International Council of Scientific Unions
Scientific Committee on Solar-Terrestrial Physics
(SCOSTEP)

1998 – International Solar Cycle Studies – 2002

ISCS Symposium 2003

SOLAR VARIABILITY AS AN INPUT TO THE EARTH'S ENVIRONMENT

SYMPOSIUM PROGRAM AND ABSTRACTS

June 23-28, 2003
Congress Centre Academia, Tatranská Lomnica
Slovak Republic

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Introduction

The worldwide community of solar and solar-terrestrial physicists met here in Tatranska Lomnica to discuss and summarize results of the exciting "International Solar Cycle Studies" project, operated under auspices of SCOSTEP during 1998-2002. The project was concerned about the variations of the solar energy flux (both electromagnetic and particles), solar magnetic fields, coronal mass ejections and the effects of solar variability on the Earth's climate system and space environment. A special attention at this Symposium will be paid to understanding of regularities in variations of the discrete and global energy fluxes. Modelling efforts and explanations of the observed changes in these fluxes are expected considering a decisive role of magnetic field in the processes.

The Scientific Organizing Committee and Conveners performed an excellent job by gathering more then 25 distinguished invited speakers who guarantee high quality of the reviews and interpretations of the partial topics of the ISCS project. The remaining number of more than 150 your oral and poster contributions equally demonstrates that the original goals of the project should be achieved. Understandably, discussing the ISCS results, some unexpected and new questions may appear requesting next investigation. These could be incorporated into the coming new project which was approved by ICSU for the SCOSTEP community, and namely CAWSES 2004-2008. Definitive framework an logistics of "Climate And Weather of the Sun-Earth System" project is intended to be discussed to the end of this Symposium.

We are proud to hold the Symposium on the solar cycle studies on occasion of the 60th anniversary of our Skalnate Pleso Observatory, situated just four kilometres from here in the mountains. On September 19, 1943 when the first regular drawing of sunspots was performed there is considered to be the foundation day of this Observatory. Another our Observatory at Mount Lomnicky Stit (2632 m a.s.l.) dealing with coronal emission lines measurements and cosmic ray detection celebrates 40th anniversary. And even more, the Slovak Academy of Sciences alone was founded fifty years ago just in these June days. Fortunately and understandably, the ISCS 2003 Symposium belongs to the highlights among the commemorative events.

This volume contains the program, abstracts of all the contributions and other useful information. The abstracts are arranged according to the individual sessions. Within the sessions the oral talks and posters are separated. While the abstracts of the oral presentations are ordered following the actual program of the Symposium (not grouping particularly the invited and oral talks), then the abstracts of posters are arranged in the alphabetical order. The author index at the end of booklet will help you to look for any abstract easily. Please note that the Sessions IV and VI were switched in the Schedule on request of the conveners.

The main sponsors of the Symposium are listed on the title sheet of this booklet. Without their help the program and scientific level of the Symposium would be undoubtedly reduced and some of accompanying enjoyments would absent. LOC feels obliged to express sincere thanks to the sponsors also on behalf of more than sixty participants who are granted in different ways to help them to attend this Symposium.

Members of the Local Organizing Committee welcome you all warmly, wish you a pleasant experience here accompanied by a rich scientific benefit acquired.

Július Sýkora
(on behalf of LOC)

Symposium Schedule

Day	Morning (08:30-12:30)	Afternoon (14:00-18:00)	Evening (19:30-)
Monday, June 23	Registration (No ISCS Session)	Registration Session X: JOSO Meeting - New Instruments/Missions/Eclipse Results, JOSO Business Meeting Convener: A.Hanslmeier	Welcome Buffet
Tuesday June 24	Session I: Magnetic Field Variations through Cycle 23 Conveners: J.Pap, C.Fröhlich	Session II: Spectral Irradiance Variability Originating in Photosphere, Chromosphere and Corona Conveners: J.Pap, C.Fröhlich	Free
Wednesday June 25	Session III: Solar Global Changes: Atmospheric/Climate Effects of Solar Variability Conveners: J.Pap, C.Fröhlich	Outing	Picnic/Dinner
Thursday June 26	Session VI: Initiation of CMEs Convener: V. Bothmer	Session V: Comparison of CME Activity: Solar Cycle Maximum and Minimum Convener: S. Plunkett	Poster Session (Refreshment)
Friday June 27	Session IV: ISCS Working Groups - Parallel Discussions Conveners: J.Pap, D.Webb, G.Simnett	Session VII: CMEs, ICMEs and Space Weather Convener: D.Webb	Folk Music/ Dances Closing Dinner
Saturday June 28	Session VIII: Interplanetary Shock Waves and Solar Energetic Particles Convener: G.Simnett Session IX: Future Activities Conveners: S.T.Wu, B.Schmieder	Departure	

Symposium Programme

SUNDAY, June 22, 2003

14:00 -19:00 Registration

MONDAY, June 23, 2003

08:30 - 19:30 Registration

SESSION X: JOSO – JOINT ORGANISATION FOR SOLAR OBSERVATIONS
New Instruments/Missions/Eclipse Results and Business Meeting
Convener: Arnold HANSLMEIER

14:00 - 14:20 Györi, L., Baranyi, T., Mezö, G., **Ludmány, A.**:
Current Status of Debrecen Photoheliographic Data

14:20 - 14:40 **Kotrč, P.**:
Problems of Measurement of Linear Polarization in Solar Flares

14:40 - 15:00 Kotrč, P., **Kschioneck, K.**:
From Czerny-Turner to a Multichannel Spectrograph, from Photografic to CCD Detectors

15:00 - 15:20 **Lefebvre, S.**, Rozelot, J.-P.:
An Original Contribution Inside the Whole PICARD Program: the MIRESOL Instrumentation

15:20 - 15:40 Otruba, W., Poetzi, W., **Hanslmeier, A.**:
Instrumentation Upgrade at Kanzelhöhe Solar Observatory

15:40 - 16:00 **Sylwester, J.**, Sylwester, B.
Patterns of X-ray Line Emission Variability as Observed by RESIK Bragg Spectrometer

16:00 - 16:30 Coffee break

16:30 - 18:30 JOSO Business Meeting

TUESDAY, June 24, 2003

OPENING:

08:30 – 08:45 Welcome

08:45 – 09:00 Opening talk - S.T. Wu (co-chairman of the ISCS project)

SESSION I: MAGNETIC FIELD VARIATIONS THROUGH CYCLE 23
Conveners: Judit PAP / Claus FRÖHLICH

Session Chair: C. FRÖHLICH

09:00 - 09:30 **A. Kosovichev**:
Global Properties (What Helioseismology Teaches Us about the Sun?) (invited)

09:30 - 10:00 **P. McIntosh**:
Patterns and Dynamics of Solar Magnetic Fields and HeI Coronal Holes in Cycle 23 (invited)

10:00 - 10:15 **E.V. Ivanov**, V.N. Obridko, B.D. Shelting:
The role of the Meridional Circulation in Generation of the 22-year Solar Cycle

10:15 - 10:45 Coffee break

Session Chair: M. DeLAND

10:45 - 11:15 **V. Bumba**:
Cyclic Changes of the Solar Global and Local Magnetic Fields Patterns (invited)

11:15 - 11:45 **C. Fröhlich**:
Solar Irradiance Variability (invited)

11:45 - 12:00 Lefebvre, S., **Rozelot, J.-P.**:
Influence of the Sun Radius Variability on Irradiance Modelling

12:00 - 12:30 **L. Floyd**, G. Rottman, M. DeLand, J. Pap:
11 Years of Solar UV Irradiance Measurements of UARS (invited)

12:30 - 14:00 Lunch break

SESSION II: SPECTRAL IRRADIANCE VARIABILITY ORIGINATING IN THE PHOTOSPHERE, CHROMOSPHERE AND CORONA

Conveners: Judit PAP / Claus FRÖHLICH

Session Chair: L. FLOYD

14:00 - 14:15 **J. Pap**, L. Floyd, R. Helizon:
Long-Term Variations of Total Solar and UV Irradiances

14:15 - 14:30 **M.T. DeLand** and R.P. Cebula:
NOAA-9 SBUV/2 Solar UV Data for Cycle 22

14:30 - 14:45 **M. Haberreiter**, E. Rozanov, W. Schmutz:
Variability of Solar UV radiation

14:45 - 15:15 **F. Eparvier** and T. Woods:
Solar EUV Spectral Irradiance: Measurements and Variability (invited)

15:15 - 15:45 Coffee break

Session Chair: J. Pap

15:45 - 16:15 **S. Walton**:
Modeling the TSI Using Ground-Based Observations: Recent Progress and New Questions (invited)

16:15 - 16:45 **P. Fox**:
Current Status, Outstanding Issues and Future Directions for Physics-based Solar Irradiance Variability Models (invited)

16:45 - 17:00 **S.K. Solanki**, A. Seleznyov, N.A. Krivova:
What Causes Irradiance Variations on Minutes to Days Time Scales?

