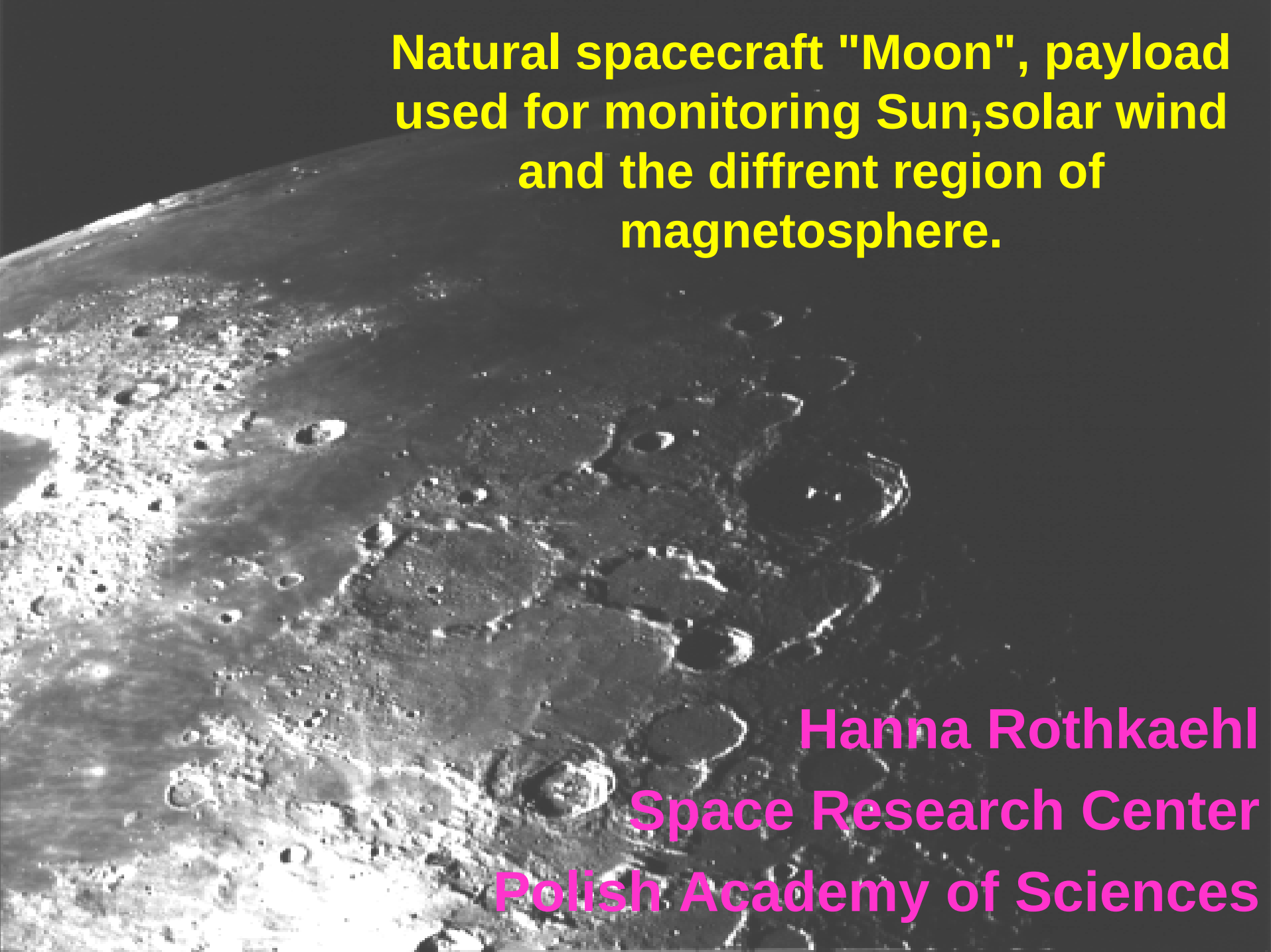
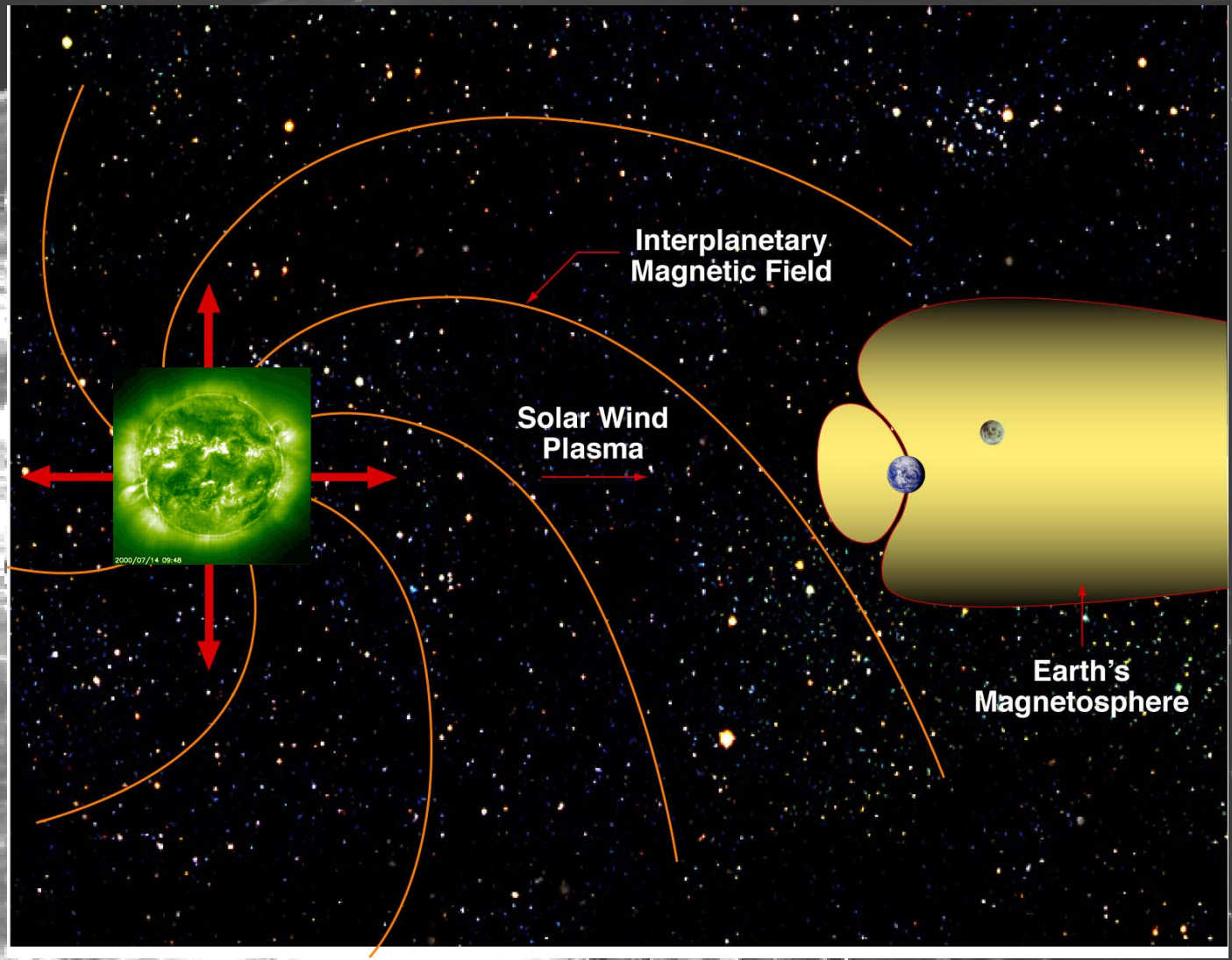


Natural spacecraft "Moon", payload used for monitoring Sun,solar wind and the diffrent region of magnetosphere.

Hanna Rothkaehl
Space Research Center
Polish Academy of Sciences

Wave diagnostics



LF ion plasma diagnostics, E B field fluctuations.

