination were utilized. This pair of detectors was oriented towards the sun. Another similar pair of instruments, oriented away from the earth yielded no solar wind data contained in this compilation.

The FC consisted of a series of grids and four coplanar collector plates. Three of these plates were 120° sectors and together formed a circular disc; the fourth plate formed a ring around the inner disc and measured particles arriving at off-axis angles between about 12° and 20°. Each collector plate individually and all plates combined were sequentially connected to a current measuring electrometer system to yield direction of flow information. The FC applied voltages that were such that the total charge flux of those positive ions whose velocity component along the

Faraday cup axis corresponded to an E/Q between 100 and 11,000 volts was measured. (This range usually included both the protons and the alpha particles in the solar wind.) The times between successive total charge flux measurements (and between successive angular measurements) were 0.288, 0.576, and 4.608 secs (and 1.152, 2.304, and 18.432 secs) for spacecraft telemetry rates of 64, 8, and 1 kbps.

The ESA was similar to that flown on Mariner 2, and had an angular response of 5^{o} half-width at half-maximum. There was available a series of 128 overlapping E/Q channels, logarithmically equispaced between 2.54 volts and 16.9 kilovolts. Three modes of using these channels have been employed - in the first, the 128 channels were observed sequentially; in the second, every fourth channel was observed sequentially; in the third (used most often), the 32 successive channels centered on the channel in which the peak current was observed in the previous spectrum were observed. The times between successive one-channel measurements were 0.144, 0.288, and 2.304 secs for 64, 8, and 1 kbps telemetry rates.

The FC and ESA data were combined to derive plasma parameters as follows. First the FC data was used to obtain flow direction, assuming a cold plasma beam. Then using this direction, the ESA data, and the assumption of a convected isotropic Maxwellian distribution, least squares fitting was employed to obtain bulk speed, temperature, and ion densities. The temperature thus obtained was then used with the FC data to refine the flow direction, which was then used with the ESA data to refine temperature, densities and velocity, etc. After the iteration had converged sufficiently,

the velocity and the FC total charge flux were combined to yield total charge density (i.e., electron density). Due to its greater reliability, the total charge density obtained from the FC flux rather than the ion density from the ESA is given in the NSSDC composite solar wind data set.

The experimenter has estimated uncertainties in calculated plasma parameters of $\pm$ 1, 15, and 8% in velocity, temperature, and absolute density, respectively. However, for flows with speeds between 320 and 400 km/sec the parameters derived from electrostatic analyzer data are not as reliable due to a photoelectron problem affecting about 20 channels of the ESA. About 25% of the OGO 5 data hours on the unnormalized NSSDC composite tape fall into this speed range. For further details on the instrument and plasma parameter derivation, see Neugebauer (1970).

HEOS-1

The ESRO (now European Space Agency) spacecraft HEOS-1 was launched December 5, 1968 into a high eccentricity orbit with apogee of about 36 Earth radii and an orbital period near 114 hours. The spacecraft was spin stabilized, with a period near 6 seconds and a spin vector direction which, after December 20, 1968, was maintained nearly perpendicular to the ecliptic plane. Most interplanetary data were obtained during approximately half year intervals centered on January 1. The spacecraft reentered the earth's atmosphere in mid-1975, although little data was acquired after the January 31, 1972 launch of HEOS 2.

The plasma experiment (S.73) was provided by the Universities of Florence and Rome (A. Bonetti, principal investigator). The instrumentation consisted of a hemispherical electrostatic analyzer (ESA) for E/Q selection followed by a Faraday cup (FC) and an electrometer system to measure the FC current resulting from the particles passing through the ESA. Solar wind data was obtained by integrating the electrometer output over the half of each spacecraft spin period centered on the solar direction. There were 64 logarithmically equispaced E/Q channels spanning the range 0.2-15 kev/charge, and each channel was measured once during 64 successive spacecraft spins. Thus a full spectral scan required about 6.5 minutes. However, the sequence of interspersing the 64 voltages was such that four 16-point spectra were obtained in each 16 spin period (about 1.5 minutes). It is the number of full 6.5 min spectra contributing to the three hour averaged plasma parameters which is given on the NSSDC solar wind tape.