17:00 - 17:15 A. Ortiz, **V. Domingo**, B. Sanahuja:
Contribution of the Small Photospheric Magnetic Elements to the Long-term Solar Irradiance Variability

17:15 - 17:30 F. Berrilli, **D. Del Moro**, S. Giordano, G. Consolini, A. Kosovichev:
Characterization of Supergranular Features via Topological Measures

17:30 - 18:00 **V.I. Makarov**, A.G. Tlatov, D.K. Callebaut:
Temperature of Solar Corona During the Last 50 Years (invited)

WEDNESDAY, JUNE 25, 2003

SESSION III: SOLAR GLOBAL CHANGES: ATMOSPHERIC/CLIMATE EFFECTS OF SOLAR VARIABILITY

Conveners: Judit PAP / Claus FRÖHLICH

Session Chair: G. THUILLIER

08:30 - 09:00 **L. Svalgaard**:
Determination of Interplanetary Magnetic Field Strength, Solar Wind Speed, and EUV Irradiance, 1890-Present (invited)

09:00 - 09:30 **I. Usoskin**:
Long-term Solar Cycle Evolution (invited)

09:30 - 10:00 **N. Krivova** and S. Solanki:
Solar Total and Spectral Irradiance: Modelling and a Possible Impact on Climate (invited)

10:00 - 10:15 Coffee break

Session Chair: P. FOX

10:15 - 10:45 **R. Muscheler** and J. Beer:
Long-term Climate Variations and Solar Effects (invited)

10:45 - 11:15 **J. F. Gonzalez-Rouco**, E. Zorita, U. Cubasch, H. v. Storch, I. Fisher-Bruns and U. Schlese:
Simulating the Climate since 1000 AD with the AOGCM ECHO-G (invited)

11:15 - 11:30 **S. Duhau**:
Global Earth Surface Temperature Changes Induced by Solar Dynamo Mean Magnetic Field Variations

11:30 - 11:45 **K. Georgieva**, B. Kirov, J. Javaraiah:
Solar Asymmetry and Sun-Earth Connections

11:45 - 12:15 **H. Schmidt** and G. Brasseur:
HAMMONIA: A New Whole Atmosphere Model to Investigate the Climate Effect of Solar Variability (invited)

12:15 - 12:30 **N. Kilifarska** and J. Haigh:
Effect of Solar Variability on Chemical Composition and Thermal Structures in Stratosphere Derived from HALOE Measurements

12:30 - 14:00 Lunch break

14:00 - 20:30 Excursions

THURSDAY, JUNE 26, 2003

SESSION VI: INITIATION OF CMEs

Convener: Volker BOTHMER

08:30 - 08:45 **D. Maricic**, B. Vrsnak, D. Rosa, B. Hrzina:
Initiation and Development of Two Coronal Mass Ejections

08:45 - 09:15 **P. Heinzel**:
EUV Filaments and their Mass Loading (invited)

09:15 - 09:30 L. Wei, P.Z. Xue, **S.T. Wu**, P. Scherrer:
Effects of Magnetic Topology on CME Kinematic Properties

09:30 - 09:45 **M. Tomczak**:
Kinematics of X-ray Ejections

09:45 - 10:00 **M. Bárta** and M. Karlický:
Radio Manifestation of Reconnection Outflow Jets

10:00 - 10:30 Coffee break

10:30 - 10:45 **A. Nindos**, J. Zhang, H. Zhang:
Patterns of photospheric evolution and the initiation and magnetic helicity of CMEs

10:45 - 11:00 **C. Foullon**:
Automated Detection and 3D Reconstruction of EUV Prominences

11:00 - 11:15 **B. Sylwester** and J. Sylwester:
Analysis of Yohkoh-observed Limb Flare Accompanying Strong CME/SEP Events

11:15 - 11:30 **D.K. Callebaut**, V.I. Makarov, A.G. Tlatov:
Relation between 'Solar Magnetic Dipole' and Filament Bands

11:30 - 11:45 **B.A. Lindblad**:
Solar Control of Meteor Radar Rates

12:30 - 14:00 Lunch break

SESSION V: COMPARISON OF CME ACTIVITY: SOLAR CYCLE MAXIMUM AND MINIMUM

Convener: Simon PLUNKETT

14:00 - 14:30 **N. Gopalswamy**:
Coronal Mass Ejections Activity during Solar Cycle 23 (invited)

14:30 - 14:45 **A.N. Zhukov**, I.S. Veselovsky, V. Bothmer, A.V. Dmitriev, F. Clette, J.-F. Hochedez, E.P. Romashets, P. Cargill:
Solar Wind Disturbances and their Sources in the EUV Solar Corona

14:45 - 15:15 **A.C. Sterling**:
A Near-Solar-Cycle's Worth of CME Studies with Yohkoh (invited)

15:15 - 15:45 Coffee break

15:45 - 16:15 **V. Bothmer**:
Sources of Magnetic Helicity over the Solar Cycle (invited)

16:15 - 16:30 **C.C. Wu**, R.P. Lepping, N. Gopalswamy:
The Occurrence Anomalies of Magnetic Clouds and CMEs Vary with Solar Activity

16:30 - 16:45 **A. Dal Lago**, L.E.A. Vieira, E. Echer, W.D. Gonzalez, A.L. Clua de Gonzalez, F.L. Guarnieri, L. Balmaceda, J. Santos, R. Schwenn, N.J. Schuch:
Solar and Interplanetary Causes of Super Storms in the Period of 1997-2001

FRIDAY, JUNE 27, 2003

SESSION IV: PARALLEL ISCS WG1 AND WG2/3 SESSIONS

Conveners: Judit PAP, David WEBB, George SIMNETT

08:30 - 12.30 WG1: Data calibration and validation
Models and techniques
Climate models and what has to be done
WG2/WG3: Space weather aspects of CMEs; forecasting tools
Interplaneatry CMEs: remote sensing and in-situ signatures, magnetic clouds, modeling
The importance of multiple eruptions of magnetic structures

12:30 - 14:00 Lunch break

SESSION VII: CMEs, ICMEs AND SPACE WEATHER

Convener: David WEBB

14:00 - 14:30 **B. Jackson**, P.P. Hick, A. Buffington:
Remote Sensing of Heliospheric Structures Using IPS and Thomson Scattering Observations (invited)

14:30 - 14:45 **B. Vrsnak**, D. Ruzdjak, D. Sudar, N. Gopalswamy:
Dynamics of Coronal Mass Ejections in the Near-Sun Interplanetary Space

14:45 - 15:00 Y. Feldstein, B. Tsurutani, W. Gonzalez, **A. Prigancová**, A. Levitin, J. Kozyra, L. Alperovich, U. Mall, L. Gromova, L.A. Dremukhina:
Space Weather Signatures of the 1-7 May 1998 Global Disturbances and their Quantification in Terms of Magnetospheric Contributions into Dst Development

15:00 - 15:30 **R. von Steiger** and T.H. Zurbuchen:
Composition Signatures of Interplanetary Coronal Mass Ejections (invited)

15:30 - 16:00 Coffee break

16:00 - 16:15 **J. Richardson:**, J.C. Kasper, A.J. Lazarus, C. Wang:
Solar Cycle and/or Helium Variations in the Solar Wind

16:15 - 16:30 **E. Romashets** and M. Vandas:
Interplanetary Magnetic Clouds of Toroidal Shapes

16:30 - 17:00 **M. Vandas**:
Interplanetary Modeling of ICMEs (invited)

17:00 - 17:15 **D. Odstrčil**, J.A. Linker, R. Lionello, Z. Mikic, P. Riley, V.J. Pizzo, J.G. Luhmann:
3-D Simulations of ICMEs by Coupled Coronal and Heliospheric Models

17:15 - 17:30 **Z. Smith**, T. Detman, M. Dryer, C.D. Fry, C.-C. Wu:
Study of Solar-based Inputs into Space Weather Models that Predict Interplanetary Shock Arrivals at Earth

17:30 - 17:45 **V.N. Ishkov**:
Short Term Forecast of Solar Geoeffective Flare Events

SATURDAY, JUNE 28, 2003

SESSION VIII: INTERPLANETARY SHOCK WAVES AND SOLAR ENERGETIC PARTICLES

Convener: George SIMNETT

08:30 - 09:00 **I.A. Robinson**:
Low Energy Proton Signatures of Halo CMEs at L1 (invited)

09:00 - 09:30 **M. Reiner**:
Radio Signatures of Solar Energetic Particle Acceleration (invited)

09:30 - 10:00 **S. Poedts**, B. Van der Holst, I. Chattopadhyay, D. Shergelashvili, D. Banerjee, R. Keppens, H. Deconinck:
Simulations of Shock Waves in the Interplanetary Medium (invited)

10:00 - 10:15 **G.M. Simnett**:
A New Concept For Solar Flares

10:15 - 10:30 **J. Magdalenic**, P. Zlobec, B. Vrsnak, M. Messerotti, H. Aurass:
Radio Signatures of Fast Oscillatory Phenomena in the Solar Corona

10:30 - 10:45 **L.I. Miroshnichenko**:
Multiple Particle Acceleration at the Sun: New Approach to Separation of the Sources

10:45 - 11:00 Coffee break

SESSION IX: FUTURE ACTIVITIES

Conveners: Shi Tsan WU / Brigitte SCHMIEDER

11:00 - 11:30 **B. Schmieder**:
Climate and Weather of the Sun-Earth System (CAWSES) (invited)

11:30 - 12:00 **J.L. Bougeret**:
Future Programs in Solar and Heliospheric Radio Astronomy (invited)

12:00 - 12:30 **R.A. Howard**:
STEREO Mission (invited)

Farewell

Session I

MAGNETIC FIELD VARIATIONS THROUGH CYCLE 23

Conveners: Judit PAP / Claus FRÖHLICH

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11:45 - 12:00 Lefebvre, S., **Rozelot, J.-P.**:
Influence of the Sun Radius Variability on Irradiance Modelling

12:00 - 12:30 **L. Floyd**, G. Rottman, M. DeLand, J. Pap:
11 Years of Solar UV Irradiance Measurements of UARS (invited)

Invited and Oral Contributions:

Title: **Global Properties (What Helioseismology Teaches Us about the Sun?) (Invited talk)**

Presenting author: **Kosovichev, Alexander, G.** (akosovichev@solar.stanford.edu)
Author(s): Kosovichev, A.G.
Affiliation(s): Stanford University, U.S.A.

Abstract: In the past decade, helioseismology has provided important insights in the internal mechanisms of solar variability on the global and local scales. The continuous monitoring by the GONG ground-based network and the MDI instrument on SOHO has revealed significant variations of the solar structure and dynamics with the activity cycle. Two regions, the tachocline and the upper convective boundary layer, are particularly critical for understanding the solar variability. Both of these regions are characterized by strong rotational shears. The helioseismic observations of the tachocline have provided evidence of puzzling 1.3-year variations of the rotation rate. A rich dynamics correlated with the magnetic activity has been revealed in the upper convective layer. Of particular interest are variations of the global circulation pattern, zonal flows ("torsional oscillations") and meridional circulation, and their interaction with large-scale converging mass flows around active regions. These variations are studied byconstructing 3D synoptic maps of subphotospheric flows. On the local scale, strong sound-speed variations and vortex shear flows are observed beneath sunspots and active regions. The key questions are: How is the internal dynamics of the Sun related to the magnetic field patterns, energy transport and irradiance variations? What are the mechanisms of the global circulation and local vortex mass flows? How does the subsurface dynamics lead to unstable magnetic topologies?