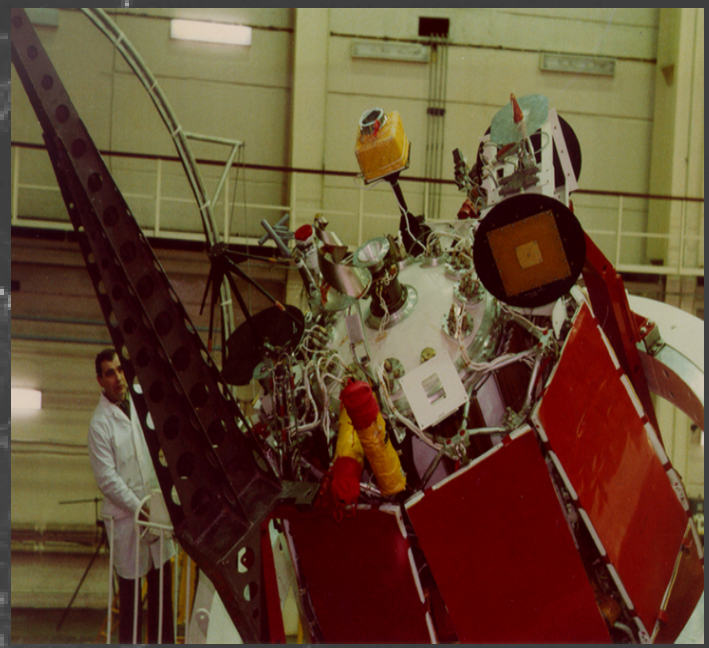
VLF low density plasma diagnostics

HF electron plasma diagnostics, Solar radio burst.

Experience

past experiment -RF diagnostics

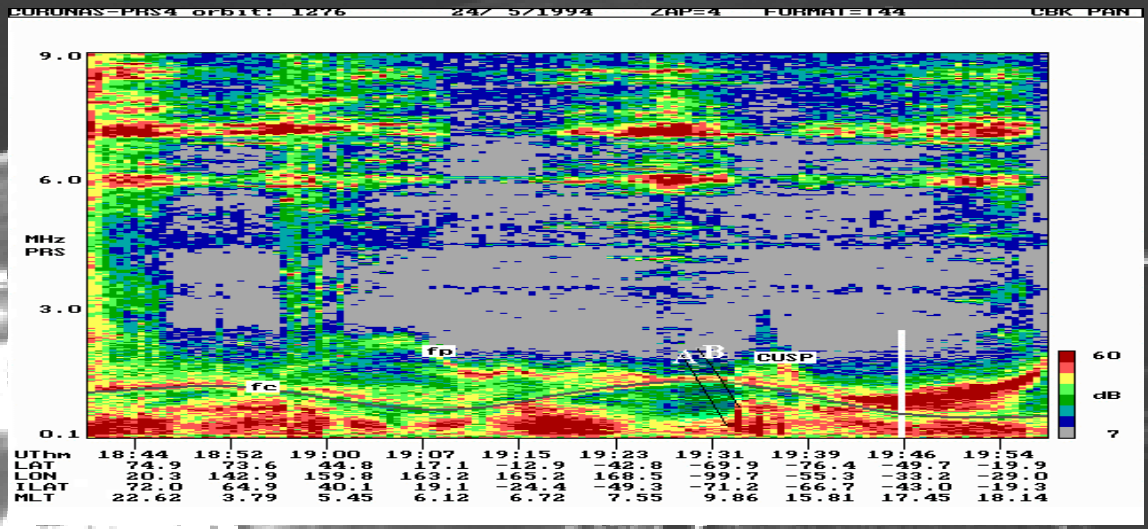
IK-19 1978-1981	**500-980 Km inc. 74 deg**	**0.1-6. MHz HF**
IK-24 Activny 1989-1990	**500-2500 Km inc. 82.5 deg**	**0.1- 10. MHz HF**
IK-25 Apex Magion-3 1991-1992	**430-3100 Km inc. 82.5 deg**	**0.1-10. MHz HF**
Coronas-I 1994	**500 Km inc. 82.5 deg**	**0.1-30. MHz HF**

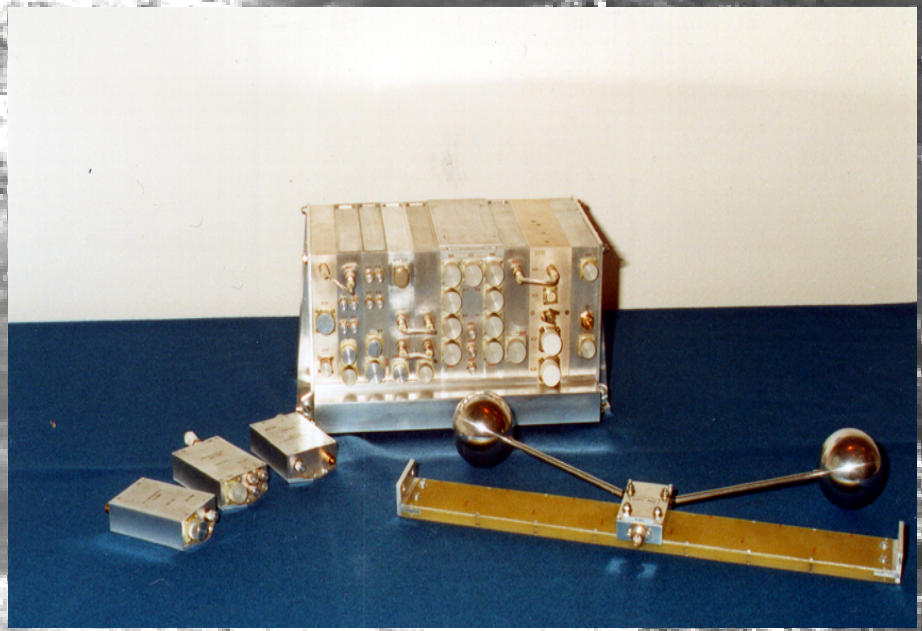


H. Rothkaehl, Z. Kłos,

A. Kiraga

CORONAS I





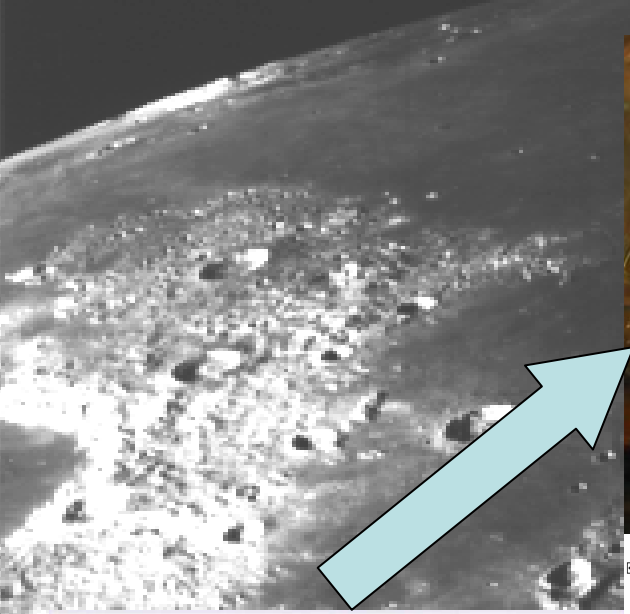
•CORONAS-I launched on March 2, 1994. The satellite had on the board Solar Radio Spectrometer (SORS) to measure radio and plasma noise electric fields 0.1-300 MHz, 20-300 MHz magnetic field, Impedance probe, active ionosonde sounding. The HF measurements were performed with dipole antenna 15 m long from tip- to-tip within the range of 0.1-30 MHz with 25 kHz step and 15 kHz passband. Consecutive spectra were registered every 30 s. with sweep period 6.4s each.

