STP ACTIVITIES IN SLOVAKIA 2001–2004

Research activities in the field of Solar Terrestrial Physics (STP) are mainly realized in scientific institutions of the Slovak Academy of Sciences (SAS) and the Faculty of Mathematics, Physics and Informatics of the Comenius University (CU):

Astronomical Institute of SAS (AISAS) Tatranská Lomnica
Institute of Experimental Physics of SAS (IEPSAS) Košice
Geophysical Institute of SAS (GPISAS) Bratislava

Department of Astronomy, Physics of the Earth, and Meteorology (DAPEMCU) Bratislava:
Division of Astronomy and Astrophysics (DAA), Division of Physics of the Earth (DPE)
Department of Nuclear Physics (DNPCU)

The other representatives of STP activities are:
Slovak Central Observatory – Solar Section (SCOSS) Hurbanovo
Slovak Hydrometeorological Institute (SHMI) Bratislava.

The observational activities and scientific results in 2001–2004 are summarized below.

Ground-Based Observations

Standard solar and geomagnetic observations (see e.g. STP Newsletter and International SCOSTEP Newsletter, v. 5, No 1, March 2002, p. 62) are carried out on a regular basis.

° Regular observations of the intensity of the green coronal line as well as H alpha prominences using the solar coronagraphs at the Lomnicky Peak Observatory and drawings of the sunspots at the Stara Lesna Observatory and at Hurbanovo – AISAS, SCOSS.

° The preparation of an extended data set of the daily hemispheric sunspot numbers for the epoch 1945-2004 based on the sunspot drawings performed at two solar observatories: Skalnate Pleso observatory (AISAS) and the Kanzelhoehe Solar Observatory (IGAM, Graz, Austria) – AISAS.

° Since 2000 the Hα telescope at Astronomical and Geophysical Observatory (DAA) in Modra-Piesok is in operation. The observations are not continuous yet. The primary interest is turned to solar flares, filament eruptions and development of active regions. For the observations refractor with f=3040 mm and 8 cm aperture is used. The telescope is equipped with the red pre-filter centered at 6564 Å with FWHM ~ 10 Å and Hα filter centered at 6563 Å with FWHM ~ 1.5 Å and CCD camera. Spatial resolution in Hα~ 2 arc sec and the field of view is 6 arc min × 4 arc min. The observations are recorded on video tapes and then digitalized – DAA.

° The CR intensity is monitored by means of 8-NM-64 (1.7×10^6 counts per hour cutoff rigidity ~4GV) at Lomnicky Peak (2634 m altitude). The continuous "in situ" checking of measurements, barometric pressure correction, upgrading of electronics are routinely done. High resolution data in real time are accessible at http://neutronmonitor.ta3.sk**.** Since October 2000 the testing of the real time access to NM 1 min data runs *(http://neutronmonitor.ta3.sk)* in order to check the relationship between fast increases of dangerous energetic particle fluxes and the GLE onsets which can be used for the forecasting service for industry and satellite operation needs – IEPSAS.

° Data on the solar corona were collected within solar eclipse observations: 21 June 2001 in Angola, 4 December 2002 in Republic of South Africa – SCOSS.

° The Hurbanovo Geomagnetic Observatory of the GPISAS continues to supply high resolution data on X, Y, and Z geomagnetic field components to the INTERMAGNET data centres in Edinburgh and Paris. The supply is regular (no gaps) and timely – GPISAS.

° The regular monitoring of electrical SR (Schumann resonances) component is performed at Astronomical and Geophysical Observatory Modra. The spectra of electrical component (in the 5 – 40 Hz frequency range) are computed every half hour and are displayed at: http://147.175.143.11/ . The monitoring of the magnetic component is in the experimental stage (sensor optimization and realization) now – DPE.

° The geosynchronous satellite METEOSTAT data on the cloud cover over the territory of Slovakia are received and processed at the Malý Javorník Observatory (near Bratislava). Data from the MSG-1 satellite (via EUMETCAST system) are also used, which allows the processing within all the 12 channels – SHMI.