Title: **Patterns and Dynamics of Solar Magnetic Fields and HeI Coronal Holes in Cycle 23 (Invited talk)**

Presenting author: **McIntosh, Patrick, S.** (pmcintosh@solar.stanford.edu)
Author(s): McIntosh, P.S.
Affiliation(s): HelioSynoptics, Boulder, CO, USA

Abstract: H-alpha synoptic charts compiled in Boulder now document large-scale solar activity for 38 years. This set of over 500 charts shows patterns of magnetic polarity in full agreement with Kitt Peak and other magnetic-field synoptic charts. By emphasizing the boundaries between polarities, which are marked with high resolution by structures in the solar atmosphere, we see the dynamics of magnetic fields more clearly than any previous synoptic database. More accurately, we see the dynamics of the sources of magnetic fields. These charts combine filaments, active regions and coronal holes with the magnetic-field patterns, giving new insight to the origin and disappearance of those three fundamental solar phenomena. The most startling revelation by H-alpha charts in Cycle 23 is that our definition of coronal holes as areas of open field lines is incomplete. The motions and evolutions of coronal holes seen with HeI 10830, show behaviors that precede changes in magnetic fields and often without any distinctive change at all in those fields. The changes among coronal holes are coordinated and the changes are synchronized with the solar cycle. These data demand a fresh start to our models of the solar cycle. That model must deal with the dynamics of magnetic field origin and regeneration.

Title: **The role of the meridional circulation in generation of the 22-year solar cycle**

Presenting author: **Ivanov, Evgeny, V.** (solter@izmiran.troitsk.ru)
Author(s): Ivanov, E.V., Obridko, V.N., Shelting, B.D.
Affiliation(s): Institute of Terrestrial Magnetism, Ionosphere, and Radio Wave Propagation, 142190, Troitsk, Moscow Region, Russia

Abstract: An empirical model of generation of the 22-year cycle of solar magnetic fields and sunspots has been proposed. The model is based on the study of cyclic evolution of local and large-scale fields: direction and duration of their heliolatitude drift, and phase ratio of their maximum intensities. It is shown that the drift from the equator to the pole occurs for 16-17 years, while the backward motion at the base of the convection zone may either take 5-6 years or 16-17 years, as well.

Title: **Cyclic changes of the solar global and local magnetic field patterns (Invited talk)**

Presenting author: **Bumba, Vaclav** (bumba@asu.cas.cz)
Author(s): Bumba, V.
Affiliation(s): Astronomical Institute, Academy of Sciences, Czech Republic

Abstract: Grouping tendency in the magnetic flux emergence in the solar photosphere; single local magnetic fields and complexes of activity. Relation of the local and background large-scale magnetic fields (global fields), dynamics of their evolution. Longitudinal distribution and sector structure in the solar magnetic fields. Magnetic field as a coupling factor of all layers of the solar atmosphere with the convective zone. Role of photospheric motions in the magnetic field distribution. Reflection of the solar magnetic field changes in the heliosphere. Regularities in the solar activity appearance. Local and global magnetic field distribution during different phases of solar activity cycle. Characteristics of such changes, quasi-biennial oscillations, long-term and ephemeral periodicities in the magnetic flux formation. North-south asymmetry of solar magnetic fields, its variations with time. Rotational periods of the background magnetic field. Solar irradiance variations and solar magnetic field evolution. Long-term variations of the solar and heliospheric magnetic fields.

Title: **Solar Irradiance Variability (Invited talk)**

Presenting author: **Frohlich, Claus** (cfrohlich@pmodwrc.ch)
Author(s): Fröhlich, C.
Affiliation(s): Physikalisch-Meteorologisches Observatorium Davos, World Radiation Center, Davos, Switzerland

Abstract: Since November 1978 a set of total solar irradiance (TSI) measurements from space is available, yielding a time series of more than 23 years. From measurements made by different space radiometers (HF on NIMBUS 7, ACRIM I on SMM, ACRIM II on UARS and VIRGO on SOHO) a composite record of TSI can be compiled. This leads to a reliable record of TSI with an overall precision of the order of 0.05 Wm^{-2}. Within this uncertainty no significant secular trend of

TSI over the 24 years can be detected. This contrasts the results of the ACRIM composite which does show a significant trend. The difference and its implication are discussed. The composite is compared to an empirical model based on sunspot darkening and brightening due to faculae and network. Since early 1996 spectral measurements by filter-radiometers of VIRGO provide continuous time series of spectral solar irradiance (SSI) at 402, 500 and 862 nm. These time series are analyzed and compared to TSI yielding information about the redistribution of energy within the spectrum during changes of TSI.

Title: **Influence of the Sun radius variability on irradiance modelling**
Presenting author: **Rozelot, Jean-Pierre** (rozelot@obs-azur.fr)
Author(s): Lefebvre, S., Rozelot, J.P.
Affiliation(s): Observatoire de la Cote d'Azur, Grasse, France

Abstract: Since the pioneer work of S. Sofia on the relationship between changes in the solar radius and the corresponding changes in the solar constant L, it is now known that a key parameter to model effects of the Sun on the Earths climate is the so-called parameter W. This parameter which is simply the ratio between the relative variations of the radius over the relative variations of the solar constant, is not yet known with a great accuracy. That will be made through dedicated satellites in a near future, such as the PICARD mission. Modelling L is thus essential; however only around 90% is explained by current models based on a ponderate function of spots and faculae areas distribution. In this presentation, we will focus on the non explained part of the luminosity variations, and we will show that a part of the remainder can be attributed to a shape distortion. We will first deal with the most achievable accurate determination of the whole solar shape, which is latitudinal dependent. We will show how it is possible to determine this outer shape and the upper limits that can be set up. Secondly, we will show what consequences are implied by such shape distortions on the solar luminosity. Then we will discuss this residual luminosity over different time scales as it is known that on the short term, variations of the solar diameter, certainly do not exceed 20 millisecond of arc, whereas on the long term, a variability of no more than 1.5 arc second may be found. Theoretical explanations may be found either through the gravitational potential or through the thermal wind.

Title: **11 Years of Solar UV Irradiance Measurements of UARS (Invited talk)**
Presenting author: **Floyd, Linton, E.** (linton.floyd@nrl.navy.mil)
Author(s): (1) Floyd, L., (2) Rottman, G., (3) DeLand, M.T., (4) Pap, J.
Affiliation(s): (1) Interferometrics, Inc., Chantilly, VA, USA, (2) Laboratory for Atmospheric and Space Physics, University of Colorado, Boulder, USA, (3) Science Systems and Applications, Inc. (SSAI), Lanham, MD, USA, (4) Goddard Earth Sciences and Technology Center, University of Maryland, Baltimore County, USA

Abstract: Since its launch in 1991, the Upper Atmosphere Research Satellite (UARS) has as its goal the study of Earth's stratosphere and mesosphere. Solar UV radiation deposits significant energy in these layers through the creation and destruction of ozone and the resulting heating. Two UARS experiments, the Solar-Stellar Intercomparison Experiment (SOLSTICE) and the Solar Ultraviolet Spectral Irradiance Monitor (SUSIM), have measured the solar spectral UV irradiance (119-400 nm) for more than 11 years, the length of a solar activity cycle. These

measurements, began during the latter stages of the solar cycle 22 activity maximum continued through the following minimum and through the solar cycle 23 maximum. Trends in instrumental responsivity cause some long-term differences in the UV irradiance measurements between the two experiments. However, the MgII index, which is constructed to minimize the impact of instrument responsitivity changes, shows that solar cycles 22 and 23 have comparable amplitudes. Other accomplishments include the assembly of a 22+ year composite Lyman alpha and MgII core-to-wing ratio time series, inferred active region wavelength-dependent center-to-limb variations, observations of flare enhanced transition region radiation, and new solar reference spectra. The UARS UV measurements will be place in the context of similar experiments, both previous and following. Progress on the outstanding questions of Earth and solar science as well as needed future work will be outlined.

Posters:

Contribution number: I.1p
Title: **Spatial distribution, time evolution and rotation of the large-scale total magnetic flux patterns on the Sun.**
Presenting author: **Ambroz, Pavel** (pambroz@asu.cas.cz)
Author(s): Ambroz, P.
Affiliation(s): Astronomical Institute of the Acad. Sci. of the Czech Rep., Ondrejov, Czech Republic

Abstract: Total intensity of magnetic flux is derived from the radial values of large-scale magnetic field measured on WSO of Stanford University. Horizontal component of the magnetic field in and above the photosphere was derived by computing of the current free approximation, all for each Carrington rotation in the time interval from the year 1976 to 2000. Spatial distribution of the enhanced regions of the total magnetic flux was studied in course of the activity cycle. Time-longitude evolution of the total flux patterns was tested in relationship with both positive and negative flux evolution in solar photosphere. Close relationship between enhanced magnetic flux regions and the green corona bright regions is found. The study brings a new light on the problem of the 'coronal rotation'.

Contribution number: I.2p
Title: **N-S asymmetry of solar activity and quasi-biennial oscillations**
Presenting author: **Obridko, V.N.** (obridko@izmiran.troitsk.ru)
Author(s): (1) Badalyan, O.G., (1) Obridko, V.N., (2) Rybak, J., (2) Sykora, J.
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Abstract: The N-S asymmetry index (A) of solar activity is investigated by using data on the coronal green line brightness, the number and area of sunspots during the period of 1939-2001, and the full magnetic flux as measured from 1975. We have found that the typical time variations of the N-S asymmetry both at the small and large time scales are consonant in all the solar activity characteristics under condiseration. The highest correlation of the asymmetry indices is found to exist in the belt of latitudes from 10° to 20°. Quasi-biennal oscillations (QBO) of the A-indices

have been revealed and studied in details, and the spectrum-time and wavelet analyses have been performed. The quantitative correlation analysis of the QBO spectrum has been carried out for the coronal green line brightness and for the number and area of sunspots. It is shown that the QBO are much better pronounced in the N-S asymmetry than in the corresponding activity indices. The QBO identified in the indices are poorly correlated with each other. On the contrary, the QBO spectra of different asymmetry indices are well correlated, the correlation coefficient being sometimes as large as 0.7 or higher. It is shown that QBO manifestations in the asymmetry of different solar activity indices and, particularly, in the coronal green line brightness are seen in antiphase with the asymmetry magnitude itself. A remarkable decrease of the QBO amplitude has been detected in the middle of the past 60-ies. This decrease coincides with the long-lasting noticeable increase of the A-indices of different solar activity parameters. The conclusion can be drawn that the N-S asymmetry represents a specific, independent and very promising tool for the analysis of the solar activity variations.