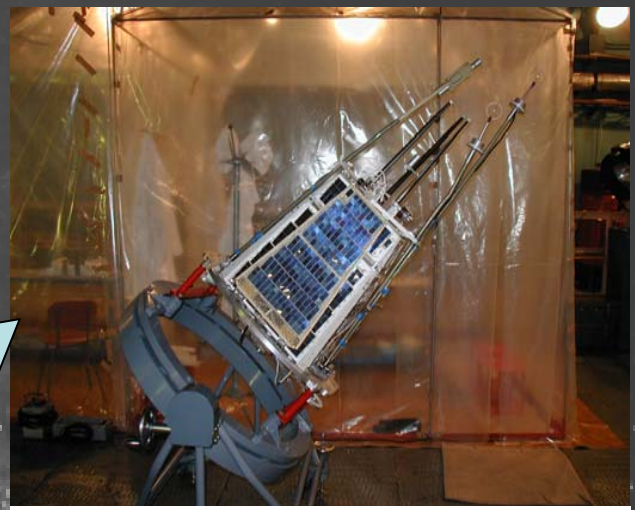
COMPASS 2

SRC PAS

IRF-u

IZMIRAN





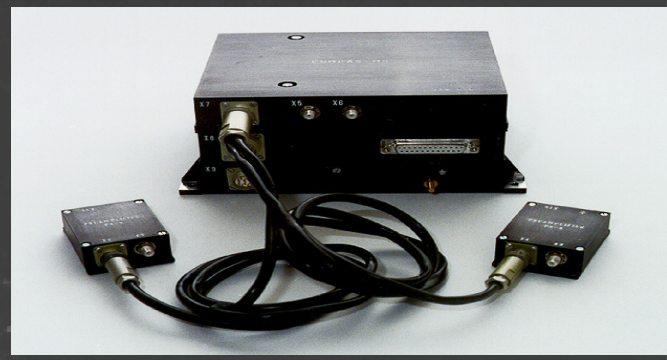


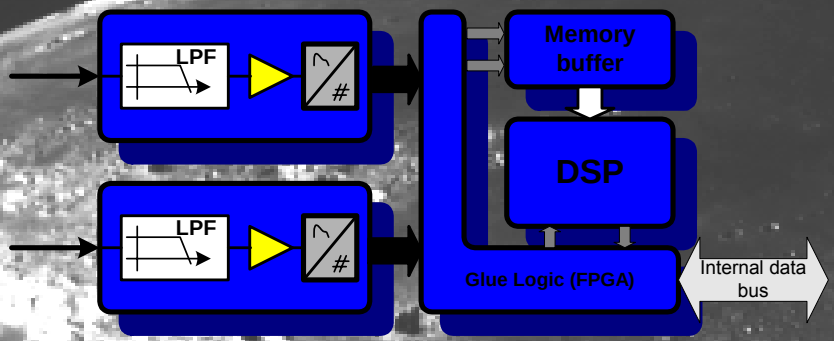
Table 2-1 Instrument main characteristic

Parameter	Value
General	
Mass [kg]	2.1 (+10% / - 30 %)
Power [W]	6.5 (+20% / - 30 %)
Voltage [V]	28.0 (+/- 4 [V])
Dimension [mm]	190.0x150.0x90.0 (TBC)
Functional	
Frequency range	100.0 [kHz] to 15.0 [MHz]
Spectrum resolution	10.0 [kHz] (0.1 to 1.0 MHz) 100.0 [kHz] (1.0 to 15.0 MHz)
Dynamic range [dB]	70.0 (TBC)
Operational	
Discrete commands	NONE
TC stream	NONE
TC packet length	0 bytes
TM stream	~ 2 packets / sec
TM packet length	120 byte (960 bits)
Internal memory buffer	256 kB (about 1 hours of measurement without TM dump)

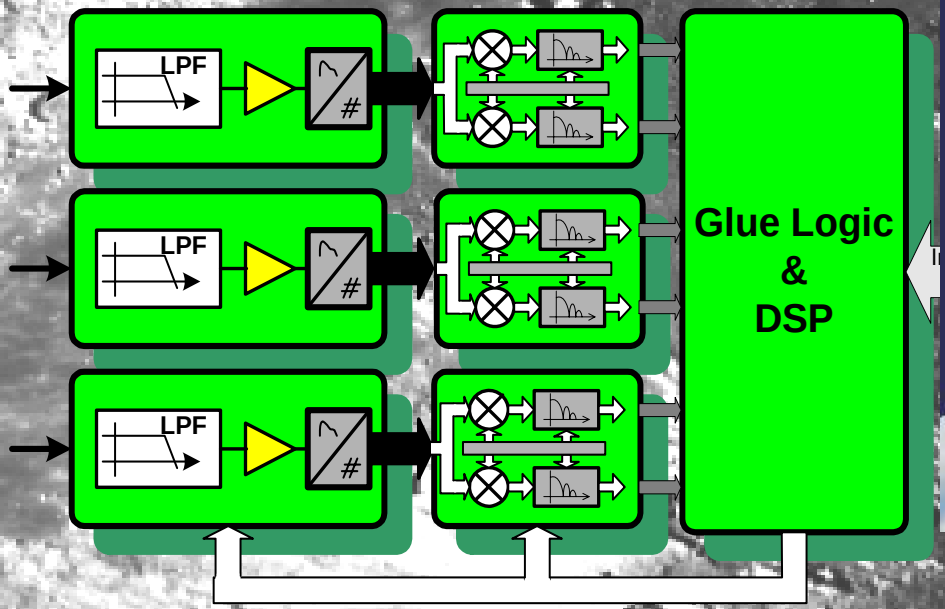
weighting 85 kg, circular orbit with height 400 km and inclination 79 degrees for development of the methods of monitoring and forecasting of natural disasters on the base of coordinated monitoring at the Earth and from space the pre-earthquake phenomena.

