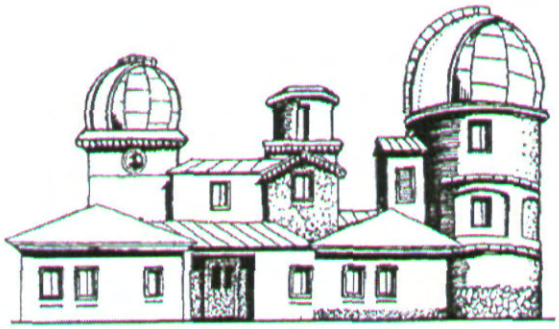
23. SLNEČNÝ SEMINÁR

Liptovský Mikuláš, 30. mája – 3. júna 2016

Slovenská ústredná hvezdáreň
v Hurbanove



Slnečná sekcia

Slovenská Astronomická Spoločnosť
pri Slovenskej akadémii vied

Slovak Central Observatory
in Hurbanovo, Slovakia

Solar Section,
Slovak Astronomical Society

23rd SOLAR PHYSICS MEETING

Liptovský Mikuláš, Slovakia, 30 May – 3 June, 2016

(http://www.karlovsky.info/sid/rtl/). Results on registration of few sample solar radiobursts are presented as casestudies.Effects of radiobursts on spaceweather are discussed as well.

Evolution of solar activity over a solar cycle – from statistics to physics

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We are investigating evolution of solar features over the solar cycle 24 using the high resolution SDO/HMI and SDO/AIA observations and using the spectroheliograms taken by the Geophysical and Astronomical Observatory in Coimbra (Portugal) in the frame of a mobility project Slovakia-Portugal. The main aim is to get more detailed knowledge on astrophysical aspects of evolution of solar features distribution on the solar disc. Two main properties of the solar activity are in focus of the project work, namely: the differential rotation of the solar activity features and their north-south asymetry. Special software tools for detection, identification and automatic tracking of various solar phenomena was already developed by the project team and it is being extended and improved in order to reach the proposed goals. These tools are tested on a sample SDO and Coimbra images to achieve besides the automatic tracking also an automatic detection and identification of features.

This research tasks are performed in the frame of a mobility project SRDA SK-PT-2015-0004 supporting cooperation between organizations in the Slovak Republic and Portugal.

Conceptual outline of charged particle monitor for ChemiX solar X-ray spectrophotometer for the *Interhelio-Probe* interplanetary mission

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Scientific equipment of long-term space missions undergoes constant cosmic radiation illumination from both: corpuscular and electromagnetic components of different energy. Cosmic particle radiation damages electronics, optics, sensors and detectors. It is therefore extremely important to prevent the failure of electronics, CCDs, semiconductor detectors, etc. at the times of passing through regions of enhanced charge particle fluxes. In particular, particle pulsations can badly affect the regular X-ray measurements by the ChemiX (Chemical composition in X-rays) instrument, which is developed for ***Interhelio-probe*** interplanetary mission. ChemiX is under construction at the Solar Physics Division of Polish Space Research Centre. In order to detect presence of these enhanced particle fluxes the Background Particle Monitor (BPM) has been developed constituting now a vital of ChemiX. The BPM measurements of particle fluxes will assist to determine periods of X-ray spectra being contaminated by enhanced particle fluxes. The BPM will also measure the energy spectra of ambient particles.

We present overall structure, design, technical and scientific characteristics of BPM, and its components. Detector head consists of three-layer detector stack placed behind conical collimator limiting the solid angle of view. First two layers consist of silicon detectors; the third one is based on the p-terphenyl scintillation crystal optically coupled with highly pixelated silicon photomultiplier. By such multilayer structure in combination with coincidence logic we are going to collect systematic data on particle sorts and their energy with 1 and/or 10 s time resolution. Digital control unit is constructed based on FPGA Actel ProAsic A3PE1500. The analogue unit is merged directly with detectors. Digital unit contains coincidence logic, forms telemetry data and housekeeping frames,

communicates with ChemiX digital processing unit and executes received telecommands. The BPM is capable to sort out *in situ* abundances of individual particle constituents from electrons up to oxygen nuclei.

Combined study of radiation belts by the satellite particle telescope STEP-F and solar soft X-ray photometer SphinX during recent deep minimum of solar activity

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We present several new features detected in the high energy particle distributions of the Earth's magnetosphere during deep minimum of solar activity. This new outcome comes as a result of joint analysis of data base derived from two instruments: the satellite telescope of electrons and protons STEP-F and from the solar photometer in X-rays SphinX. Both instruments have been flown in 2009 aboard ***CORONAS-Photon***, the low, circular and highly inclined orbit satellite. Due to orthogonal orientation of viewing axes of STEP-F and SphinX instruments we have seized an opportunity to study anisotropy of particle beams in different volumes of the near Earth space at the height of ~550 km.

The comparison of data obtained from both instruments allowed to specify that Sun-oriented soft X-ray photometer SphinX detected electrons of intermediate and subrelativistic energies and their bremsstrahlung contributing to the signal observed predominantly in the last bins of 256 channel's dynamical energy spectra. By this way SphinX extended the energy range of particle being detected by STEP-F towards lower energies.

We present peculiar characteristics of electrons at the off spurs of traditional Van Allen outer and inner radiation belts, inside the region of South Atlantic Anomaly, and outside of well known zones of enhanced particle fluxes during the weak geomagnetic storm of May 6-8, 2009. In the research presented, the lifetimes of electrons under both belts, directivity of particle fluxes, variability of energy spectra in different zones of magnetosphere, the splitting of outer radiation belt during the recovery phase of mentioned above storm and interplanetary shock of August 9, 2009 are discussed. The comparison of analyzed data obtained aboard ***CORONAS-Photon*** with particle fluxes observed at L1 Lagrange point as well as on geostationary GOES satellite data allows advancing the concept of different physical mechanisms of populating enhanced electron fluxes during the initial and recovery phases of a substorm. From this standpoint we consider electron flux pulsations during various phases of geomagnetic activity as an important constituent of space weather.

Effect of the non-equilibrium ionization by the electron beam on EUV spectra

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It is widely anticipated that the solar corona is heated by small scale and possible recurrent nanoflares. Theenergyrelease by the magnetic reconnection accelerates particles and form an electron beam. Therefore, we investigated an effect of the periodic high-energy electron beam on the synthetic EUV spectra. Initially, plasma has the Maxwellian distribution. It is supposed, thatplasma interacts with high-energy beam during the first-halfperiod and the electron distribution during this interaction can be described by a kappa-distribution. The ionization, recombination, and excitation rates for the both distributions were used to calculate the time-dependent non-equilibrium ionization state, EUV synthetic spectra and their averages over one period.Weconsiderperiods several tens of seconds corresponding to exposure times or cadences of space-borne spectrometers. It is shown that plasma is out of the ionization equilibrium for the whole timein the coronal conditions.The instantaneous spectra