Space Experiments

A number of instruments for space experiments were developed in the IEPSAS. The measurements obtained are gradually processed:

° Due to 56 quasi-logarithmically distributed energy channels in the range ~20–600 keV the DOK instruments allow to study the dispersive events using the detailed energy spectra within the medium energies with regard to altitude, L distance, and MLT and to identify the particle injection (timing, location) during magnetic disturbances.

° Data on proton/electron fluxes in plasma and neutral sheets were gathered by the INTERBALL-tail probe (numerous magnetotail crossings during 3 months of each year within 1995-2000).

° The electronic part of the SONG M instruments to measure both the gamma rays up to 10 MeV and neutrons of more than 3 MeV was designed, constructed and tested. Based on this instruments (on board of a low altitude polar orbiting satellite CORONAS-F since July 2001) about 40 high energy gamma ray emissions were identified during 2002-2003.

° A strong shift of the outer electron radiation belt to unusually low L was reported for severe storms in October – November 2003 using the CORONAS-F data.

° Within the co-operation with STIL Maynooth, Ireland the energetic neutral atom imager NUADU was constructed and tested. This instrument on board TC-2 (launched on25 July 2004 in China) of the Double Star mission (WSA-China mission) works successfully. The development and construction of new instruments for future studies is under way.

DNPCU activities (within the frame of international co-operation) in experiments are as follows:

° The participation in the space missions NEAR, Mars Odyssey, and Mars Smart Lander.

° The participation in the preparation of future missions to Mercury and Mars.

° The simulation of expected gamma ray production and transport from the origin to the detector was performed within the frame of a number of space missions. Based on simulations the study of dependence of production rates of gamma rays on chemical composition water content and thickness of the atmosphere for aims of interpretation of experimental data obtained in space missions is possible.

Results of scientific investigations

Solar Physics

° Comparison of the long-term variability (1943-1999) in behavior of the sunspot index and the green-line coronal brightness allowed to predict parameters of solar activity for the period of declining phase of the running 23rd solar cycle and further until maximum of the coming 24th cycle (envisaged to occur in 2010-2011). At the same time, prediction of an enough deep secular minimum of solar activity (similar to that at the beginning of the 19th century) during the 24th 11-year solar cycle seems to be the most interesting for the future properties of „space weather" – AISAS.

° A close relation of the observed global shape of the solar corona and of its structures (coronal holes, condensations and streamers) with the topology of the coronal magnetic field lines of force and the field strength is demonstrated, once more indicating a dominant role of the magnetic field in the active processes on the Sun – AISAS.

° Different aspects of the large-scale brightness distribution in the coronal emission Fe XIV 530.3 nm spectral line are presented and intensity evolution in this line during five 11-year solar activity cycles is demonstrated. Relevance of the solar middle-latitude zones for the strength of solar activity and the degree of its variability is underlined in comparison with the polar regions and equatorial zone of the Sun – AISAS.

° Analysis of the space-time distributions and mutual correlations of the north-south (N-S) asymmetry in various solar activity indices has shown that the N-S asymmetry variations both at short and long time scales are consonant in all the activity indices under consideration. Quasi-biennial variations of the N-S asymmetry index were revealed and examined.
A conclusion is drawn that the N-S asymmetry represents a specific, independent and perspective tool for investigation of the solar activity variations – AISAS.

° A simple exponential relation of type $I \propto B^q$ was found to exist between the coronal green-line intensity I and the magnetic field strength B. As shown the q exponent may have opposite sign in the equatorial and the polar zones of the Sun. During maxima of the solar cycles the I versus B relation is much more complicated and cannot be expressed by such a simple formula – AISAS.

° Homogenous data of the green coronal 530.3 nm line intensity was updated for the period 1999 - 2003, and the coronal index of solar activity was derived for this period. The green coronal intensity in cycle 23 is about one third lower with the comparison of the green corona intensity in cycle 22, and this green corona intensity decrease is in agreement with the solar magnetic field intensity. The green corona maximum occurred in 2001, and coincided with the 2800 MHz solar radio flux, both 2 years shifted of sunspot number that occurred in 1999 – AISAS.

° Observations of ten solar eclipses (1973-1999) enabled us to describe mutual relations between the white-light corona structures and the coronal magnetic field strength and topology. The found correspondence strongly suggests a governing role of the field in the evolution of all the coronal features. Therefore, the white-light corona structures as observed over a long period of time can provide valuable information about the physical properties and cyclic variations of the Sun's magnetic field in the epoch long before introducing the direct photospheric magnetic field measurements – AISAS.