Plasma parameters were derived using the assumption of a convected isotropic Maxwellian distribution function. Sensor response was computed for an array of triads of assumed plasma parameter values (bulk speed, ion density, and mean thermal speed), and the "correct" triad of parameter values was obtained by interpolating to the actually observed sensor response. For further details on the instrumentation and plasma parameter derivation, see Bonetti et al, 1969.

The HEOS plasma parameter values found on the NSSDC composite tape were obtained from 5-spacecraft listings published in Diodato et al, 1975. Only 3-hr. periods for which HEOS data alone were available in this listing were transferred to the NSSDC tape. Three hour periods whose parameters resulted from both HEOS 1 and Explorer 33 data were not transferred.

IMP's 6, 7, 8 (IMP's I, H, J; Explorers 43, 47, 50)

The IMP 6, 7, and 8 spacecraft were launched on March 13, 1971, September 23, 1972, and October 26, 1973. Each was spin stabilized, with spin vectors normal to the ecliptic plane and with spin periods of 10.5, 1.3, and 2.6 secs (IMP's 6, 7, and 8, respectively). IMP 6 was placed in a highly eccentric orbit with apogee near 32 earth radii and an orbital period near 100 hours. IMP 6 reentered the earth's atmosphere October 2, 1974. IMP's 7 and 8 were placed into low eccentricity orbits (30-40 R_E for IMP 7, 25-45 R_E for IMP 8) with orbital periods near 12 days. These spacecraft continue to provide much useful data. Details of their trajectories are found in Fairfield et al (1973) and in King and Teague (1976). Plasma experiments were flown on all three spacecraft by L. Frank (U. Iowa) and by S. Bame (Los Alamos), on IMP's 6 and 7 by K. Ogilvie (GSFC) and on IMP's 7 and 8 by H. Bridge (MIT).

Los Alamos Detectors

Hemispherical electrostatic analyzers were flown on IMP's 6, 7, and 8 by the Los Alamos Scientific Laboratory solar wind plasma physics team. The instruments were very similar to each other and to the instruments flown on the Vela spacecraft series. Likewise, the method of deriving plasma parameters from the detector outputs is basically the same as that used in processing the Vela data, viz. least squares fits of the data to a convected bimaxwellian distribution function.

For the IMP 6 instrument in its solar wind mode of observation, a full two-dimensional plasma ion spectrum consisting of 5-msec samples

of the counting rate at each of 1024 velocity grid points is obtained in about 440 sec. The two-dimensional velocity grid consists of 16 ecliptic longitude sectors within a 45^{o} octant centered on a direction 2.5^{o} west of the sun, and 64 logarithmically spaced energy channels from 124 ev to 5.16 kev nominal acceptance proton energies. The time sequence of data acquisition is such that a full 440-sec spectrum is assembled from 4 independent spectra (each with 16 E/Q steps) requiring 90 sec to obtain but repeated every 110 sec. It is the number of these 110-sec spectra contributing to hourly averaged parameter values which are given on the NSSDC composite plasma tape. Further details on the IMP 6 instrument and data reduction procedures are found in Feldman et al, (1973).

Bame, S.J., J.R. Asbridge, H.E. Felthauser, E.W. Hones, and I.B. Strong, Characteristics of the Plasma Sheet in the Earth's Magnetotail, J. Geophys. Res., 72, 113, 1967.

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Behannon, K.W., K.H. Schatten, D.H. Fairfield, and N.F. Ness, "Trajectories of Explorers 33, 34, and 35, July 1966 - April 1969," GSFC X-692-70-64, 1970.

Bonetti, A., G. Moreno, S. Cantarano, A. Egidi, R. Marconero, F. Palutan, and G. Pizzella, Solar Wind Observations with Satellite ESRO HEOS-1 in December 1969, Nuovo Cimento, 46B, 307, 1969.

Burlaga, L.F. and K.W. Ogilvie, Observations of the Magnetosheath-Solar Wind Boundary, J. Geophys. Res., 73, 6167, 1968.

Diodato, L., G. Moreno, and C. Signorini, Compilation of Normalized Solar Wind Densities and Velocities (1965/1971), Astron. Astrophys. Suppl., 20, 313, 1975.

Fairfield, D.H., K.W. Behannon, R.P. Lepping, and N.F. Ness, "Trajectories of Explorers 33, 35, 41, 43, and 47, May 1969-December 1972," GSFC X-692-73-291, 1973.