Contribution number: I.3p
Title: **Photospheric background Doppler velocity field during active regions development**
Presenting author: **Bumba, Vaclav** (bumba@asu.cas.cz)
Author(s): (1) Bumba, V., (1) Klvana, M., (2) Garcia, A.
Affiliation(s): (1) Ondrejov Observatory, Ondrejov, Czech republic, (2) University Observatory, Coimbra, Portugal

Abstract: We investigate changes of the photospheric background Doppler velocity field, measured by a scanning photoelectric magnetograph during the development of several active regions. Our results demonstrate that the whoule local system of active region's magnetic and motion field represents some kind of disturbance of the semiregular motion patterns of the quiet photosphere which seem to have its physical background in the local strenghtening of convection and the local concentration of the magnetic field. In such a local Doppler motion system, the positive (blue-shifted) Doppler motion elements are considerably diluted (with exception of Evershed's positive motion areas), while the negative (red-shifted) elements are strongly concentrated, parallel with the distribution of the local magnetic field. At the same time, they are cellularly organized. There also exists a simultaneous relationship of the distribution of the active region's photospheric magnetic and negative velocity fields with the chromospheric emission patterns of the line K3 CaII, and of the positive motion elements (located in the regions of no, or weak magnetic fields) with the dark interiors of the same K3 CaII line supergranules.

Contribution number: I.4p
Title: **How are magnetic flux structure and imbalance related to field value in solar active regions**
Presenting author: **Chumak, Oleg, V.** (chumak@sai.msu.ru)
Author(s): (1) Chumak, O., (2) Zhang, H.
Affiliation(s): (1) Shternberg Astronomical Observatory, Moscow, Russia (2) National Astronomical Observatories, China

Abstract: Observed data on the longitudinal component of magnetic field in six solar active regions, obtained in Huairou Solar Observing Station of National Astronomical Observatories of

China, were analyzed. On the base of this analysis the investigation of magnetic field structure on various levels of field value has been carried out. The results of the exploration are presented in this report. The parameters, quantitatively characterizing a structure and imbalance for any given field value have been introduced. It was shown that both the structural properties and imbalance could differ heavily for various field values in the same active region. The diagrams of structure parameters and imbalance variation as functions of field value for the six active regions are plotted. Possible reasons of essential differences of these functions in different active regions are discussed. The parameters integrally characterizing a current level of structural complexity and an imbalance of magnetic fluxes in the active regions are proposed. The senses of the evolutional trajectories of solar active regions in the space of these parameters are discussed.

Contribution number: I.5p
Title: **Relationship between areas of polarities and their integral magnetic fluxes in solar active regions.**
Presenting author: **Chumak, Oleg, V.** (chumak@sai.msu.ru)
Author(s): (1) Chumak, O., (2) Zhang, H.
Affiliation(s): (1) Shternberg Astronomical Observatory, Moscow, Russia, (2) National Astronomical Observatories, China

Abstract: The results of study the correlation between integral areas of polarities and corresponding total magnetic fluxes for solar active regions are presented. It is shown that some of these relationships are satisfied to simple power laws. These laws can differ from each other for different active regions or different polarities of the same active region. Fractal examination showed that some of these power laws can not be justified inside the simple models of stationary magnetic flux tubes aggregation. Time independence of these power laws and their high level of trustworthiness allow regarding exponents of these laws to be quasi-invariant parameters useful for quantitative classification of solar active regions.

Contribution number: I.6p
Title: **Solar Activity Prediction from Reconstruction of Wavelet Analysis**
Presenting author: **Djamaluddin, Thomas** (t-djamal@bdg.lapan.go.id, t-djamal@hotmail.com)
Author(s): Djamaluddin, T.
Affiliation(s): National Institute of Aeronautics and Space (LAPAN),Bandung, Indonesia

Abstract: Solar activity prediction methods have been developed, but no one can predict accurately. This paper will report a new alternative method by using reconstruction of wavelet analysis. Weighted wavelet Z-transform is used to produce periodicities spectral at current cycle. Then the analysis results are used to reconstruct the current cycle and predict the next cycle. Preliminary results show that the method is good enough to predict time of next peak, but poor in predicting amplitude of solar maximum. Geomagnetic precursor method recognized as the best method so far to predict solar maximum amplitude may be combined to this method.

Contribution number: I.7p

Title: **Green Corona versus Photospheric Magnetic Flux: Solar Cycle Dependence**

Presenting author: **Dorotovic, Ivan** (dorotovic@suh.sk)

Author(s): (1) Dorotovic, I., (2) Rybak, J.

Affiliation(s): (1) Slovak Central Observatory, P.O. Box 42, 94701 Hurbanovo, Slovak Republic, (2) Astronomical Institute, Slovak Academy of Sciences, 05960 Tatranska Lomnica, Slovak Republic

Abstract: Relationship between the green corona and the photospheric magnetic flux is analyzed over the epoch 1995-2001. Homogeneous dataset of the green coronal line intensities and Kitt Peak magnetic flux data are used for determination of this relationship. In particular, a solar cycle dependence of the numerical relation between these two parameters has been investigated. It is shown that any overall fit with fixed parameters for epoch several years long is unrealistic in order to describe this relation as such relation was found to be time dependent. The coefficients of the linear fit, used in the paper, display a quite significant changes of their values in time. Moreover, the inverse relation of the absolute and linear coefficient of the fit was obtained during the ascending phase of the solar cycle between the year 1998 and 2001. Therefore, in order to extrapolate magnetic flux data using existing longer datasets of the green coronal intensities, it is necessary to take into account the revealed solar cycle dependence of their relation and to estimate the quantitative parameters of relation separately for the individual phases of the solar cycle.

Contribution number: I.8p

Title: **The Influence of the Non-thermal Kappa Distribution on Ionization and Excitation Equilibrium of C and O**

Presenting author: **Dzifcakova, Elena** (dzifcakova@fmph.uniba.sk)

Author(s): Dzifcakova, E., Kulinova, A.

Affiliation(s): Astronomical Institute, Fac. of Math., Phys. & Informatics, Comenius University, Bratislava, Slovakia

Abstract: Kappa distribution is the non-thermal distribution with enhanced number of the particles in high-energy tail. This type of distribution can be originated in the solar corona and also in transition region. We have studied the changes in the ionization and excitation equilibrium due to this type of electron distribution. Both equilibria are strongly influenced. Total changes in C and O spectrum are due to summation of changes both in ionization and excitation equilibrium. The changes in synthetic spectrum of C and O due to changes of the distribution are shown in these three cases:(i) one temperature and one density plasma, (ii) for DEM of the quite sun and (iii) for DEM of the active region. The possibilities for the diagnostics of the shape of the electron distribution from solar spectral line intensities are disscused.

Contribution number: I.9p
Title: **Development of the Global Solar Activity as Based on Polarization Observations with the Nobeyama Radio Heliograph**
Presenting author: **Makarov, Valentine** (makarov@gao.spb.ru)
Author(s): (1) Gelfreikh, G.B., (1) Makarov, V.I., (1) Tlatov, A.G., (2) Shibasaki, K.

Affiliation(s): (1) Pulkovo astronomical observatory, St-Petersburg 196140, Russia, (2) Nobeyama Radio Observatory, NAO, Nagano 384-1305, Japan

Abstract: Development of the solar activity at all heliographic latitudes was studied as based on the radio maps of the Sun at the wavelength of 1.76 cm obtained with the Nobeyama radio heliograph. Both intensity and circular polarization were analyzed for the period of 1992-2002. 1. An increase of brightness presented on the latitude-time diagram have shown the ;Mounder Butterfly; picture at lower heliographic latitudes and ;polar faculae butterfly; at higher ones reflected the 11-year solar cycle. 2. 11-year cycle variations of the magnetic fields clearly seen on the latitude-time diagram in the channel of the circular polarization. 3. It is shown that the polarized component in the North and South hemisphere of the Sun had opposite dominating polarities. That changed while transferring from the 22nd to 23 rd cycle. 4. The sign of the circularly polarized signal reflected the leading parts of the active regions taking into account that an excess of the x-mode is expected from the thermal emission at the levels of the higher chromosphere and the lower corona. 5. Polarized component was also detected at high heliographic latitudes reflecting development of the solar cycles. 6. The problems of the global development of the solar activity and some ways to study these on the base of the radio observations. This work was partially supported by the grants of RFBR 02-02-16035 and 02-02-16548, 00-02-16355, INTAS-00-00181.

Contribution number: I.10p
Title: **The Current 23 Solar Cycle: Its Evolution and Principal Features**
Presenting author: **Ishkov, Vitaly, N.** (ishkov@izmiran.rssi.ru)
Author(s): Ishkov, V.N.
Affiliation(s): IZMIRAN, Troitsk, Russia

Abstract: We discuss the current 23 solar cycle evolution at 7 year his development. This cycle started in June 1996 and 48 months later already reached his maximum (W*=120.7). The second (lower) peak (W*=115.6) falls at November 2001. Its second maximum in common to connect with peak of magnetic fluxes emergences and flare activity. The principal features of the current cycle are: - the starting smoothed sunspot number was W*=8.6; - the first active region appeared at the minimum - in May 1996, and from February 1997 the solar structures of new cycle have been dominant; - the ascending phase began in September 1997 (W=51.3); - the second lower peak in the smoothed sunspot numbers falls at November 2001 (W*=115.6), but in smoothed radio flux on 10.7 cm at February 2002 far exceed (F*=197.2) the same at April 2000 (F*=180.5); - the total number of active regions (AR) is considerably smaler when compared with the AR number at the same point in previous five cycles but the total number of coronal holes is an excess; - susnpot groups are smaller, less complex, slower to evolve, and longer-lived than normal; these properties are signs of stable AR, and this fact may indicate a weaker circulation in the solar convection zone; - flare activity (the total number of optical, X-ray and large solar flares) is dramatically less

than in cycle 18-22; - short timeof the epoch of solar magnetic reversal - June-December, 2000; These data possible testifies that the Sun came into period of middle and small solar cycles to be continious 50-100 years. The decrease of solar activity presents in heliosphere a new conditions yet to be studied as considerable body of background space and environment data obtained in situation of high solar cycles (cycles 19-22). The current cycle evolution and its parameters (in Russian) you can see in WEB-site http://www.wdcb.ru/WDCB/cyc23.html.