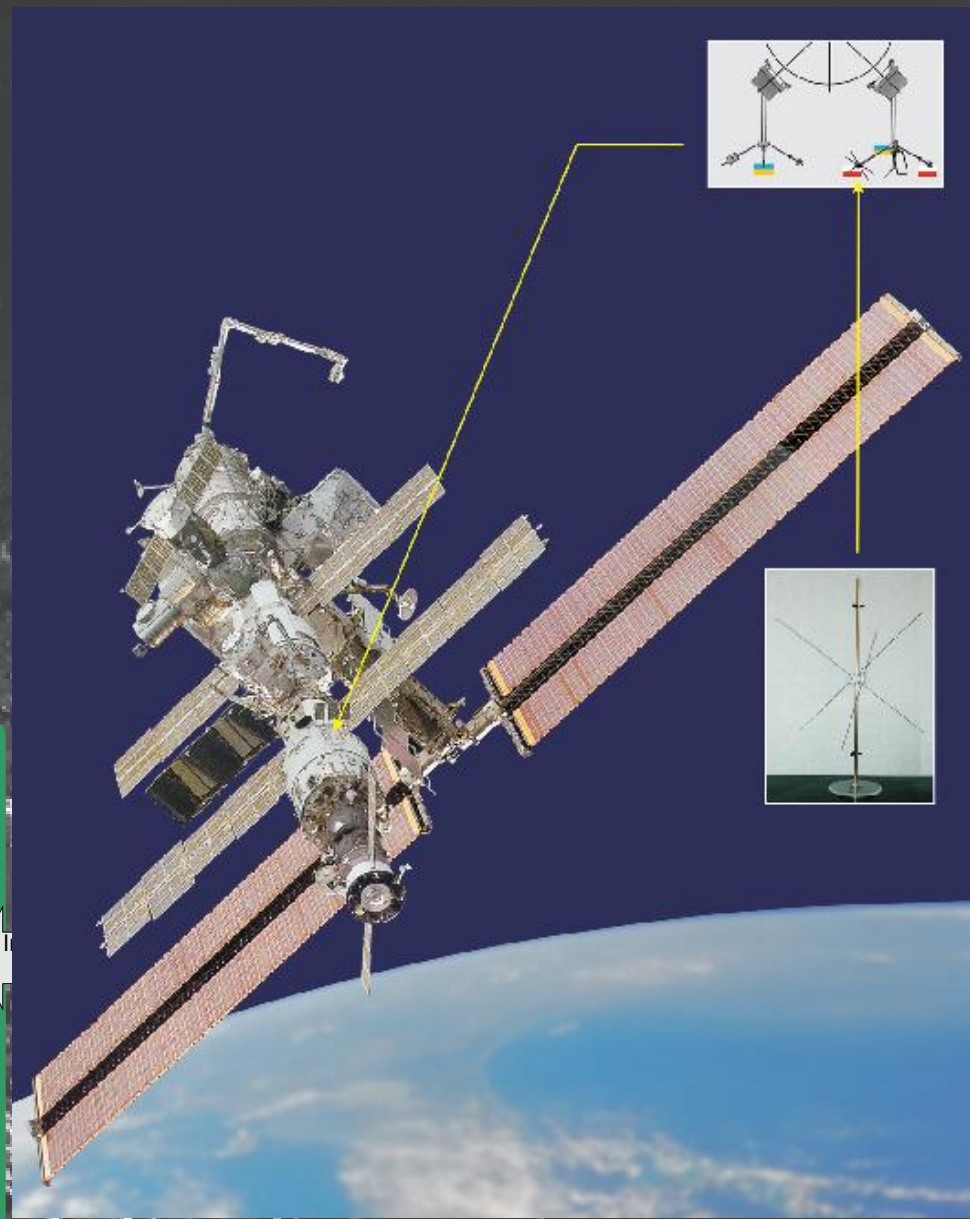
OBSTANOVKA ISS

Wave Recorder concept

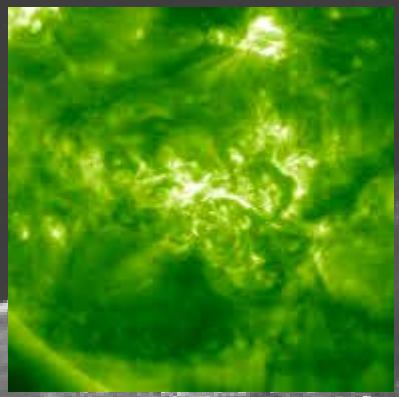


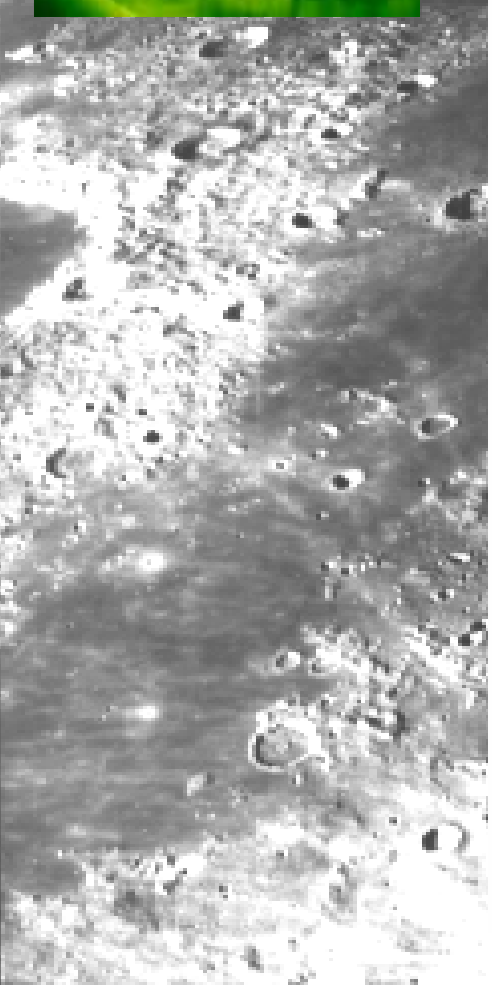
Vector Digital Receiver concept

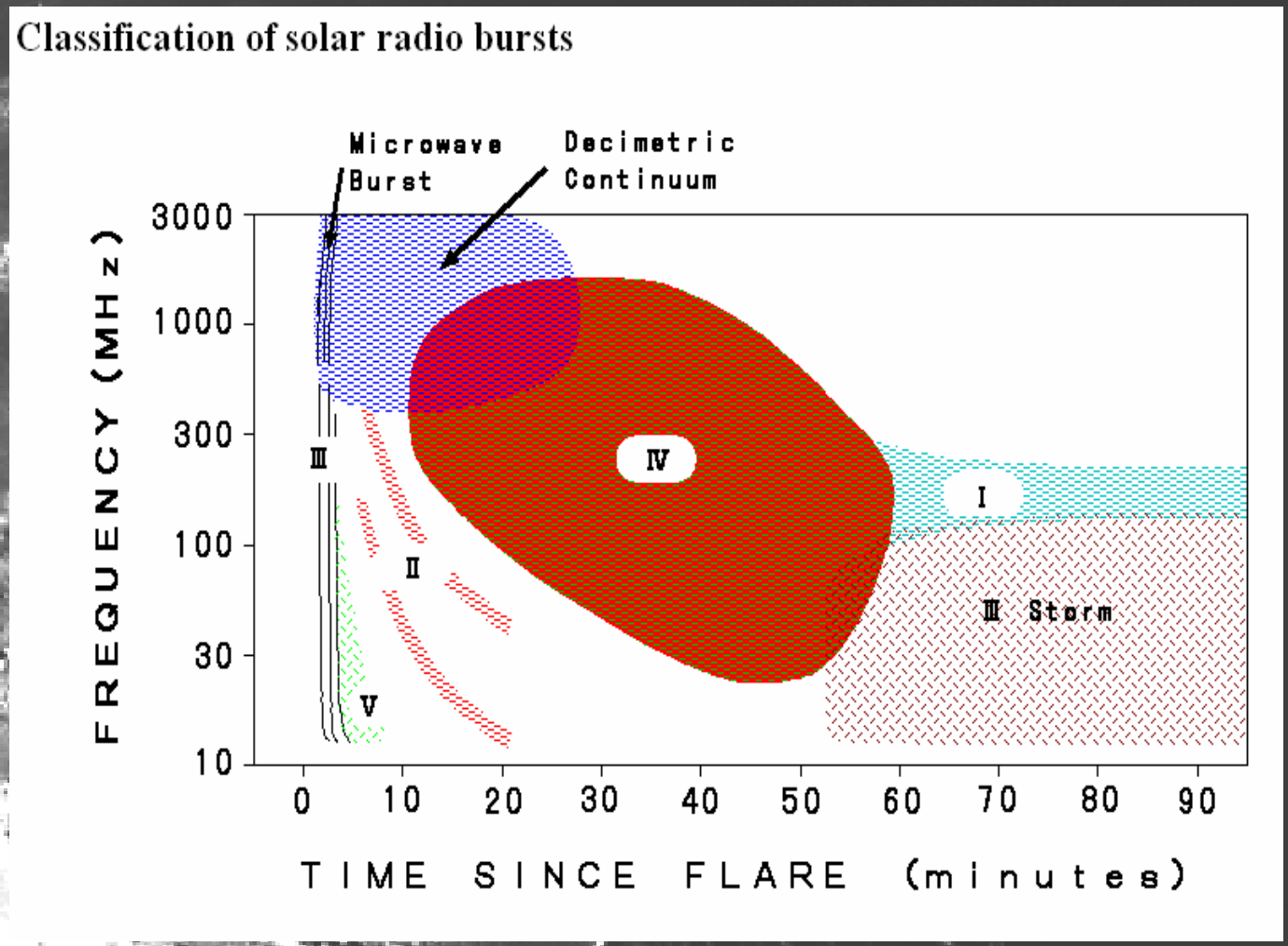




Sun






Classification of solar radio bursts
Microwave Burst
Decimetric Continuum
FREQUENCY (MHz)
3000
1000
300
100
30
10
0
10
20
30
40
50
60
70
80
90
TIME SINCE FLARE (minutes)
I
II
III
IV
V
III Storm