° Analysis of the time-latitudinal distribution of the green corona (530.3 nm) local intensity maxima in the period 1939-2002 shows a regularly poleward migration that begins in mid-latitudes at cycle minima, and reaches solar poles around cycle maxima. Separation of the poleward migration branches (the north and south) has its stable time, and using this relation we forecasted forthcoming minima and maxima of solar cycles to 2050 – AISAS.

° Study of temporal variability of the solar flare index over the epoch of almost 4 solar cycles revealed significant variability of the intermediate periods on the northern as well as on the southern solar hemisphere. Utilization of the wavelet transform allowed to determine which periods are just harmonics of the real periods of the flare index – AISAS.

° By comparing both the limb green-line intensities and photospheric magnetograms we found a relation between the strength of magnetic field and coronal intensities. Behavior for the green corona intensities is different between high-latitude and mid-latitude regions, and this break occurs at the heliographic latitude of 45 deg. This relation enables us to extend the values of solar surface magnetic fields since 1976 back to 1939. From 1947 to 1992 the total magnetic flux at cycle maxima grew by a factor of 1.5-2 – AISAS.

° A temporal variability of the coronal index of the green coronal line for the epoch of almost 5 solar cycles was determined for all periods including 150 days, 1 year and 28 days in relation with the phase of the solar cycles. Enhancement of the period of 150 days was dominant before and after the maximum of the solar cycle during 4 out of 5 solar cycles under study. On the other hand, no such period was found during the maxima of solar activity. Significant variations of the periodicities around the rotational period up to 5 days were found to take place over short temporal intervals – AISAS.

° Utilization of the GOES (NASA) long-term observations of the solar flare X-ray flux in order to derive the periodicities of the solar flaring activity separately on the hemispheres as like as on the Sun-as-a-star – AISAS.

° The excitation equilibrium of Fe XXV for the electron power distribution was determined. The diagnostics of the shape of the distribution function from intensities of Fe XXV lines was suggested. The results can be used especially in diagnostics of the impulsive phase of solar flares, where the deviations from the Maxwellian distribution can be large – DAA.

° The ionization equilibrium of Fe for the electron kappa-distribution and new atomic data was determined. The diagnostics of the electron kappa-distribution from ionic stage of Fe was proposed, which can be preferably used in the analysis of the ion composition of the solar wind – DAA.

° The excitation equilibrium of Fe, C and O for the electron kappa-distribution was analyzed. The synthetic spectra at 500-2000 Å of Fe, C and O for different parameters of kappa-distribution were computed. The possibility of determination of the electron distribution shape was discussed. It was shown that some of C III, O IV and especially C IV line intensities are very sensitive to the shape of the distribution function. These lines can be enhanced by a factor 2-6 for a strongly non-thermal distribution. – DAA.

° The loop structures of the July 19, 1999 flare were analyzed by comparison the SOHO/EIT 195 Å and Hα images with the magnetic field extrapolations of MDI/SOHO magnetograms. A new combined extrapolation technique which includes localized electric currents was used to model the current-carrying flux rope; the extended helical structure was found and the pitch angle of the helical thread was determined – DAA.

° The analysis of the expanding flare loops of C8.5/1F April 2, 2001 flare in EUV and Hα has shown that besides magnetic processes (reconnection with $\beta << 1$) the other processes with $\beta \sim 1$ can be also at work in the flare process. A possible role of the "ballooning" instability in destabilizing the loop has been discussed – DAA.

° The relationship between subphotospheric flows and flaring activity has been investigated. The strong subphotospheric flows were found close to the places where active quasi-separatrices are located and where the magnetic field lines change their connectivity during the flare event – DAA.

° It is known that 3-min oscillations in sunspots appear in spectral lines covering a vast temperature range from the low chromosphere to coronal temperatures. It was investigated how non-thermal distribution affects the emission measure distribution and contribution function in sunspot plume. It has been shown that coronal lines normally formed just below 1×10^6 K are shifted to lower temperatures – DAA.