Contribution number: I.11p
Title: **Dynamics of active longitudes as inferred from sunspot observations**
Presenting author: **Ivanov, Evgeny, V.** (solter@izmiran.troitsk.ru)
Author(s): Ivanov, E.V.
Affiliation(s): IZMIRAN, 142190, Troitsk, Moscow Region, Russia

Abstract: The data from Greenwich, Pulkovo-Kislovodsk, and Mt.Wilson Observatories for 1874-2001 have been used to plot a Carrington rotation vs. time diagram of the sunspot distribution. Then, the active longitudes have been identified on these diagrams by intensive long-lived features (sunspot formation centres). The behaviour of the active longitudes (their location, shift, and intensity variations) has been analysed over the entire time interval under consideration.

Contribution number: I.12p
Title: **Velocity fields in an irregular sunspot**
Presenting author: **Jurcak, Jan** (jurcak@asu.cas.cz)
Author(s): (1) Jurcak, J., (1) Sobotka, M., (2) Martinez-Pillet, V.
Affiliation(s): (1) Astronomical Institute AS CR, Czech Republik, (2) Instituto de Astrofisica de Canarias, Spain

Abstract: Line-of-sight velocity fields in an irregular sunspot (NOAA 8990) have been determined from Stokes-I spectra of the line Fe I 630.15 nm, obtained with the La Palma Stokes Polarimeter at the Swedish Vacuum Solar Telescope on May 13, 2000. We show and discuss the resulting velocity maps, the dependence of velocities on the continuum intensities, and the correlation between velocities and line asymmetries.

Contribution number: I.13p
Title: **Effect of Polarity Reversal of Solar Magnetic Field in Cosmic Ray Fluctuations**
Presenting author: **Kozlov, Valery, Ignatyevic.** (valery@ikfia.ysn.ru)
Author(s): (1) Kozlov, V.I., (1) Kozlov, V.V., (1) Markov, V.V.
Affiliation(s): (1) Yu. G. Shafer Institute of Cosmophysical Research and Aeronomy SB RAS, Russia

Abstract: Transient process of decay of the large-scale magnetic field of the Sun at a stage of his polarity reversal is manifested as a giant 'wave of a polarity reversal' with the period of a half-year. Maximas of a wave in the galactic cosmic ray (GCR) scintillation index are 2-3 Bartels

rotations of the Sun before GCR intensity minima. The revealed relationship already used by us for the long-term forecast of geoeffective of solar activity periods (http://teor.ysn.ru/rswi/). The semi-annual wave is also detected in the interplanetary magnetic field parameters. The presence 'waves of a polarity reversal' explains a 'gap' in the majority of parameters by a uniform way both in a maximum of solar activity ('Gnevyshev effect') and in the beginning of a declining branch of the 11-year cycle.

Contribution number: I.14p
Title: **Photosphere velocity field generated by tidal forces**
Presenting author: **Klvana, Miroslav** (mklvana@asu.cas.cz)
Author(s): (1) Krivtsov, A. M., (2) Klvana, M., (2) Bumba, V.
Affiliation(s): (1) St.-Petersburg State Technical University, Russia (2) Astronomical Institute, Academy of Sciences of the Czech Republic, Observatory Ondrejov, Czech Republic

Abstract: The influence of the planet motion on the solar activity could be considered as a subject of astrology. However, our recent research shows correlation between the planets disposition and the solar activity. Analysis of the astronomical data invents the question about influence of the planetary-induced tides on the number and distribution of the active regions on the solar surface. In the presented work we are considering dynamical deformation of the solar sphere induced by the action of the planetary system. Influence of the tidal deformations on the photospherical velocity fields and their interaction with the active regions in the photosphere are studied.

Contribution number: I.15p
Title: **Analysis of Relationship between Flaring Activity and Subphotospheric Flows in NOAA 9393**
Presenting author: **Kulinova, Alena** (kulinova@fmph.uniba.sk)
Author(s): (1) Kulinova, A., (1) Dzifcakova, E., (2) Duvall, T. L. Jr., (3) Kosovichev, A.G.
Affiliation(s): (1) AI FMPhI CU, Slovakia, (2) NASA GSFC, USA, (3) Stanford University, USA

Abstract: The relationship between the subphotospheric flows and flaring activity s not well understood. It is believed that subphotospheric shearing flows play important role in creating unstable magnetic topology that leads to initiation of flares and CMEs. Active region NOAA 9393 has been already studied within the frame of subphotospheric dynamics of sunspots and developing active regions. In this paper we have studied subphotospheric flows and their relationship with two flares observed in this region and one of them is connected with halo CME. SOHO/MDI and helioseismology data are used for determining the changes in morphology and are compared with changes of the topology as observed by TRACE. It seems that there is some connection between subphotospheric flows within 12 Mm below the photosphere and changes of photospheric magnetic fields and also the flaring activity.

Contribution number: I.16p
Title: **The sign reversal of the solar magnetic field and N-S asymmetry of the spots**
Presenting author: **Lorenc, Marian** (lorenc@suh.sk)
Author(s): (1) Lorenc, M., (1) Pastorek, L., (2) Rybansky, M.
Affiliation(s): (1) Slovak Central Observatory, Hurbanovo, Slovakia, (2) Astronomical Institutte, Slovak Academy of Sciences, Tatranska Lomnica, Slovakia

Abstract: In the contribution is compared the N-S asymmetry of spots during the sign reversal of the global Sun's magnetic field in the cycles 22 and 23. The different time of the sign reversal in N- and S-pole is connected with asymmetry of solar activity and with poleward drift of the prominence zones.

Contribution number: I.17p
Title: **High-resolution Studies of Coronal Index of Solar Activity and Solar Magnetic field**
Presenting author: **Petropoulos, Basil** (emavromi@cc.uoa.gr)
Author(s): (1) Mavromichalaki, H., (2) Petropoulos, B., (1) Plainaki, C., (1) Zouganelis, J., (1) Vassilaki, A.
Affiliation(s): (1) Nuclear and Particle Physics Section, Physics Department, AthensUniversity, Pan/polis 15771 Athens, Greece, (2) Research Center for Astronomy and Applied Mathematics of Athens Academy, Anagnostopoulou 14, 10673 Athens, Greece

Abstract: Global changes of the solar activity can be expressed by the coronal index that represents the averaged daily power of the green corona emitted from the Suns visible hemisphere. Statistical analysis of the daily values of this index for the period 1975-1998 has shown a network of periodicities from 13.5 days to 11 years. The most of these periodicities have been also found in the sunspot number, as well as in the solar flare index, while some others are dominant in the solar magnetic field. From this analysis an analytical relation has been obtained in order to express the coronal index as a global index of solar activity with respect to the other three parameters. This relation can be used for space weather applications.

Contribution number: I.18p
Title: **A method to determine the solar cycle length from 530.3.nm green line corona observations**
Presenting author: **Minarovjech, Milan** (milanmin@ta3.sk)
Author(s): Minarovjech, M., Rybansky, M., Rusin, V.
Affiliation(s): Astronomical Institute of Slovak Academy of Sciences, Tatranska Lomnica, Slovakia

Abstract: The main periodicity in the Sun's activity is the 11-year cycle called the solar cycle. The period is not constant, but varies between about 9.5 and 12.5 year. The cycle length is

conventionally defined as the time difference between two successive sunspot minima. Here we propose a new method to define the solar cycle length from 530.3 nm green coronal emission line observations. The solar cycle length is defined as a difference between two successive splitting of the primary pole ward branches from main equator ward branches. This solar cycle length during the solar activity cycles 17 - 23 is approximately constant.

Contribution number: I.19p
Title: **Long-term Evolution of the Photospheric Magnetic Fields on the Sun: Separation of Active/Diffuse/Background Flux by Optimum Thresholds.**
Presenting author: **Mocak, Miroslav** (mirkuf@post.cz)
Author(s): (1) Mocak, M., (2) Rybak, J.
Affiliation(s): (1) Faculty of Natural Science, Pavol Jozef Safarik University, Kosice, Slovakia , (2) Astronomical Institute, Slovak Academy of Sciences, Tatranska Lomnica, Slovakia

Abstract: The distributions of the magnetic flux in the Sun's photosphere is studied using NSO/Kitt Peak Carrington rotation maps of the magnetic flux in the period from 1975 to 2002. It was found that it is possible to separate the magnetic fields using the Kitt Peak magnetic data into three types: background fields, dissipation fields from the active regions and the active region fields. The contribution documents a determination of the optimum thresholds for such separation. The threshold between background fields and dissipation fields was derived from the average value of the magnetic flux measured in high latitudes where/when no active and dissipation fields were detected. It's value is near 5 Gauss. A histogram analysis of all available magnetic data was used to obtain the threshold of 25 Gauss between the dissipation fields and the active region fields. This separation allows to study the temporal and latitudinal behaviour of these three types of the magnetic fields. The first quantitative results on the mutual relations of these three types of the magnetic fields are discussed.

Contribution number: I.20p
Title: **Peculiarities of Large-scale Magnetic Field Changes on the Sun through Cycle 23**
Presenting author: **Molodykh, Sergey, I.** (sim@iszf.irk.ru)
Author(s): Molodykh, S.I., Zherebtsov, G.A., Kovalenko, V.A.
Affiliation(s): Institute of Solar-Terrestrial Physics SB RAS, Irkutsk, Russia

Abstract: This paper presents the results of a comprehensive analysis of the dynamics of the suns global magnetic structure, solar wind parameters, the interplanetary magnetic field and geomagnetic activity during fast global changes of magnetic fields on the Sun. It is shown that in each 11-year cycle of solar activity there exist at least two periods of fast global changes on the Sun, which are accompanied by anomalous manifestations in the heliosphere and in the Earths atmosphere. The periods are both characterized by increased flaring activity that reflects fast changes in magnetic structures and recur in a regular fashion in each 11-year cycle of solar activity; however, the details of their characteristics and manifestations differ from cycle to cycle. One period, during the rising phase of solar activity, corresponds to the start of the interaction of the 'old' cycle magnetic fields and emergent fields of the 'new' cycle. This interaction is accompanied by

the destruction of a common current system, an enhancement of large-scale magnetic fields, fast changes in the global magnetic structure of the corona, and by a significant increase in inhomogeneity of the interplanetary magnetic field. Furthermore, 'favorable' conditions are created for an effective acceleration of solar cosmic rays. During the decreasing phase there occurs an opposite process - the interaction of the fields of the 'old' and 'new' cycles comes to an end, and a new common, global magnetic system is produced. This period is characterized by a simplification of the magnetic structure and by an attenuation of magnetic fields in the corona. It is shown that fast global changes in magnetic fields on the Sun can occur not simultaneously for different-scale fields.