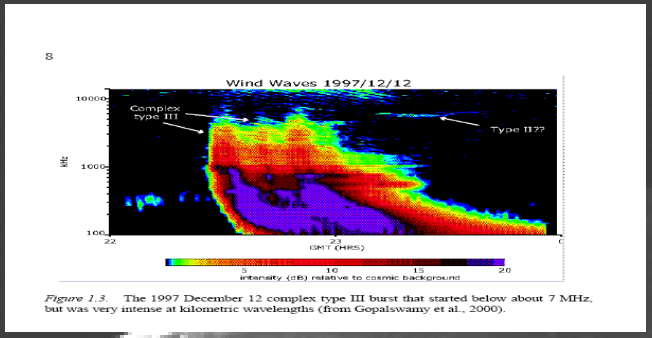
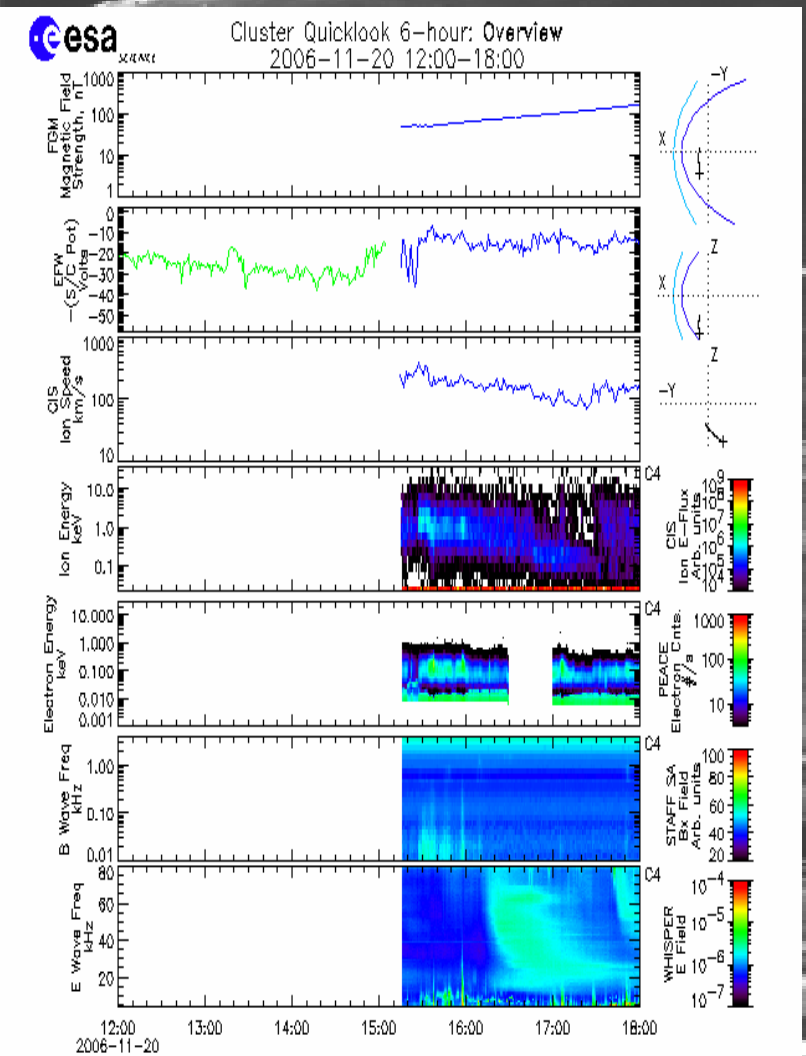
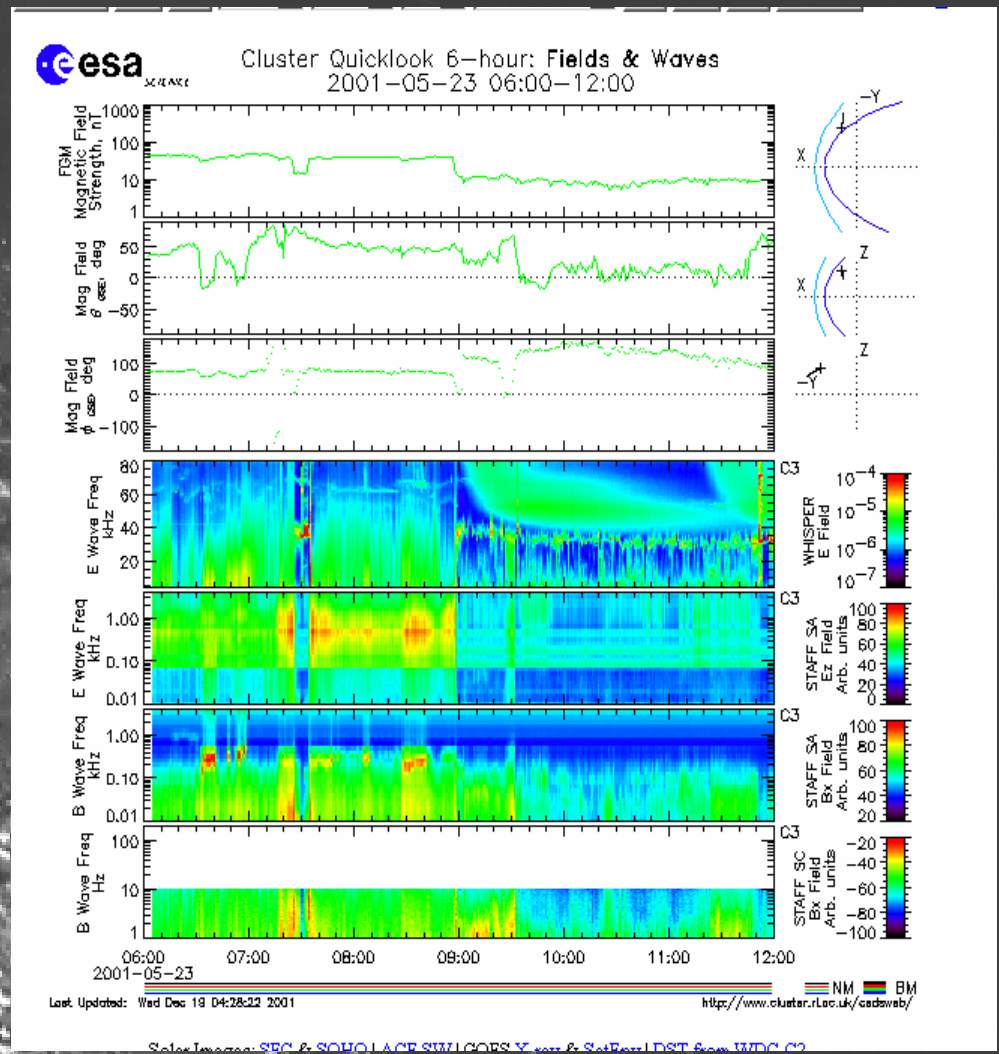


