1. EXPERIMENTS ON THE SATELLITES.

1.1. SLOVAK SPACE MISSION TO STATION MIR

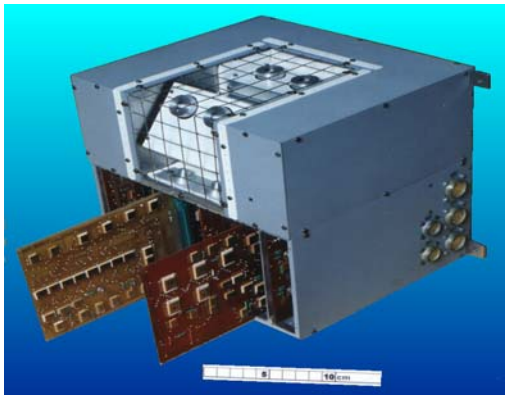
On February 20-28.1999 a short-term space flight of the first Slovak Astronaut Ivan Bella was realized during the Russian - French - Slovak mission. The program of Slovak space mission was named M.R.Stefanik- the outstanding Slovak scientist in astronomy, political person and French general (1880-1919). The first Slovak astronaut performed research program prepared by the Institutes of the Slovak Academy of Sciences. On the station MIR four experimental projects were realized: Dozimetria (in space physics [1]), Endotest and Senso-asymetria (in space medicine) and Quail (in space biology).

1. Just, L., and K. Kudela, Cosmic Rays and possibilities of the experiments on Orbital Station (in slovak), Proc. 13th Conference of Slovak and Czech Physicists, Zvolen, Technical University, ed. M. Reiffers and L. Just, August 1999, p. 10-15

1.2. INTERBALL.

During the period 1997-1999 four energetic particle instruments, namely DOK2X, DOKSX, DOK2A and DOKSA were providing the data on fluxes, energy spectra and angular distribution of medium energy electrons and ions (energy range ~20 – 600 keV) onboard Interball satellites (Tail probe with 200.000 km apogee launched on August 3, 1995 and working at least until February 2000; its subsatellite Magion 4; the Auroral probe with the apogee 20.000 km launched on August 29, 1996; its subsatellite Magion 5). The energetic particle instruments have been designed, tested and constructed at the Institute of Experimental Physics, Slovak Academy of Sciences, Košice (IEP SAS Košice), in the cooperation with the institutes in Russia and Greece. Two of the instruments are seen in Fig.6 and Fig.7. Results obtained until now are listed in part 2.

Fig.6. Apparatus DOK2 for the measuremets of medium energy electrons and ions, developed



at the IEP SAS Košice, in the collaboration with laboratories in Russia and Greece providing more than 4 years of measurements on Interball-1 satellite.

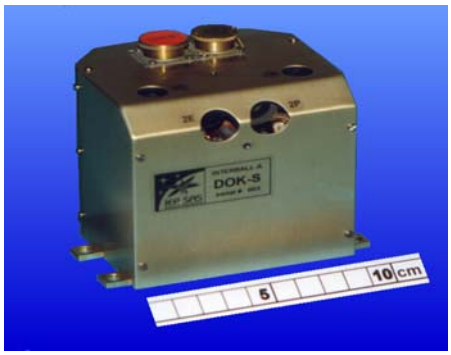


Fig.7. The detector block of DOKS, the simplified version of DOK2, for medium energy particle measurements at Magion 5 developed at IEP SAS Košice with the Technical University of Košice.

2. SPACE PHYSICS, GEOPHYSICS AND ASTRONOMY.

The institutes of the Slovak Republic are continuing the space research activities in the directions of space solar physics and X-ray astronomy, interplanetary matter and explorations of the comets, solar wind and its interactions with the Earth's magnetosphere, energetic particles in the magnetosphere and in interplanetary space, atmosphere and ionosphere of the Earth. The following short survey presents selected activities of the abovementioned directions and the obtained results.