° The SUMER observations of EUV bi-directional jets were studied. The phenomenon was observed in chromospheric S III 1251.16 Å and C I 1251.17 Å, transition region N V 1238.8 Å but there was no detectable signature in the coronal line Mg X 625 Å. However, TRACE imager with the 171 Å filter detected the phenomenon clearly. The discrepancy was explained using a non-Maxwellian electron distribution. This could also have implications for other phenomena observed in the TRACE pass-bands, including the transition region `moss' and the 3- and 5-min oscillations – DAA.

° The flare accompanied with a surge was analyzed in EUV, Hα, radio and HXR. The observed structure of the flaring active region and its topology was compared with the potential magnetic field model. The start of the surge was accompanied with HXR pulses, type III radio bursts, several slowly negatively drifting features and with huge EUV brightening close to the position where quasi-separatrix layer cuts the photosphere. The magnetic reconnection as a driving mechanism for this surge was discussed – DAA.

° Assuming the presence of non-thermal (power) distribution of electrons during the impulsive phase of a flare, the theoretical line synthetic spectra (X-ray) for Fe XXV were calculated. The series of models were computed for the observed temporal evolution of plasma temperature, density and with the assumption of different temporal evolution of the shape of the distribution function. The results confirmed that under the strongly non-thermal distribution of electrons the ratio of satellite lines to allowed lines increases – DAA.

° Computation of the excitation equilibrium of Fe IX – Fe XV for non-thermal (power) electron distribution shows that at given temperature and electron density the excitation rates increase significantly with the deviation of the distribution function from the Maxwellian one while the deexcitation rates are not influenced so much. As a result, the population of higher levels increases and the emisivities of lines belonging to the transitions starting from these levels also increase. The synthetic spectrum at 180-300 Å was computed for different power distributions, temperatures and electron densities. Some lines strongly sensitive to the distribution shape and useful in plasma diagnostics have been found – DAA.

Energetic particles dynamics and near-Earth plasma

In the IEPSAS numerous studies were carried out to investigate plasma dynamics.

° According to the statistical study of a number of upstream ion events, the diffusive upstream events observed near the bow shock reveal a much higher probability of observing high flux of protons for quasi-parallel connections to the model bow shock than for the cases with quasi-perpendicular geometry, which is in accordance with the Fermi acceleration at the shock.

° This dependence is apparent for low energy ions (~20 – 30 keV) and becomes less pronounced with the increasing energy; however, the dependence on geomagnetic activity increases with the ion energy.

° The relative importance of sources of up stream ions, namely from the solar wind and the leaking particles from the magnetosphere was followed up to 300eV.

° The strong changes of the ion flux anisotropy were revealed near the reconnection point in the central magnetotail region during a small substorm.

° The fast change of energy spectra was revealed in the neutral sheet.

° Based on the plasma flow variation analysis a dependence of the level of ion/proton fluxes on the IMF orientation was described.

° The motion of the magnetopause due to the IMF variations was described using the DOK-2 data (available for the interval of August 1995-October 2000).

° The comparison of Interball and POLAR data indicates that ions are accelerated at the quasi-parallel bow shock to energies as high as 1 MeV and subsequently transported into the

magnetosheath during that event on 4 May 1998.

° The correlation between the dispersion structure of ion/electron energy spectra and Pc5 activity in the auroral region was reported.

° The ion anisotropy and energy spectra during a small substorm on 3 December 1996 were studied for the Interball crossing of the central plasma sheet region (tailward and earthward flows from the reconnection point).

° The Interbal-2 and Magion 4 data were interpreted in terms of wave-particle interaction in the polar cusp region.

° Using plasma data (SOHO, ACE, WIND, Interball) traveling shocks were analyzed with regard to numerical models

° The altitude distribution of electron fluxes at low L (≥ 1.15 and 1.2 - 1.9, respectively) was determined using measurements from Active satellite (1989-1991) and from the MIR station (1999).

° The interconnection between gamma ray fluxes (SONG and GORONAS-I data) and radiation belt electrons was revealed, which can be used to update the existing trapped population models.

° Using the SAMPEX and CORONAS-I data the correlation between energetic gamma ray fluxes and relativistic electrons in the drift loss cone was reported.

° The coordinated magnetic field and energetic particles measurements during the 30 July 1999 substorm were analyzed.