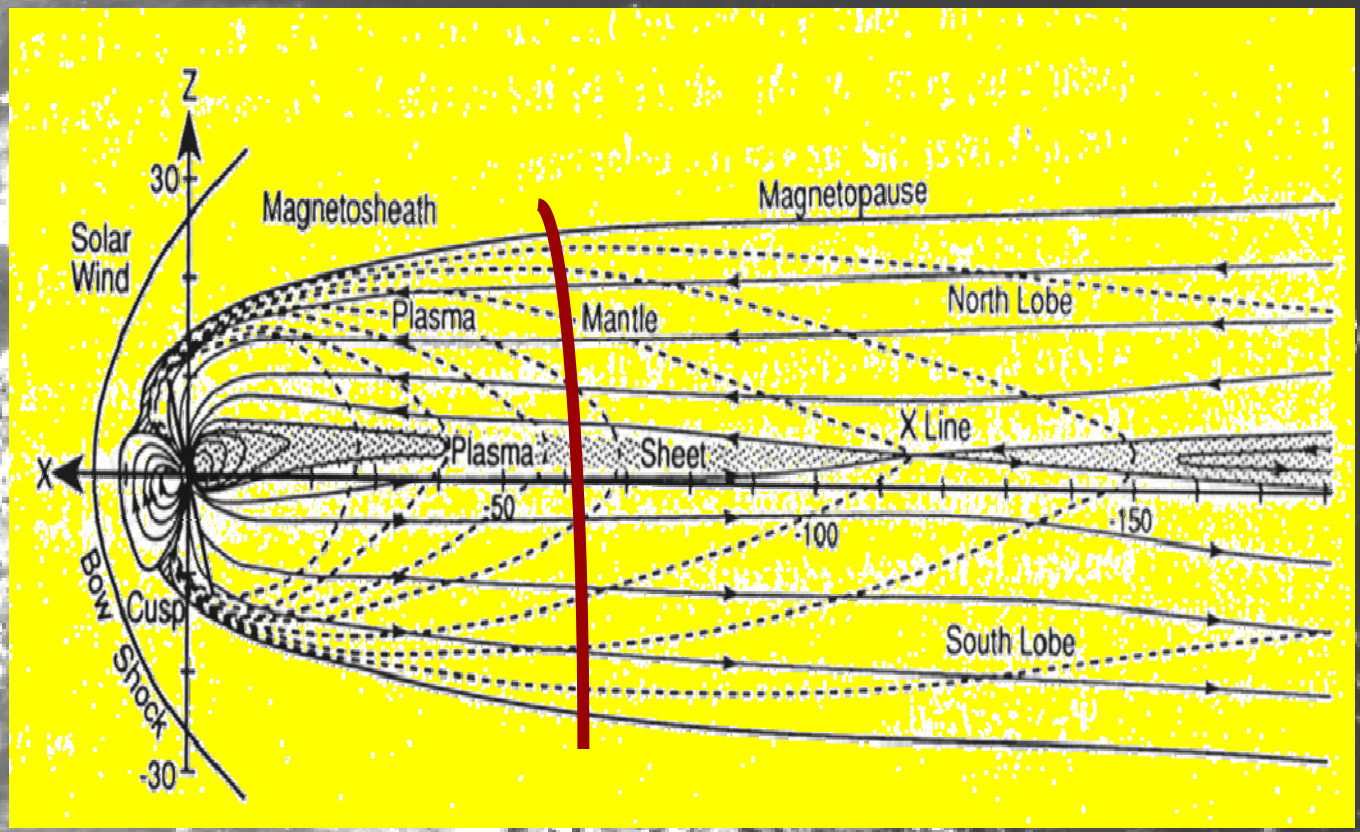
Figure 1.3. The 1997 December 12 complex type III burst that started below about 7 MHz, but was very intense at kilometric wavelengths (from Gopalswamy et al., 2000).

Cluster





Magnetosphere



Plasma Sheet

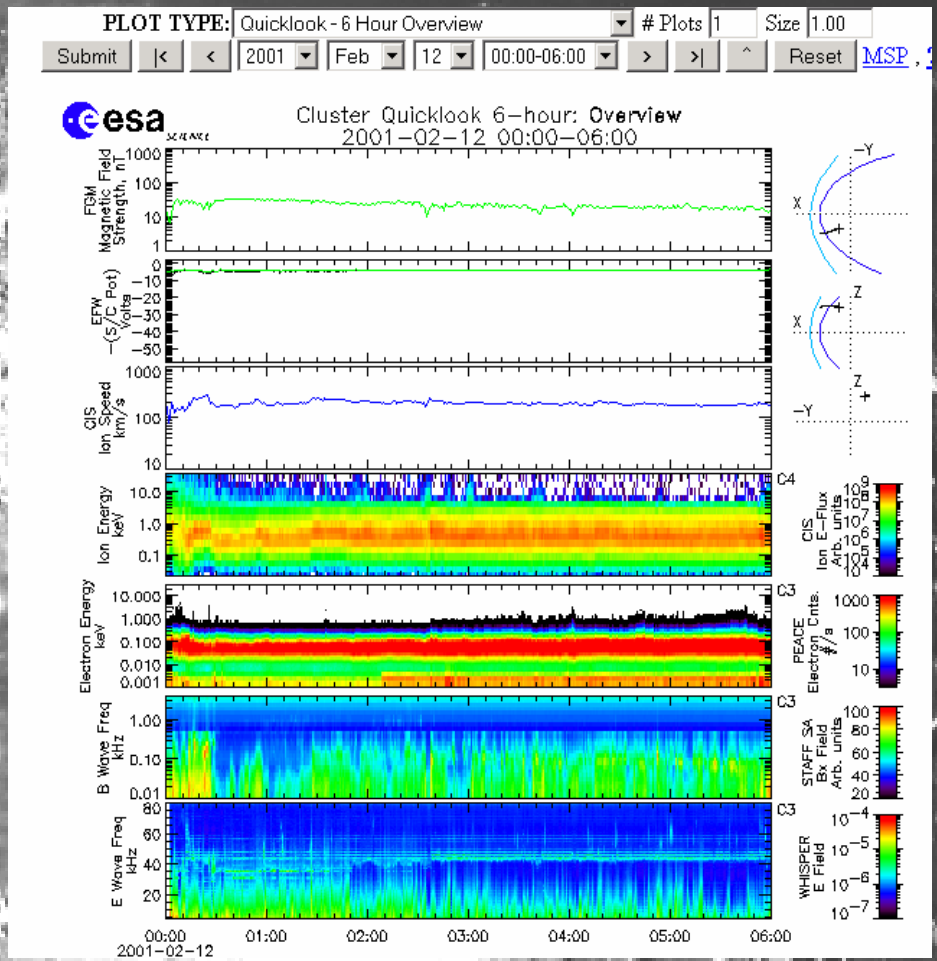
Plasma Mantle

Magnetopause

Bow Shock

Plasma instability, diagnostic of evolution magnetospheric plasma during geomagnetic storm, define the position of boundary layers