Contribution number: I.21p
Title: **Short-Term Periodicities in the Flare Index Between the Years 1966-2001**
Presenting author: **Ozguc, Atila** (ozguc@boun.edu.tr)
Author(s): (1) Ozguc, A., (1) Atac, T., (2) Rybak, J.
Affiliation(s): (1) Bogazici University, Kandilli Observatory and ERI, Istanbul, Turkey (2) Astronomical Institute of the Slovak Academy of Sciences, 059 60 Tatranska Lomnica, The Slovak Republic

Abstract: A brief description and the results of the temporal variability of the flare index over the epoch of almost 4 cycles (1966-2001) are presented. Using Fourier and wavelet transforms the short-term periodicities in the daily flare index data for the total surface and for the northern and the southern hemispheres of the Sun are presented. A significant variability was found for all periods. The wavelet transform results show that the occurrence of flare index power is highly intermittent in time. A comparison of the results of the Fourier transform and the time-period wavelet transform of the flare index time series has clarified the importance of different periodicities, whether they are or are not the harmonics of the basic ones, as well as the temporal location of their occurrence.

Contribution number: I.22p
Title: **On mutual relation of the Wolf sunspot number periodicities**
Presenting author: **Karlovsky, Vladimir** (astrokar@hl.isk.sk)
Author(s): (1) Rybak, J., (2) Karlovsky, V.
Affiliation(s): (1) Astronomical Institute, Tatranska Lomnica, Slovakia, (2) Observatory and Planetarium, Hlohovec, Slovakia

Abstract: Contribution presents the temporal variability of the solar activity, represented by the Wolf sunspot number on the epoch 1850-2002 focusing on the intermediate periods between 1 and 6 years. Results were obtained using wavelet analysis of the Wolf sunspot number data series (SIDC, RWC Brussels, Belgium) and different estimations of the power significance is discussed. Possible relations between occurrence of different intermediate periods and the general behaviour of the colar cycles is studied showing relative timing of particular periods in different solar cycles according to phase of the cycles. Problems possibly caused by the north/south assymetry of the Wolf number and the general level of the signal noise over the whole epoch under study used in calculations are discussed as well.

Contribution number: I.23p
Title: **Cycle 23, the First of Weak Solar Cycles Series**
Presenting author: **Shahinaz, Yousef, M.** (bebarsesha@yahoo.com)
Author(s): Shahinaz, Y.
Affiliation(s): Astronomy & Meteorology Dept, Faculty of Science, Cairo university, Egypt

Abstract: There are indications that the present solar cycle number 23 is not a normal sunspot cycle, but rather is a weak cycle of about 12-years duration and the first of a series of 3-4 successive weak cycles intermediate between two Wolf-Gleissberg cycles. Such weak long duration cycles did occur during the periods 1797-1823 and 1877-1913. Equatorial rotational rates estimated during the period 1880-1980, by previous investigators proved to be faster in the beginning of this period of weak cycles implying a drop in solar irradiance. It is anticipated that increased equatorial solar rotational rates are going on both in the photosphere and the convection zone. This suggestion can be verified from helioseismology. Some of the implications of entering a period of weak 12 years solar cycles on the Earth were found from the previous two periods and can be reflected into the future. Among those implications are; drops in the global air and sea surface temperatures, sudden rise of equatorial African lakes at the start of the first solar cycle of the series indicating the start of a period of climatic fluctuations. Increased frequencies of El Nios and hurricanes and wide spread flood-drought hazards are other manifestations. Drop in solar wind and weakening of interplanetary magnetic field and hence increased invasion of galactic comic rays Drops in solar UV and X-rays fluxes are additional implications. Lakes or closed sea levels have entered a period of dramatic rise or fall. Already lake Victoria level; rose suddenly by 1.6m in 1997,while several dramatic effects are happening in Dead sea, Caspian, and great American lakes and others. Among the multi effects of these present weak and long solar cycles will be delayed rise in sea level and a hope for the closure of the ozone hole and God knows best.

Contribution number: I.24p
Title: **Dynamics of motions in the quiet photosphere.**
Presenting author: **Svanda, Michal** (svanda@asu.cas.cz)
Author(s): (1) Svanda, M., (2) Klvana, M., (2) Sobotka, M., (2) Bumba, V.
Affiliation(s): (1) Charles University, Faculty of Mathematic and Physics, Prague, Czech Republic, (2) Astronomical Institute, Academy of Sciences of the Czech Republic, Observatory Ondrejov, Czech republic

Abstract: We determine the vector velocity fields describing the plasma motions in the quiet solar photosphere, using the motions of the supergranular structures, obtained by the evaluation of series of Doppler measurements of velocity fields of the whole solar disk. It turned out that the studied vector velocity fields can be submerged under the noise level, originating due to the strong variability of the supergranular structures during their life time. We describe the method we used for the suppressing of such noise, and we bring the criterions used by the election of free parameters. We demonstrate examples of obtained vector velocity fields and of the resulting motions of matter on the visible photospheric surface. We discuss different factors influencing the

reproductivness of obtained results. We construct a graph of the dependence of the differential rotation on the heliographic latitude from the mean vector velocity field, we got for the solar disk without expressive magnetic fields.

Contribution number: I.25p
Title: **An Active Region QBO**
Presenting author: **Ludmany, Andras** (ludmany@tigris.klte.hu)
Author(s): (1) Szasz, C., (1) Kero, J., (2) Baranyi, T., (2) Gyori, L., (2) Ludmany, A., (2) Mezo, G.
Affiliation(s): (1) Swedish Institute of Space Physics, Kiruna, Sweden (2) Heliophysical Observatory, Debrecen, Hungary

Abstract: A quasi-biennial fluctuation has been detected in the time-series of the sunspot umbra/penumbra area ratio (U/P) on the basis of the Debrecen Photoheliographic Data. The study is based on an intermittent period of nearly eight years, the material comprises more than 18.000 individual sunspots. The present contribution reports preliminary pieces of information about the temporal behaviour of the U/P ratio, period analysis and umbral area dependence. The physical background of the phenomenon is yet unclear but it seems to belong to the growing family of mid-term fluctuations.

Contribution number: I.26p
Title: **On rotational patterns of the solar magnetic field**
Presenting author: **Temmer, Manuela** (manuela.temmer@uni-graz.at)
Author(s): (1) Temmer, M., (1) Veronig, A., (2) Rybak, J., (1) Hanslmeier, A.
Affiliation(s): (1) Institute for Geophysics, Astrophysics and Meteorology, University of Graz, Austria, (2) Astronomical Institute of the Slovak Academy of Sciences, 059 60 Tatranska Lomnica, The Slovak Republic

Abstract: We analyze solar magnetic field variations (NSO/Kitt Peak data) through solar cycle 23 with respect to rotational modulations. A comparative study to solar cycles 21 and 22 is performed. The results are compared to the rotational behavior of activity tracers like Sunspot Numbers and solar flares. Periodical occurrences of flares often match the 27-day solar rotation due to recurrent stable sunspot groups and complexes of activity which likely produce more flare events than short-living small sunspots. However, periods with strong deviations from the solar rotation are obtained for higher energetic flares. The solar magnetic field is found to vary on similar time scales, which suggests a close relation to the occurrence of strong flare events.

Contribution number: I.27p
Title: **On the Formation of the Zonal Structure of the Solar Magnetic Field**
Presenting author: **Makarov, Valentine** (makarov@gao.spb.ru)
Author(s): (1) Tlatov, A.G., (1) Makarov, V.I., (2) Sivaraman, K.R.
Affiliation(s): (1) Pulkovo astronomical observatory, St-Petersburg 196140, Russia, (2) Indian Institute of Astrophysics, Bangalore, 560034, India

Abstract: We have picked magnetic elements with sizes (D) greater than 12 arc sec and of intensity (of magnetic field) B ¿ ±8 G from the daily SOHO/MDI magnetograms for the period 1996 - 2002 and have determined their sizes, areas, coordinates, magnetic flux and intensity. On an average, we have in our collection of about 800 magnetic elements for each day and a total of about 1.4 million elements for this period. We have determined the latitude - time distribution of these magnetic elements. From this we find, that the zonal structure of the magnetic field of the Sun described by magnetic elements of sizes in the range of 28 - 48 arc sec is identical to that derived from the Hα - synoptic charts.

Contribution number: I.28p
Title: **The automated analysis of solar active regions**
Presenting author: **Verwichte, Erwin** (Erwin.VERWICHTE@oma.be)
Author(s): Verwichte, E.
Affiliation(s): Royal Observatory of Belgium, Brussels, Belgium

Abstract: Developments in the automated identification of solar active regions and the characterisation of their coronal emission will be presented. Active regions are studied because they are primary sources of solar activity. Central to this effort is the image data archive of the Extreme-ultraviolet Imaging Telescope (EIT), which now spans seven years of the current solar cycle, and whose increasing size favours the application of automated analysis schemes. Michelson Doppler Imager (MDI) magnetograms are used for the localisation of active regions. The ultimate goal of this work is to classify active regions on the basis of their coronal emission and to characterise their main constituents, i.e. coronal loops.