° Two types of plasma wave emissions (ELD magnetic and broad band electrostatic noise) within the cusp region was reported using Cluster 3 data for cusp crossing. These emissions seem to be a proper proxy for identification of cusp crossings.

CR variability and cosmogenic nuclides

° Long time series of daily values of the cosmic rays intensity, acquired by the neutron monitors of different rigidity (Calgary, Climax, Lomnicky Peak and Huancayo/Haleakala) were analyzed using the wavelets in the interval of periods between 60 and 1000 days. While 1.7 years period, which was the most pronounced in the temporal interval under study, strongly affects the profile of the cosmic rays intensity in the cycle 21 (especially in year 1982), 1.3 years period was significant mostly on the descending phases of cycles 20 and 22. The results support differences between solar activity in odd an even solar cycles – AISAS, IEPSAS.

° The utilization of CR ground-based measurements for the space weather studies was reported – IEPSAS.

° A code to reconstruct the CR trajectory in the Earth's magnetosphere was developed. The effects of local time, geomagnetic activity level were taken into account. The computation of asymptotic direction for charged particle access to the neutron monitors was carried out – IEPSAS.

° The latitudinal anisotropy of the primary CR flux was deduced from the comparison of SONG and ground-based neutron monitor data – IEPSAS.

° The method of the magnetospheric transmission function was shown to be applicable to disentangle the contribution of primary protons to the measured spectra and to recover CR spectra outside the magnetosphere – IEPSAS.

° Comparison of data on gamma ray fluxes obtained from the NEAR mission and those simulated was carried out. The analysis of NEAR data and their comparison with our simulations showed that most of the meteorites have their origin from the bodies like the asteroid 433 Eros studied – DNPCU.

° Simulations of cosmic ray interactions with the Martian surface and simulations of production of secondary particles in these interactions were carried out. Using the simulated fluxes and experimental or evaluated cross sections, the fluxes of gamma rays over the Martian surface were calculated – DNPCU.

° Combined gamma-neutron spectroscopy leads to the unique determination of hydrogen presence at Mars – DNPCU.

° The study of cosmogenic nuclide production in extraterrestrial objects, in the Earth's atmosphere, on Earth's surface and also on some space objects was realized within the 2001-2004 period –DNPCU.

° Within the frame of international co-operation the study on neutron and gamma ray production from the surface of Mars and determination of water presence on or near the Martian surface was continued – DNPCU.

° Production of cosmogenic nuclides in various meteorites was studied and interpreted from the point of view of their exposure history, geometry of irradiation. Meteorites Monahans, Gold Basin, Cingnetti, Campo del Cielo and others were studied – DNPCU.

° Production of rare gases was studied in detail in meteorites and lunar samples. As a result, the 22Ne/21Ne ratio, most frequently used as an indicator of the shielding depth, was corrected – DNPCU.

° Cosmic radiation and cosmogenic nuclides were used for the study of climate variations in the past. The existence and character of De Vries cycle (205 years) was confirmed in the ice core samples. The possible link between the variations of the galactic cosmic ray flux and climate variability was also investigated – DNPCU.

Research of the Magnetosphere-Ionosphere-Atmosphere System

° The underlying nonlinear complexity of dynamical processes in the Earth's magnetosphere and its multi-scale characteristics were treated by means of fractal concepts using ground-based data sets. It was shown that global singularity spectra estimations of the single observatory measure (e.g. geomagnetic H component) and multi-observatory measure (e.g. AE index) data sets on different scales allows to separate fluctuations due to the solar wind influence and those of the magnetospheric origin – GPISAS.

° A wavelet approach used for geomagnetic diagnosis of magnetospheric processes has proved to be efficient in understanding the basic nature of turbulent fluctuations partially driven by the solar wind. The identification of intermittent events using wavelet based filtering methods for geomagnetic time series, allowed to interpret the nonlinear multi-scale magnetic fluctuations in terms of turbulence and complexity-theory concepts – GPISAS.

° The multifractal approach valid for nonlinear description of high-frequency singular fluctuations in the solar wind and in the Earth's magnetosphere was shown to be also proper for the more comprehensive insight into effects of the Earth's fluid core turbulence – GPISAS, SCOSS.