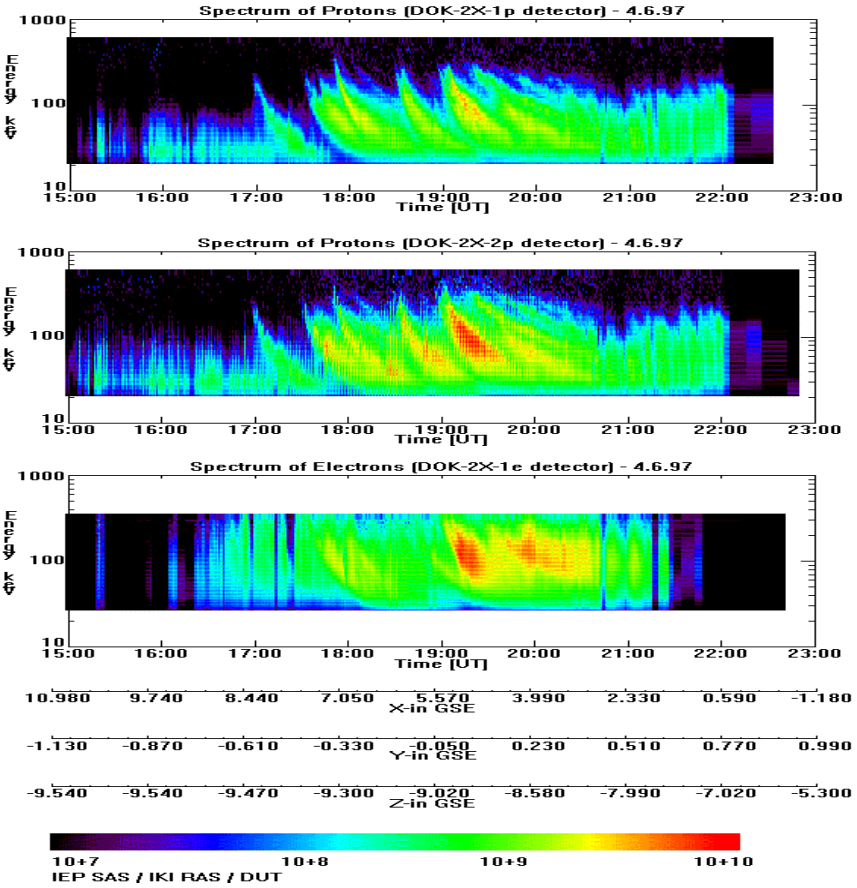
Populations of particles with the energies well below those of cosmic rays and well above those of solar wind (from few tens of keV up to several MeV) have been studied in the ***Institute of Experimenatal Physics, SAS, Košice*** in the cooperation with the laboratories in abroad. The analysis of the obtained data both from the low altitude and high apogee satellites, as well as development and construction of new instruments for the future studies have been carried out during 1997-1999. The measurements with DOK2/DOKS instruments on Interball 1 and 2, as well as on Magion-4 and 5 instruments provided large amount of data on energy spectra and angular distribution of energetic particles in the outer magnetosphere, in the geomagnetic tail, within the magnetosheath and in the region upstream of the bow shock. This required large effort in data processing and archiving . The data processing contains the separation of the frame modes (time profiles and energy spectra of electrons and protons), merging the particle flux data with the time, satellite position, IMF vector, geometry

of connection to the bow shock (in the region upstream from the bow shock), orientation and pitch angles of single detectors. These works are in still in progress. For reviewing the data as well as for the multi-instrument and multi-satellite studies the review pictures are constructed. The comparison of two point measurements of energetic particles in wide energy range (Interball 1 and Magion 4) have confirmed the result found earlier in data from Prognoz-10 [1]. The statistical studies of the ion and electron flux within the magnetosheath based on Prognoz-10 and Interball 1 measurements have indicated that energy spectra of the particles close to the magnetopause are harder than those deep in that region and the strong dependence of ion flux (28 keV) in the upstream region on the angle between the magnetic field vector and normal to the bow shock at connection point exists [2,3]. The streaming of ions dawnward and duskward close to the magnetopause is not showing any clear pattern in (ZY) GSE plane. This is consistent with suggestion of patchy structure of merging at the magnetopause and with the leakage of magnetospheric particles to magnetosheath. Possible use of DOK2 measurements for the upper limit estimate of quiet time particle fluxes in the heliosphere was examined [4]. High energy resolution (56 energy channels) of DOK2 instruments enabled to find the unusually narrow, almost monoenergetic ions within the magnetosheath and in the upstream region [5]. These measurements give also the possibility

of investigating the velocity dispersive effects (one example is in Fig.8). Another results with using the DOK2 and/or DOKS energetic particle data can be found in [6-12,54-55].