Feldman, W.C., J.R. Asbridge, S.J. Bame, and M.D. Montgomery, Double Ion Streams in the Solar Wind, J. Geophys. Res., 78, 2017, 1973.

Gosling, J.T., J.R. Asbridge, S.J. Bame, and I.B. Strong, Vela 2 Measurements of the Magnetopause and Bow Shock Positions, J. Geophys. Res., 72, 101, 1967.

Hones, E.W., J.R. Asbridge, S.J. Bame, M.D. Montgomery, S. Singer, and S.I. Akasofu, Measurements of Magnetotail Plasma Flow Made with Vela 4B, J. Geophys. Res., 77, 5503, 1972.

Hundhausen, A.J., J.R. Asbridge, S.J. Bame, H.E. Gilbert, and I.B. Strong, Vela 3 Satellite Observations of Solar Wind Ions: A Preliminary Report, J. Geophys. Res., 72, 87, 1967.

Hundhausen, A.J., S.J. Bame, J.R. Asbridge, and S.J. Sydoriak, Solar Wind Proton Properties: Vela 3 Observations from July 1965 to June 1967, J. Geophys. Res., 75, 4643, 1970.

King, J.H. and M.J. Teague, "Trajectories of Explorers 43, 47, and 50, September 1972-December 1975," GSFC X601-76-38, 1976.

Lyon, E.F., H.S. Bridge, and J.H. Binsack, Explorer 35 Plasma Measurements in the Vicinity of the Moon. J. Geophys. Res., 72, 6113, 1967.

Lyon, E., A. Egidi, G. Pizzella, H. Bridge, J. Binsack, R. Baker, and R. Butler, Plasma Measurements on Explorer 33 (1) Interplanetary Region. Space Research VIII, 99, 1968.

Montgomery, M.D., J.R. Asbridge, and S.J. Bame, Vela 4 Plasma Observations near the Earth's Bow Shock, J. Geophys. Res., 75, 1217, 1970.

Neugebauer, M., Initial Deceleration of Solar Wind Positive Ions in the Earth's Bow Shock, J. Geophys. Res., 75, 717, 1970.

Ogilvie, K.W., L.F. Burlaga, and H. Richardson, "Analysis of Plasma Measurements on Imp F," GSFC X-612-67-543, 1967.

Ogilvie, K.W., N. McIlwraith, and T.D. Wilkerson, A Mass-Energy Spectrometer for Space Plasmas, Rev. Sci. Inst., 39, 441, 1968a.

Ogilvie, K.W., L.F. Burlaga, and T.D. Wilkerson, Plasma Observations on Explorer 34, J. Geophys. Res., 73, 6809, 1968b.

Schaeffer, D.H., and J.W. Snively, Jr., On-Board Plasma Data Processor, Rev. Sci. Instr., 39, 452, 1968.

For Explorer 33 one 25 second plasma data acquisition cycle was executed during each 82 second spacecraft telemetry sequence. This cycle consisted of 2 parts. For the first 5 seconds, current associated with ions with E/Q between .07 and 3 kev was continuously measured and the azimuth of peak flux was determined. Then the modulator voltage was stepped through 8 energy windows on 8 successive revolutions while the current was sampled at the selected peak-flux azimuth. The 8 steps spanned the range .04-4 kev; the upper 7 steps covered 0.3-4 kev. For Explorer 35 the data acquisition cycle was similar, with similar but not identical numerical values.

Plasma parameters were derived by fitting the data to a convected, isotropic "Kappa" distribution, which predicts a larger high energy tail than the more often used maxwellian distribution function. For further details on the experiments and plasma parameter derivations, see Lyon et al (1967) and Lyon et al (1968).

IMP 4 (IMP F, Explorer 34)

IMP 4 was launched on May 24, 1967 into a high eccentricity orbit of 34 earth radius apogee and 100 hour period. The spacecraft spun with a period of about 2.6 seconds and a spin vector direction normal to the ecliptic plane. Solar wind data was obtained between launch and the end of 1967. The spacecraft decayed from orbit on May 3, 1969.