° Multi-scale behavior of intermittence together with multi-periodic features visible in sunspot data was analyzed using modern tools of nonlinear time series analysis. The plausible association of dynamical characteristics of solar cycle variability mentioned with turbulent processes in solar dynamo was shown. Taking into account the turbulence seems to be necessary to promote theoretical modeling and explanation of the observed solar variability – GPISAS, SCOSS.

° The high resolution data on solar wind and geomagnetic activity indices were used to study nonlinear characteristics in the development of disturbances. On the basis of the analysis of nonlinear characteristics of the magnetic field it was found, that interplanetary

disturbances having significant components of intermittent fluctuations are more geoeffective – GPISAS.

° A neural network model for the Dst index prediction was constructed with an optimized input parameter field of principal components. Exploiting artificial neural networks (ANN), a method for geomagnetic storm prediction was proposed, in which an extra information based on local scaling characteristics of magnetic fluctuations in the solar wind significantly improved the performance of a layered ANN with feedback. On the basis of omnipresent scaling the auroral activity index was also determined through a neural network architecture – GPISAS.

° Non-Gaussian properties of intermittent magnetic fluctuations in the solar wind and within the Earth's plasma sheet were intercompared using data from ACE, WIND and GEOTAIL spacecraft. It was argued that proper statistical studies on solar wind-magnetosphere interaction processes have to include intermittency parameters from all key regions of the complex system. This approach led to the analysis of nonlinear characteristics of the magnetic field and it was found, that interplanetary disturbances having significant components of intermittent fluctuations are more geoeffective – GPISAS.

° Using wavelet and structure function analysis it was found that higher-order statistical properties of geomagnetic fluctuations agree well with the predictions of the shell-models of turbulence. Shell-models belong to the class of deterministic models which still allows taking into account the complex behaviour in nonlinear systems and hence appears to be perspective in predicting of the space weather – GPISAS.

° On the basis of international cooperation the variable magnetospheric magnetic field was modelled using the paraboloid model with independent input parameters – GPISAS.

° Analyzing the magnetic storm development the significant contribution of the magnetotail current magnetic field to Dst variation was reported – GPISAS.

° Based on the analysis of the intense magnetic storm on 24–26 September 1998 the essential change of the magnetospheric geometry was reported in co-operation with IZMIRAN. The shift of the magnetotail current sheet to deep L shells (L~3.3–4.0) enhances the magnetic field effect of the tail current in the Dst variation during the storm main phase – GPI SAS.

° Two fast solar ejecta as sources of weaker and intense magnetic storms on 2–7 May 1998 were studied within the international team activity. The solar plasma parameters were used as input data to model these storms. The accuracy of modeling is higher if the internally generated current systems are considered as an integral part of solar wind-magnetosphere interaction – GPISAS.

° Response of the mesosphere and the lower ionosphere to solar energetic particles was studied. As to changes of neutral components after the SPE, the increase of OH is concentrated at 70-80 km and lasts about 2 weeks. The increase of the NO peaks at 60-70 km but lasts longer. The main maximum of ozone destruction located at 70-80 km, is caused by OH production. The SPE-induced increase of NO density can be reason of the substantial increase of the daytime radio wave absorption in central Europe – DPE.

° The electron density in relation to the SPE was studied. Its increase by about 3-orders of magnitude just after the SPE onset during day/night time was reported. Shortly after the SPE, the daytime electron densities are by 200% higher than those of night time due to the different influence of negative ions. At 80-90 km this day-to-night difference vanishes on day 2, i.e. on the most disturbed day. Modelling has proved that changes of neutral species are so great that the resulting electron density below 75 km is substantionally reduced – DPE.

° The reduction of Ne is in direct relation with the changes in ion composition. It was found that below 80 km the relative abundance of cluster ions (parameter f) is reduced for longer than two weeks after the SPE. The effective recombination parameter alpha is reduced for

about two weeks, too. Its calculated values indicate the possibility that the response depends on season – DPE.

° The difference in response of the lower ionosphere to the SPE during day and night time was reported. Model calculations also showed that after a long lasting event (such as the October 19, 1989 SPE) delays in accumulation of NO can lead to changes of dominant negative ion. CO_3 and CO_4 were found more abundant than NO_3 at nights shortly after SPE – DPE.