Contribution number: I.29p
Title: **The Influence of Ion-acoustic Turbulence on the Electron Acceleration in Reconnecting Current Sheet**
Presenting author: **Wu, Guiping** (wuguiping@seu.edu.cn)
Author(s): (1) Wu, G.P., (2) Huang, G., (3) Tang, Y.H.
Affiliation(s): (1) Department of Physics, Southeast University, China (2) Purple Mountain Observatory, China (3) Department of Astronomy, Nanjing University, China

Abstract: It's widely accepted that the magnetic reconnection in the current sheets is the basic process for the flare and the particle acceleration to take place. Under the assumption of quasi-stable magnetic reconnection, we first argue that the ion acoustic wave should be excited due to the average drift velocity of electrons relative to protons inside the current sheet is larger than the thermal velocity, which are accelerated by super-Drecier electric field induced by reconnection , while the wave-particle interaction leads the fast reconnection to occur. Then, based on the time scales of the electron acceleration in three-dimensional magnetic reconnecting current sheets , we study the evolution of energetic electrons in different parameters by solving the Fokker-Planck equation, which includes induced time-dependant electric field, ion-acoustic turbulence scattering. The calculated results may be used to explain the evolution of the hard x-ray and microwave spectrum of flare on 2000 March 6.

Session II

SPECTRAL IRRADIANCE VARIABILITY ORIGINATING IN THE PHOTOSPHERE, CHROMOSPHERE AND CORONA

Conveners: Judit PAP / Claus FRÖHLICH

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Session Chair: L. FLOYD

14:00 - 14:15 **J. Pap**, L. Floyd, R. Helizon:
Long-Term Variations of Total Solar and UV Irradiances

14:15 - 14:30 **M.T. DeLand** and R.P. Cebula:
NOAA-9 SBUV/2 Solar UV Data for Cycle 22

14:30 - 14:45 **M. Haberreiter**, E. Rozanov, W. Schmutz:
Variability of Solar UV radiation

14:45 - 15:15 **F. Eparvier** and T. Woods:
Solar EUV Spectral Irradiance: Measurements and Variability (invited)

15:15 - 15:45 Coffee break

Session Chair: J. Pap

15:45 - 16:15 **S. Walton**:
Modeling the TSI Using Ground-Based Observations: Recent Progress and New Questions (invited)

16:15 - 16:45 **P. Fox**:
Current Status, Outstanding Issues and Future Directions for Physics-based Solar Irradiance Variability Models (invited)

16:45 - 17:00 **S.K. Solanki**, A. Seleznyov, N.A. Krivova:
What Causes Irradiance Variations on Minutes to Days Time Scales?

17:00 - 17:15 A. Ortiz, **V. Domingo**, B. Sanahuja:
Contribution of the Small Photospheric Magnetic Elements to the Long-term Solar Irradiance Variability

17:15 - 17:30 F. Berrilli, **D. Del Moro**, S. Giordano, G. Consolini, A. Kosovichev:
Characterization of Supergranular Features via Topological Measures

17:30 - 18:00 **V.I. Makarov**, A.G. Tlatov, D.K. Callebaut:
Temperature of Solar Corona During the Last 50 Years (invited)

Invited and Oral Contributions:

Title: **Long-Term Variations in Total Solar and UV Irradiances**
Presenting author: **Pap, Judit, M.** (papj@marta.gsfc.nasa.gov)
Author(s): (1) Pap, J., (2) Floyd, L., (3) Helizon, R.
Affiliation(s): (1) UMBC, MD, USA (2) Interferometics./NRL, USA, (3) JPL, USA

Abstract: In this paper we show the recent results on total solar and UV irradiance variations and their relation to solar magnetic activity over solar cycles 21 to 23. Comparison of the multi-decade long irradiance and magnetic field measurements indicates that the shape and magnitude of irradiance variations are different from that of magnetic indices. Specifically, while magnetic indices show that solar cycle 23 is weaker than the two previous cycles, the long-term variation of total solar irradiance over solar cycles 21 to 23 is rather symmetrical, showing that its maximum and minimum levels were about the same within their measuring uncertainties. In this paper we address the questions: (1) is there a strict linear relationship between solar variability and irradiance variations; (2) what is the role of weak magnetic fields in irradiance changes; (3) is there a significant non-magnetic component in the observed irradiance variations? The results presented in this paper underscore the need to further develop new analysis techniques to determine whether there is a secular variation in solar irradiance over years to decades - a necessary step to study and predict the climate impact of solar variability.

Title: **NOAA-9 SBUV/2 Solar UV Data for Cycle 22**
Presenting author: **DeLand, Matthew, T.** (matt-deland@sesda.com)
Author(s): DeLand, M.T., Cebula, R.P.
Affiliation(s): Science Systems and Applications, Inc., Lanham, MD, USA

Abstract: The NOAA-9 SBUV/2 instrument collected solar spectral UV irradiance data (170-400 nm) from March 1985 to July 1997, covering the entire range of solar cycle 22. We have used multiple techniques to create a long-term calibration for the NOAA-9 irradiance data set. The corrected data will be compared with overlapping results from NOAA-11 SBUV/2, UARS SUSIM, and UARS SOLSTICE. The NOAA-9 SBUV/2 data set provides the final component needed to construct a continuous record of solar UV irradiance data from November 1978 to the present.

Title: **Variability of the solar UV radiation**
Presenting author: **Haberreiter, Margit** (m.haberreiter@pmodwrc.ch)
Author(s): (1)(2) Haberreiter, M., (1) Rozanov, E., (1) Schmutz, W.
Affiliation(s): (1) Physical Meteorological Observatory Davos, Davos, Switzerland, (2) Intstitute for Astronomy, ETH Zurich, Switzerland

Abstract: Due to its strong influence on the terrestrial stratosphere, we model the variability of the solar UV radiation from 1200A to 3000A. As the continuum and lines are not formed in local thermodynamic equilibrium below 2000A, it is necessary to model the spectrum in this wavelength region in non-LTE. For this purpose we apply the code COSI (COde for Solar Irradiance). The

latest theoretical photoionization cross sections of the elements most abundant in the Sun (H-, H I, C I, Mg I, Al I, Si I, Fe I) have been implemented in the code. We present non-LTE spectra of the Sun for the different temperature stratifications of the quiet Sun, sunspots and faculae. In particular, we also account for the rising temperature profile of faculae. The reconstruction of the solar UV irradiance on the time scale of years is based on magnetograms of the solar disc. By deriving weighting factors for sunspots and faculae, we account for their varying contribution to the solar spectrum. Our results are compared with observational data.

Title: **Solar EUV Spectral Irradiance: Measurements and Variability (Invited talk)**

Presenting author: **Eparvier, Francis, G.** (eparvier@colorado.edu)
Author(s): Eparvier, F.G., Woods, T.N.
Affiliation(s): University of Colorado - LASP, Boulder, CO, USA

Abstract: Quantification of the solar extreme ultraviolet (EUV) spectral irradiance in both absolute value and variabilty over time is of vital importance for understanding the structure and variability of the Earth?s thermosphere and ionosphere. Observations of solar EUV irradiance have been sporadic, limited in both temporal and spectral coverage, with large absolute uncertainties. The measurements have often raised more questions than they have answered. The maximum of solar cycle 23 has seen the beginning in a new era of solar EUV observations with unprecedented accuracy and precision. This paper will provide overviews of the history of EUV spectral irradiance measurements, the current state of measuring and understanding solar EUV variability, and the future measurement plans into solar cycle 24 and beyond.

Title: **Modeling the TSI Using Ground Based Observations: Recent Progress and New Questions (Invited talk)**

Presenting author: **Walton, Stephen** (stephen.walton@csun.edu)
Author(s): Walton, S.
Affiliation(s): San Fernando Observatory, CSU Northridge, USA

Abstract: I will report on the recent results from the San Fernando Observatory (SFO) in our efforts to understand the sources of solar irradiance variability. The results are based on the SFO's ongoing full disk photometric images program, which has now accumulated about 1-1/2 solar cycles of data. The results are in three parts: (1) statistics of solar active regions and their possible variation during the solar cycle; (2) modeling of the total solar irradiance using the photometry of both individual features and the entire disk; and (3) the relative contribution of bright features to increases in TSI. Because resolved absolute photometry of the solar disk has not yet been carried out, all of these results are based on regression analyses. I will discuss what progress we can still make with such analyses, and close with a prediction of what future absolute solar photometry may tell us.

Title: **Current status, outstanding issues and future directions for physics-based solar irradiance variability models (Invited talk)**

Presenting author: **Fox, Peter, A.** (pfox@ucar.edu)
Author(s): Fox, P.A.
Affiliation(s): High Altitude Observatory, National Center for Atmospheric Research. USA

Abstract: In this presentation we present the current state of physics-based radiative transfer models of the solar spectrum including: physical approximations and completeness of atomic and molecular input data. We will present the results of the application of these models to the problem of solar spectral synthesis for parts of the UV, visible and near-IR solar spectrum, and compare them to related observations. We also estimate the variability due to solar surface activity. Finally, we will indicate near-future directions for such synthesis models. (NCAR is sponsored by the National Science Foundation. This work is sponsored by the NSF RISE program and the NASA SORCE program.)

Title: **What causes irradiance variations on minutes to days time scales?**

Presenting author: **Solanki, Sami, K.** (solanki@linmpi.mpg.de)
Author(s): Solanki, S.K., Seleznyov, A., Krivova, N.A.
Affiliation(s): Max-Planck-Institut fuer Aeronomie, Katlenburg-Lindau, Germany

Abstract: Solar irradiance measurements available since 1978 show that it varies on all accessible time scales. A lot of effort has gone into understanding the irradiance variations on time scales of days up to a solar cycle, which clearly demonstrated that their main driver is the evolution of the solar surface magnetic field. The origin of variations on shorter time scales remains unclear. We analyze solar variability on time scales of minutes to days.

Title: **Contribution of the Small Photospheric Magnetic Elements to the Long-term Solar Irradiance Variability**

Presenting author: **Domingo, Vicente** (vdomingo@uv.es)
Author(s): (1) Ortiz, A., Domingo, V., Sanahuja, B.
Affiliation(s): (1) Universitat de Barcelona, Dept. Astronomia i Meteorologia, Barcelona, Spain

Abstract: Solar Active Regions (AR) are considered to be the main drivers of total and spectral irradiance variations on time scales of a solar rotation. However, the situation is less clear when variations of the irradiance are considered on solar cycle time scales ($\approx 0.1\%$ from minimum to maximum). Different mechanisms have been proposed as responsible for those variations; among them, the small scale magnetic elements composing the enhanced and quiet network. This is a key question for understanding the solar cycle and the underlying physical processes. We have analyzed the long-term evolution of the intensity contrast of small magnetic features -faculae and magnetic network- as a function of position, magnetic signal and time, from minimum to maximum of cycle 23, in order to study their possible contribution to the solar cycle irradiance variations. We

have used near-simultaneous full disk magnetograms and images of the photospheric continuum intensity provided by MDI/SOHO. We found evidence that the change from minimum to maximum in the contribution of the small magnetic elements (specially the network) is significant, and are a good candidate to be the main responsible for the long-term irradiance variations.