The plasma experiment was provided by Goddard Space Flight Center and U. of Maryland (K. Ogilvie, principal investigator). The instrumentation consisted of a curved plate electrostatic analyzer (ESA) for E/Q selection followed by a crossed electric field/magnetic field device for velocity selection followed by a particle counter. The entrance aperture measured 2^{o} x 18^{o}, and data were taken in 16 22.5^{o} sectors during each of 5 spacecraft spins every telemetry sequence (20.48 seconds).

A full measurement cycle consisted of data taken during 45 spacecraft spins occuring during 9 successive telemetry sequences (about 3 minutes). During the first 3 telemetry sequences the ESA voltage was stepped through 14 5% bandwidth channels from 0.3 to 5 kilovolts, and for each step the velocity selector electric field was set such that only protons would enter the particle counting portion of the experiment. During the next 3 telemetry sequences the same series of ESA voltages was applied, but for each the velocity selector electric field was set to pass only alpha particles to the counters. The next three telemetry sequences involved measurement of protons at a single E/Q channel; this mode permitted the study of phenomena occuring at time scales of $\geq$ 3 seconds.

```
0000002C  40404040  404C4040  4326D2F8  40404040  4C4C4040  40404040  40404040  40404040  40404040
40404040  00400000  0C000049  00000168  0000000B  00000063  0000002C  40404040  40404040  4326D2F8
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150 RECORDS IN FILE 1 OF TAPE

```
IEF142I - STEP WAS EXECUTED - COND CODE 0000
IEF285I   SYS76139.T155133.RV000.YZJRJJP1.LODMOD        PASSED
IEF285I   VOL SER NOS= K3SCR3.
IEF285I   SYS76139.T155133.RV000.YZJRJJP1.S0000633      SYSIN
IEF285I   VOL SER NOS= K3SCR2.
IEF285I   SYS76139.T155133.RV000.YZJRJJP1.S0000633      DELETED
IEF285I   VOL SER NOS= K3SCR2.
IEF285I   SYS76139.T155133.SV000.YZJRJJP1.R0000629      SYSOUT
IEF285I   VOL SER NOS= K3SCR4.
IEF285I   SYS76139.T155133.SV000.YZJRJJP1.R0000630      DELETED
IEF285I   VOL SER NOS= K3SCR5.
IEF285I   SYS76139.T155133.SV000.YZJRJJP1.R0000631      DELETED
IEF285I   VOL SER NOS= K3SCR4.
IEF285I   SYS76139.T155133.RV000.YZJRJJP1.R0000632      KEPT
IEF285I   VOL SER NOS= JJ0007.
IEF280E K 0D4.JJ0007.YZJRJJP1.GO
IEF373I STEP /GO       / START 76139.2222
IEF374I STEP /GO       / STOP  76139.2226 CPU    0MIN 14.14SEC MAIN 186K LCS    0K
- STEP 03 -     RETURN CODE = 0000                                STEP TIME =      .40 MINS=(CPU=      .23,IO=      .17)
                                        IO IN SECS. DISK=     5.95,DRUM=      .38,TAPE=     3.89,CELL=      .00,OTHR=      .13
IEF285I   SYS76139.T155133.RV000.YZJRJJP1.LODMOD        DELETED
IEF285I   VOL SER NOS= K3SCR3.
IEF375I  JOB /YZJRJJP1/ START 76139.2218
IEF376I  JOB /YZJRJJP1/ STOP  76139.2226 CPU    0MIN 18.07SEC
-   SYSTEM=MVT-21 (11-21-73)   K3                                                TIME=22.26.26.86 DATE=05-18-76
- JOB 0155-                                                 TOTAL TIME =      .73 MINS=(CPU=      .30,IO=      .43)
                                        IO IN SECS. DISK=    16.97,DRUM=     1.12,TAPE=     7.80,CELL=      .00,OTHR=      .36
 THERE WERE 03 TAPES MOUNTED FOR THIS JOB. TAPE MOUNT CHARGE WAS 00.0 MINUTES.
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D-23730
7/21/64 - 12/31/23

```
IEF237I 331   ALLOCATED TO SYSPRINT
IEF237I 231   ALLOCATED TO SYSPRINT
IEF237I 232   ALLOCATED TO SYSPRINT
IEF237I 0D4   ALLOCATED TO FT08F001
```

RECORD 1 OF FILE 1
LENGTH = 25604 BYTES

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