DISPERSION OF PLASMA PARAMETERS MEASURED BY A SONDING SATELLITE DURING A REPEATED TRANSIT THROUGH A BOW SHOCK WAVE*

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The paper deals with plasma parameters analyses during crossing bow shock. Statistical evaluation of these parameters is presented; the data have been obtained from several rapidly following transits of the satellite through shock waves. The data on which this paper is based were measured by a plasma spectrometer MONITOR on board the satellite Prognoz 8 (Balebanov V. M. et al.: Adv. Space Res. 2 (1983) 75).

1. INTRODUCTION

In the year 1981 an experiment named MONITOR, designed to study plasma processes in solar wind and the Earth's magnetosphere, was carried out on board the satellite Prognoz 8. This experiment offered the possibility of monitoring continually the basic plasma parameters of solar wind, that is ion velocity, density, temperature and the angle of the bulk velocity vector and the direction to the Sun. The temperature and the value of bulk velocity were obtained from ion energy spectra measured in 32 points ranging from 0.16 to 4.1 keV by means of an electrostatic analyser directed to the Sun. A second such analyser deflected by 7° from the Sun direction enabled observation of the angular asymmetry of the distribution function.

The detector system included a Faraday cup with a collector segmented into 3 independent parts for the measurement of ion density and the angle of solar wind bulk velocity relative to the Sun. The geometrical set-up allowed the determination of the ion flux direction in the range of approximately 20° with respect to the Faraday cup axis (oriented to the Sun) as a ratio of the currents collected by the different segments. The sum of these 3 currents together with the value of bulk velocity was sufficient for the determination of ion density.

The data from these analysers can be transmitted to the Earth in one of two forms. In short intervals when direct transmission was possible the data were received as complete real time spectra from both channels. Most of the time, however, the spectra were processed on board and only 3 parameters from each channel were transmitted to the Earth: the maximum height of the distribution function, $N_M$, the energy corresponding to this maximum, $E_M$, and the half width determined from lower energies $N_L$.


Under assumptions usually made about solar wind ions (Maxwellian distribution, mean thermal velocity negligible with respect to bulk velocity) these parameters enabled the approximative reconstruction of the proton section of the distribution function and the determination of all basic plasma parameters.

2. EXPERIMENTAL DATA AND THEIR PROCESSING

The results presented were obtained mostly in the monitor regime when only three monitored parameters, $NL, N_p, NM$, and three currents $Y_1, Y_2, Y_3$, collected by the Faraday cup collectors, were measured every 1.28 s and later transmitted to the Earth. The data were registered on January 4, 1981 when from 23:40 to 8:50 several repeated

![Graphs showing the evolution of parameters $N_p$ and $NM$.](image1)

Fig. 1. The evolution of the parameters $N_p$ (upper part) and $NM$ (lower part) in the rough time resolution (scale).