Turbulence diagnostics magnetosheat

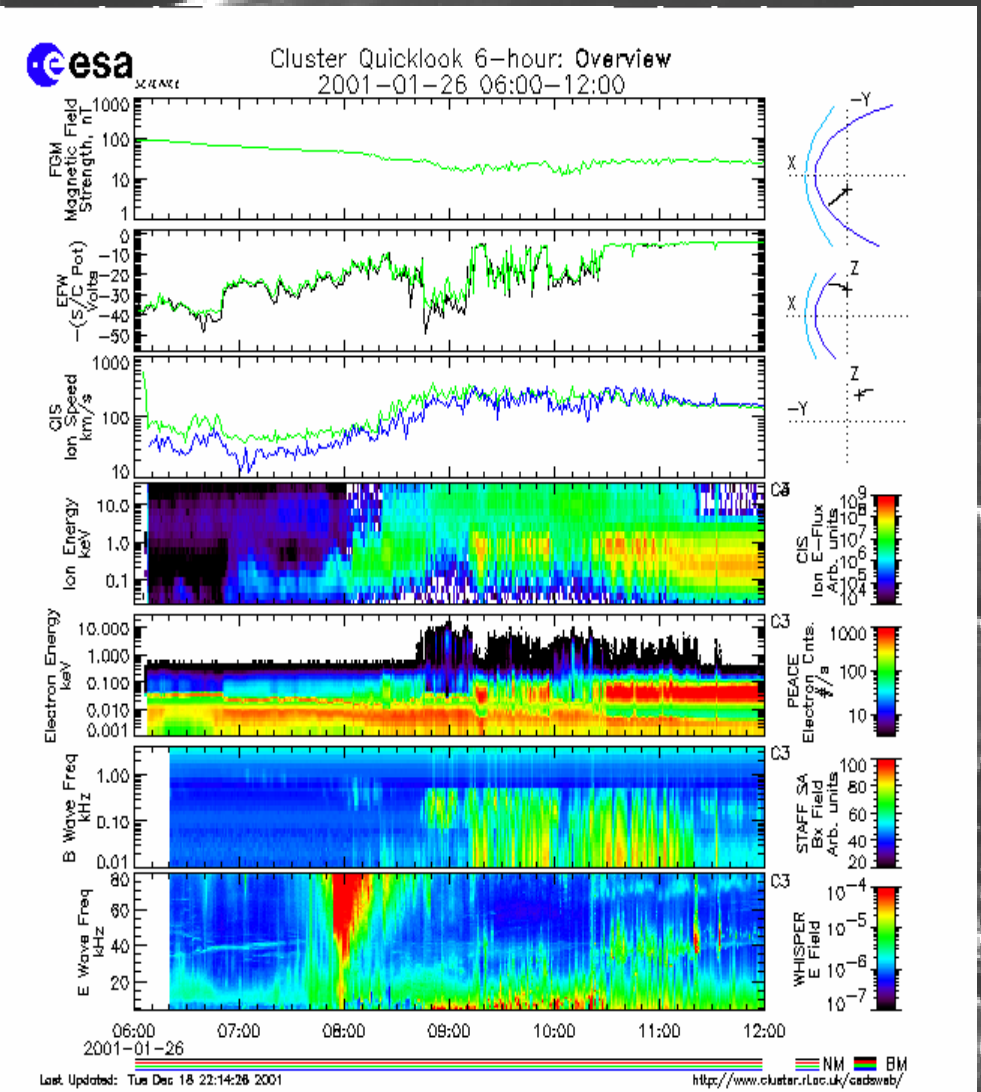


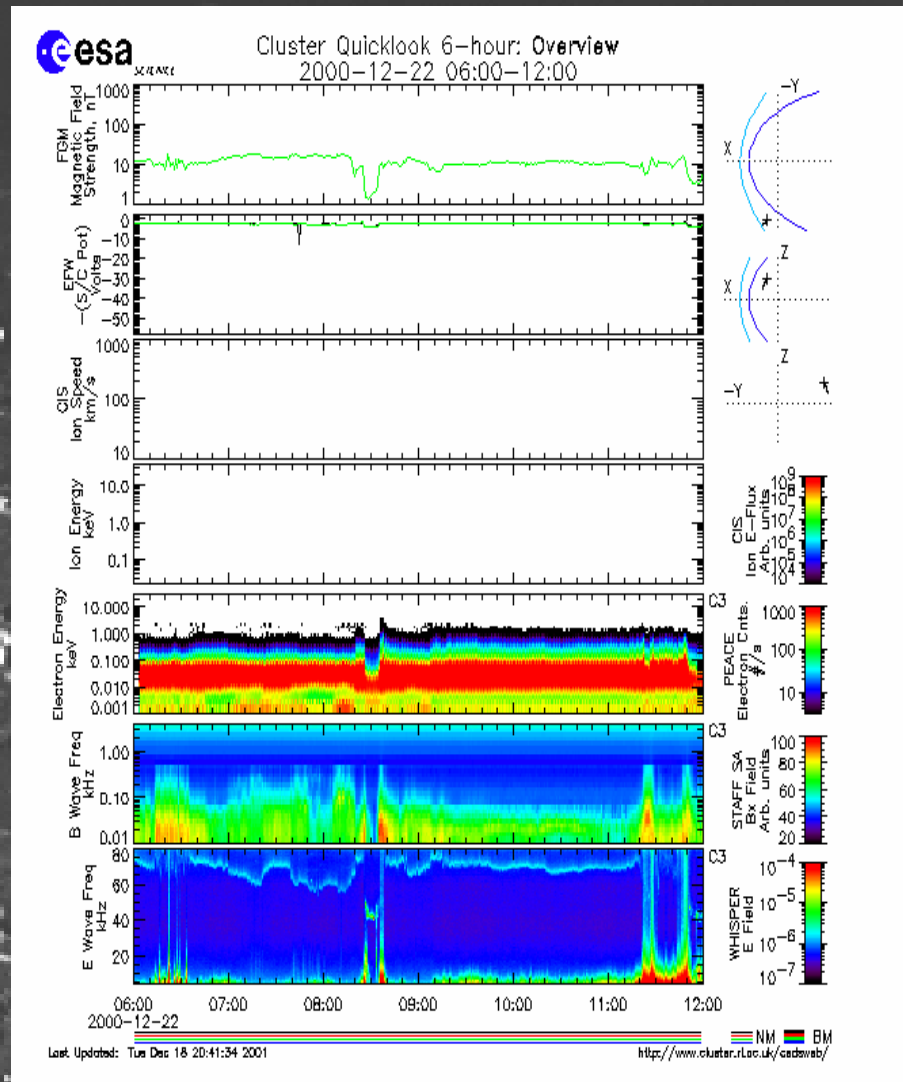
Classical electric field measurements

Lunar ionosphere as laboratory of different type plasma instability and LOIS new challenges

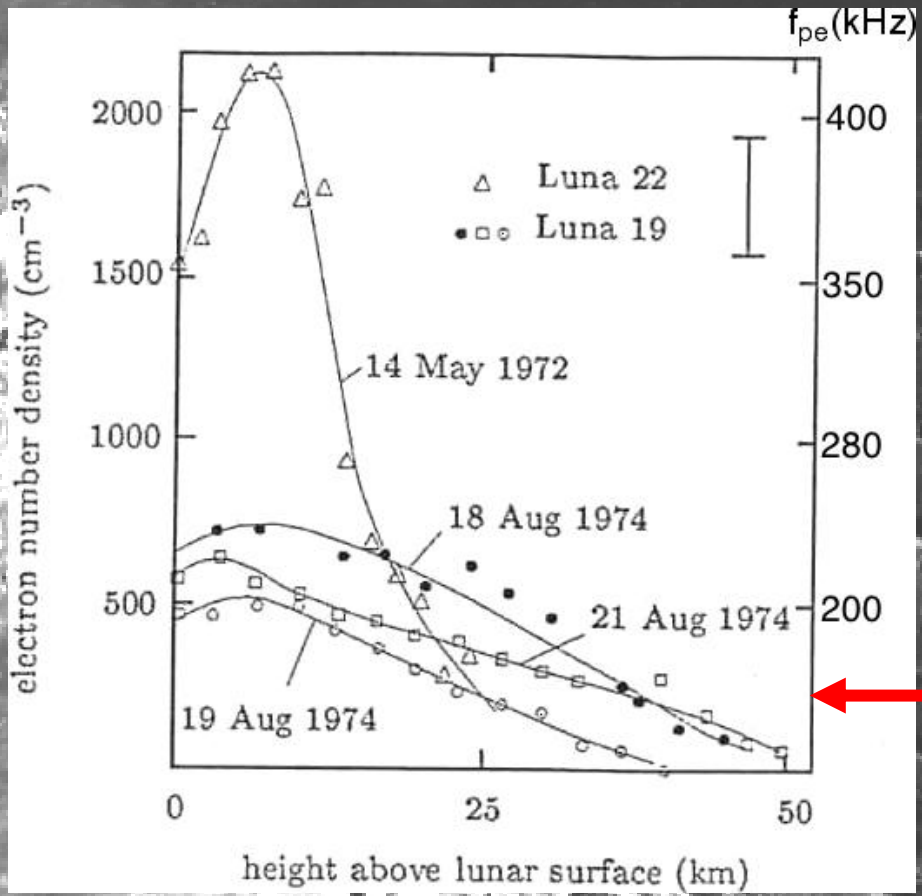
Magnetopause

Bow Shock





Two point diagnostic

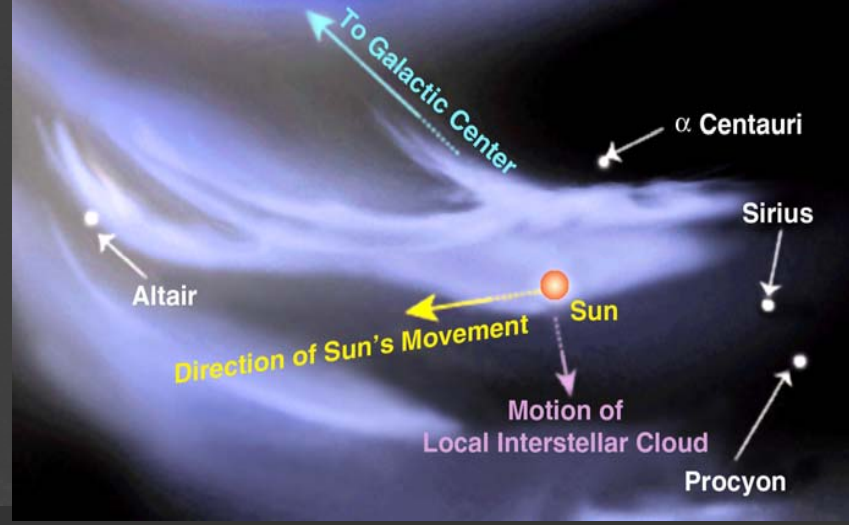


Lunar orbiter

Lunar surface

No direct diagnose

Energetic Neutral Atoms (ENAs): diagnostics on the Moon



Scientific background:

Species: H, D, He, O, C, Na, K…

Sources (from charge exchange with plasma populations):

- LISM (Local InterStellar Matter)
- Heliospheric Interface (Heliosheath)
- Inner solar system (dust)
- Sun (Neutral Solar Wind)
- Magnetosphere and Exosphere
- Moon

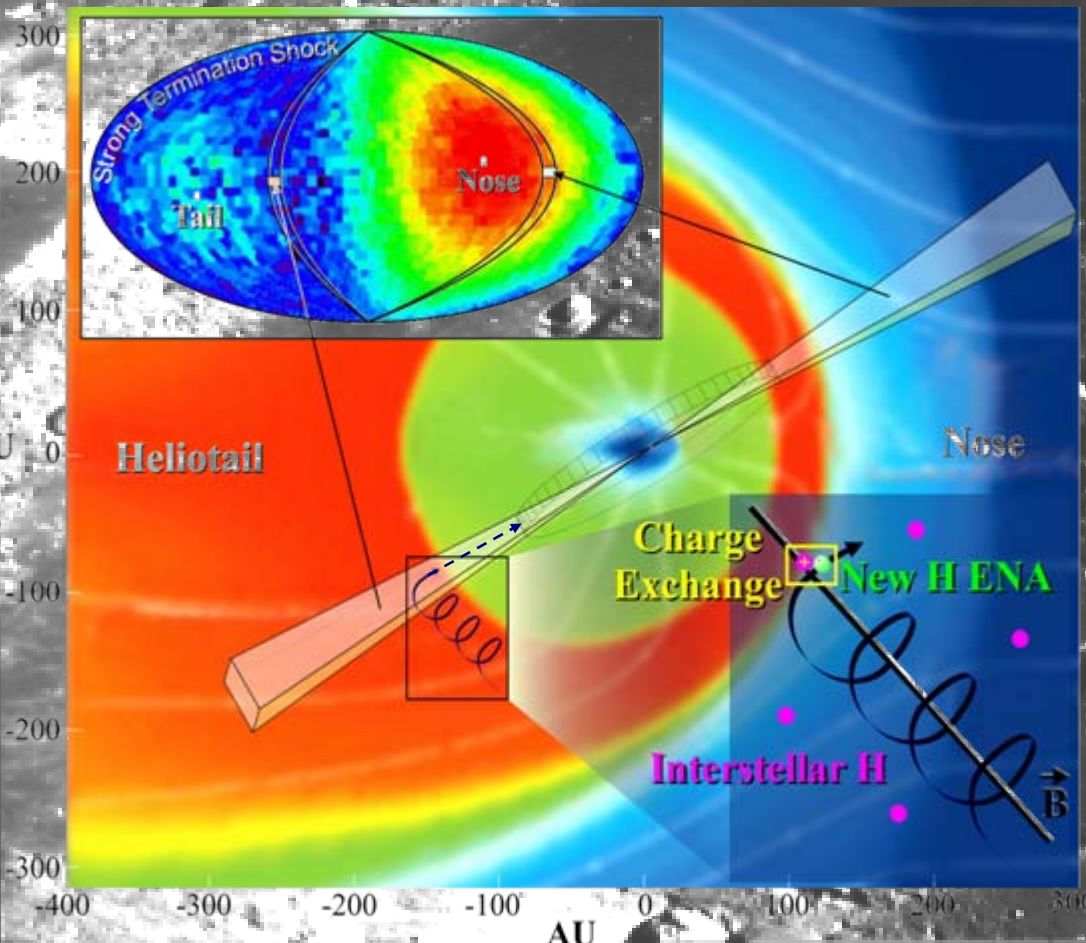
Energy range: eV – few KeV, distribution functions depend on the source

What do we know: LISM He parameters (from Ulisses), several Aspera instruments, IBEX mission (in preparation) to measure heliosheath population

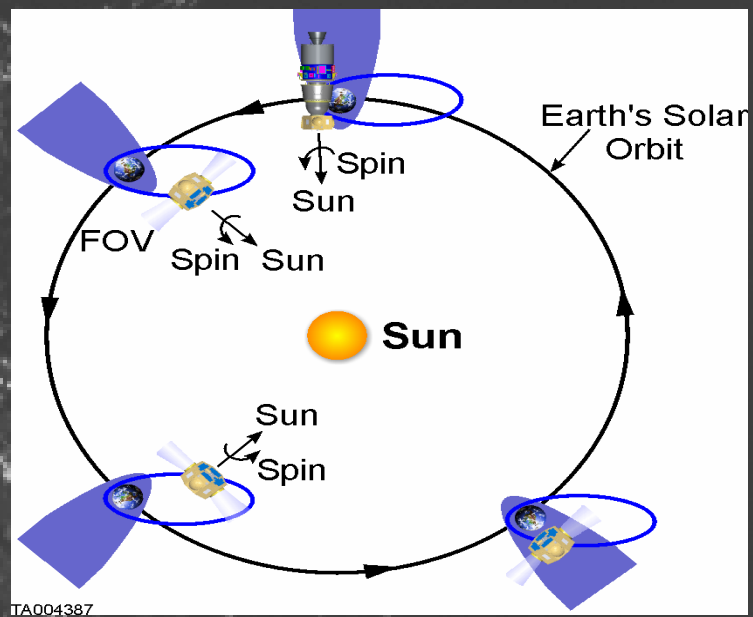
IBEX – NASA mission

Imaging of the Heliosphere

- Launch: 2007
- Small class, short term mission (2 years)
- 2 instruments, no energy resolution



Nominal orbit – 37 Re



Instrument on the Moon

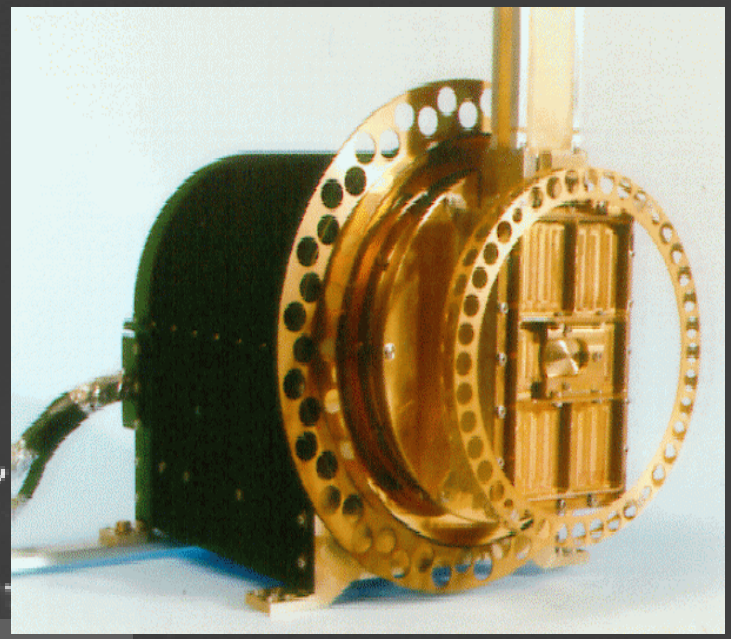
- Advantages:

  - long-term diagnostics: full coverage of the solar cycle
  - energy/mass resolution in a large energy window
  - possible large aperture and detector area

- Objectives:

  - to determine elemental composition of LISM's and heliospheric ENAs
  - to obtain characteristics of the distribution functions of ENAs
  - to employ neutrals for monitoring magnetospheric tail plasma

Experience



- **NeutralGAS on Ulysses** (PI: M. Witte – MPAe, M. Banaszkiewicz – data interpretation)
- **GAS on Relikt2** (not launched) – 2 instruments (M. Hlond, M. Banaszkiewicz)
- **IBEX** – M. Bzowski (SRC) is a Polish co-I
- 30 years of experience in modeling neutral populations in the solar system (prof. S. Grzedzielski and his group)

Thank You !