° The influence of the Sun on the near-Earth environment was manifested in terms of the eclipse-induced effects in the ionosphere and magnetosphere. Using the data on the GMF measurements during the total solar eclipse on 11 August 1999, it has been analytically shown that the pronounced signatures of these effects can be followed mainly in the Y component of the geomagnetic field – GPISAS.

° The possible links between variability of the space weather and long-term modulation features in climate evolution were studied. On the basis data from a number of meteorological stations the analysis of the anomaly field for temperature and total precipitation for more than 100 years was carried out. The secular and quasi-bidecadal modulation features were revealed – GPISAS.

° To analyze the SR features several measurement campaigns were performed outside the observatory area during 2004 summer. The spectra (of the SR electrical field component) are used as a raw material for Lorentzian peaks fitting and subsequent finding of dynamic behaviour of spectra. The deeper connections between such a behaviour and locations of prominent source areas (of lightning activity over Europe) were found and justified. The time variations of prominent peaks frequencies and Q-factors were also studied, especially with connection to solar particle events –DPE.

° The possible correlation between first SR modes and EEG signals from experimental subjects was studied for justification of possible synchronization between these phenomena (in the collaboration with research group from The Netherlands) – DPE.

° From the theoretical point of view, for the numerical modelling of Earth-lower ionosphere resonator the special FEM-code was developed and tested. The first computations gave the hopeful results, next efforts will be directed in this area – DPE.

° The total radiation balance of surface on the territory of Slovakia for the 1951–2000 period was calculated using data from 31 meteorological stations. The accuracy of the method used was evaluated – SHMU.

International Meetings in Slovakia

The Scientific Committee on Solar Terrestrial Physics (SCOSTEP) adopted the International Solar Cycle Studies (ISCS) program with a goal to investigate all aspects of the physics of the Sun in different layers of the solar atmosphere and various time-scales during the rising phase of Solar Cycle 23. In 2001 the ISCS steering committee accepted the invitation of the Slovak National Committee of SCOSTEP to meet at Tatranska Lomnica, Slovak Republic for the final symposium to concluding the ISCS program.

The first kick-off meeting was held at Nagoya, Japan in conjunction with 1998 COSPAR Plenary Meeting. There were approximately 40 people attending the meeting. The proceeding was published as a special issue of Advances in Space Research, 2002. The second meeting was held at Longmont, Colorado, USA. There were 125 people from 20 countries around the globe to attend. The proceedings appeared as the AGU Geophysical Monograph 141, J.M. Pap and P. Fox (Eds.), 2003.

The success of the ISCS program was unanimously emphasized by 146 participants from 34 countries. Altogether 163 contributions were presented at this Symposium (23-28 June 2003). Proceedings of the ISCS 2003 Symposium titled as *Solar Variability as an Input to the*

Earth's Environment (ESA SP-535, A. Wilson (Ed.), 856 pages, September 2003) is available for the scientific community. There were twenty-seven invited presentations, thirty-three oral presentations and one-hundred three posters within the frame of eight scientific sessions and a parallel session of WG1 and WG2/3 (with discussion of both the current achievements and future plans.
The aim of a special Session was to discuss details of the future large SCOSTEP program „Climate and Weather of the Sun-Earth System" (CAWSES). This program (2004-2008) is now approved and provides a scientific impetus for the worldwide SCOSTEP community.

Future activities
To be in line with efforts of the solar terrestrial community all over the world our future activities are going to be concentrated on the goals of the Space weather studies and CAWSES program, especially within the frame of the International Heliophysical Year (IHY). Julius Sýkora (Astronomical Institute of Slovak Academy of Sciences, 05960 Tatranska Lomnica, Slovak Republic, e-mail: sykora@ta3.sk) was appointed by the SNC SCOSTEP as a National Co-ordinator within the IHY activities.

Web site addresses:

AISAS	htpp://www.ta3.sk
IEPSAS	http://www.saske.sk
GPISAS	http://gpi.savba.sk
SHMU	http://www.shmu.sk
FMPH (DAA, DPE, DNPCU)	www.fmph.uniba.sk
SCOSS	http://www.suh.sk

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