Fig.8. Multiple dispersive events observed by DOK2X on the Tail probe of Interball in the outer magnetosphere. The ion detecors are oriented in the antisolar direction (1p) and at angle 62 with respect to solar direction. The different types of dispersions are seen also on electrons. The values plotted are the fluxes (in #/(cm^2.ster.s.keV)) multiplied by E^3 , where E is the kinetic energy in keV.

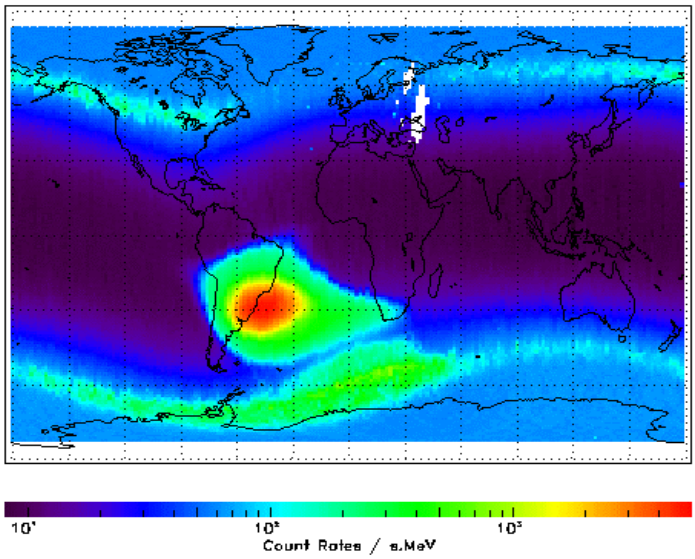
Low altitude measurements with use of SPE1 instrument onboard the Active (Intercosmos - 24) satellite have shown strong, short duration (few tenths of second) pulsations of electrons (> 20 keV) precipitating to the atmosphere. The patterns of these pulsations in subauroral and auroral regions have been described in [13-15]. Both pitch angle and energy diffusion is deduced from them. The pulsations are found in the regions with enhanced intensity of VLF emissions having also spiky character. SPE1 data are also used in the comparative study [16].



The detailed map of distribution of low energy gamma ray flux (energy range 0.12 – 8.3 MeV) at the altitude 500 km according to the measurements of the instrument SONG on CORONAS-I was constructed [17-19]. Another results based on SONG measurements are published in [42-44,53].

For the low altitude satellite COMPASS (checking the eventual precursors of the earthquake activity in magnetospheric data at low altitudes) the monitor of energetic particles MEP-1 [20] using the silicon detectors and highly flexible system of data recording has been developed in the international collaboration. The programmable particle spectrometer MEP-1 [21,22] was prepared for this satellite. The flight model of the MEP-1 is ready for the launch. The device is now under reconstruction for the MIR and ISS (Russian segment) purposes.

Fig.9. Map of gamma ray 3.0-8.3 MeV count rate by SONG instrument (IEP SAS in collaboration with Moscow University) on CORONAS I at altitude 500 km [17].



Also, the studies of cosmic rays were continuing in IEP SAS. The correlation dimensions of cosmic ray time series have been examined in [23,24]. Fractal properties of the time series were examined in [25]. Eventual possibilities of using cosmic ray variability as one of the parameters of prediction of Dst have been examined together with artificial neural network and fuzzy neural network schemes for the prediction [26-30,45,46]. Short term cosmic ray pulsations are analyzed in [31] and transparency of the magnetosphere for cosmic rays in [32,33]. Studies of the relations between the cosmic ray modulation and various effects of solar activity, especially the long duration effects of solar X-rays are discussed in series of papers [34-41,47-52].

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