Title: **Characterization of supergranular features via topological measures**
Presenting author: **Del Moro, Dario** (delmoro@roma2.infn.it)
Author(s): (1) Berrilli, F., (1) Del Moro, D., (1) Giordano, S., (2) Consolini G., (3) Kosovichev, A.G.
Affiliation(s): (1) Physics Department, Rome 'Tor Vergata' University, Italy, (2) IFSI/CNR, Rome, Italy, (3) Stanford University, Stanford, USA

Abstract: The spatial configuration of enhanced magnetic field (active regions) in the outer layers of the Sun derives from the interaction between convective flows with the solar magnetic field. Temporal evolution of active regions is considered the main responsible of radiative output variations. Particularly, supergranular convective flows, advecting magnetic flux tubes, produce the magnetic network that results located on the boundaries of supergranular cells. We present the preliminary results of the application of two analysis methods: the Pair Correlation Function $G_2(r)$ and the Information Entropy, applied to segmented images obtained from MDI/SOHO, to investigate the spatial correlation length in supergranular structures and the possible appearance of near neighbor order in such structures.

Title: **Temperature of Solar Corona During the Last 50 Years (Invited talk)**
Presenting author: **Makarov, Valentine** (makarov@gao.spb.ru)
Author(s): (1) Makarov, V.I., (1) Tlatov, A.G., (2) Callebaut, D.K.
Affiliation(s): (1) Pulkovo astronomical observatory, St-Petersburg 196140, Russia, (2) Physics Dept., UIA, University of Antwerp. B-2610, Antwerp, Belgium

Abstract: Recently it was found that the area of polar zones of the Sun, Apz, occupied by unipolar magnetic field at the minimum sunspot activity, has risen by a factor of two during the last 120 years, (Makarov et al., 2002). In this connection we have studied the long-term changes of polar corona intensity and temperature during 1952-2000, (Makarov et al., 2002a). We continued the study of long-term variations of temperature in the solar corona at the all latitudes. The combined Kislovodsk series of the green (FeXIV 5303; KI5303), and red (FeX 6374; KI6374) coronal intensities for 1952-2002 has been obtained using the coronal observations at the Kislovodsk, Arosa, Pic du Midi, Norikura, Wendelstein and Lomnicky Stit. The mean monthly corona intensity has been calculated in the sunspot zone (0 - 40) degrees and at the high-latitude zone (40 - 85) degrees. It was found that the value of KI5303 decreased 1.5 time at the high-latitudes during the last 50 years. Using the ratio KI6374/KI5303 we found the 22-year solar cycles in coronal temperature. The maximum ratio KI6374/KI5303 is observed during the minimum sunspot activity. It shows a long-term increase (more than twice) during the last 50 years. It corresponds to a change of the mean corona temperature about 0.1K million. In reality, the coronal temperature may be (0.1 - 1.0)K million hotter or cooler than the mean one in the different quite and active regions. It is supposed that the polar decrease of coronal temperature is connected with an increase of the magnetic flux from high-latitude regions of the Sun and increase of polar coronal hole sizes. References: 1. Makarov V.I., Tlatov A.G., Callebaut D.K. and

Obridko V.N.: 2002, Solar Phys. 206, 383; 2. Makarov V.I., Tlatov A.G., Callebaut D.K.: 2002a, Proc."SOLSPA 2001: The Second Solar Cycle and Space Weather Conference", ESA SP-477, 241.

Posters:

Contribution number: II.1p
Title: **Report of the ISCS Working Group 1, Panel 2**
Presenting author: **Eparvier, Francis, G.** (eparvier@colorado.edu)
Author(s): (1) Eparvier, F.G., (2) Schmidtke, G., (3) Tobiska, W.K., (1) Woods, T.N., (4) Winningham, D., (5) Solomon, S.C.
Affiliation(s): (1) University of Colorado - LASP, Boulder, CO, USA, (2) Fraunhofer-IPM, Freiburg, Germany, (3) Space Environment Technologies, Pacific Palisades, CA, USA, (4) Southwest Research Inst., San Antonio, TX, USA, (5) NCAR - High Altitude Observatory, Boulder, CO, USA

Abstract: Working Group 1, Panel 2 of the SCOSTEP International Solar Cycle Study ISCS has had two main thrusts. The first has been the Thermospheric/Ionospheric Geospheric Research (TIGER) program. The primary objective of the TIGER program is to provide the scientific community with parameters representing the variable solar EUV/UV and X-ray irradiances as well as the solar wind-originated energy influx which can be used to improve existing and future thermospheric-ionospheric models. This paper will present a report of the recent and future activities of the program, including the 4th (Virtual) TIGER Symposium held on the internet in June, 2002, and the inclusion of the 5th TIGER Symposium as a special session in the 2004 COSPAR meeing in Paris. The second thrust of Working Group 1, Panel 2 has been the development of a draft standard for solar irradiance for the International Standards Organization (ISO). Designated as ISO-21348, this draft standard is currently under review by the member countries. This paper will give a brief overview of the ISO solar irradiance draft standard and of its review status.

Contribution number: II.2p
Title: **Origins of Strong Solar Geo-effective Events as seen by SXT Telescope**
Presenting author: **Gburek, Szymon, J.** (sg@cbk.pan.wroc.pl)
Author(s): (1) Gburek, S., (1) Sylwester, J.
Affiliation(s): (1) Space Research Centre, Polish Academy of Sciences, Solar Physics Division, Wroclaw, Poland

Abstract: We investigate origins of stronger solar geo-effective events in soft X-rays. The data from SXT telescope on Yohkoh satellite are used to address this issue. The investigation covers the period since September 1991 to December 2001 - the Yohkoh mission duration. For selected events their coincidence and relationship to flares, coronal mass ejections and/or solar energetic particle emission is studied also.

Contribution number: II.3p
Title: **Modeling solar irradiance variations through PSPT full-disk images and semiempirical atmospheric models**
Presenting author: **Penza, Valentina** (penza@roma2.infn.it)
Author(s): (1) Penza, V., (1) Caccin, B., (2) Ermolli, I., (2) Centrone, M.
Affiliation(s): (1) Universita di Roma Tor Vergata, Rome, Italy, (2) IFA - Osservatorio Astronomico di Roma, Rome, Italy

Abstract: We try to reconstruct the variations of the disk integrated spectrum, both in the spectral ranges of VIRGO (blue at 403 nm, green at 501 nm and red at 863 nm) and in the bolometric flux, using semiempirical models (FAL models, Fontenla et al., 1999), built to reproduce different regions of the solar atmosphere. Each computed spectrum is weighted with the corresponding disk coverage factor, provided by the Rome PSPT observations. We present the results obtained reconstructing variations measured by VIRGO bolometers during periods spanning from a solar rotation up to the entire ascending phase of solar cycle 23.

Contribution number: II.4p
Title: **Semiempirical modeling of bright magnetic structures observed with Rome PSPT**
Presenting author: **Penza, Valentina** (penza@roma2.infn.it)
Author(s): (1) Penza, V., (1) Caccin, B., (2) Ermolli, I., (2) Centrone, M.
Affiliation(s): (1) Universita di Roma Tor Vergata, Rome, Italy (2) IFA - Osservatorio Astronomico di Roma, Rome, Italy

Abstract: Since 1981, several attempts to build semiempirical models designed to represent the various types of active regions across the solar disk (quiet Sun, network and faculae), have followed one another. Here we test the capability of those calculated by Fontenla et al. (1999) to reproduce different experimental data, comparing the computed spectra with the observations made by the PSPT of the Rome Observatory. In particular, we study the average center-limb variation of the network and facular contrast. In this way, we are able to single out the models better reproducing the different structures operationally identified by the PSPT data analysis.

Contribution number: II.5p
Title: **High resolution temporal and spatial dynamics of solar flares from the SPIRIT MgXII 8,42A spectral images of the Sun**
Presenting author: **Pertsov, Andrey, A.** (perzov@sci.lebedev.ru)
Author(s): Pertsov, A., Zhitnik, I., Bougaenko, O., Ignatiev, I., Krutov, V., Kuzin, S., Mitrofanov, A., Oparin, S., Slemzin, V.
Affiliation(s): P.N. Lebedev Physical Institute, Moscow, Russia

Abstract: One of the main tasks of the SPIRIT experiment on-board the Coronas-F satellite, started in 2001, is an investigation of dynamics of solar flares with high spatial (10") and temporal (10 s) resolution in hot (10 MK) MgXII 8.42 A line. For studying of the flare triggering

mechanism, the most interesting is to see with such resolution pre-flare and impulse phases of flare several minutes before and after the flare maximum. Because of telemetry limitations, as well as an impossibility to predict a place and time of flare event, a special software was developed and uploaded to the instrument which permits to monitor for a long time (up to one day) the flare events by measuring of the MgXII radiation level without sending the data to the telemetry. Before the flare images of the Sun are keeped in special cyclic buffer. In case of flare event the instrument sends to the telemetry last(10)full disk images,registered before the event, and 54 flare images in the window of 1/4 of the disk centered in place of the flare event. Using such mode, several tens of flares were registered with temporal resolution of 7 s during a continuous time of observation of 7 min. Tuning the level of flare detection by commands, in some cases a frequency of observed weak flare events was sufficiently increased (up to 10 times). Some examples of the data obtained are emonstrated (movies, time dependencies of the intensity in the flare maximum and integrated over the total flare area).

Contribution number: II.6p
Title: **The total brightness of the solar corona during the eclipse June 21st 2001**
Presenting author: **Pinter, Teodor** (pinter@suh.sk)
Author(s): (1) Pinter, T., (2) Klocok, L., (2) Minarovjech, M., (2) Rybansky, M.
Affiliation(s): (1) Slovak Central Observatory, Hurbanovo, Slovakia, (2) Astronomical Institutte, Slovak Academy of Sciences, Tatranska Lomnica, Slovakia

Abstract: The total brightness of the white-light corona in the standard region (1.03 - 6.00) alter during the solar actidity cycle in relation 1:3. We have used for its determination during the 2001 solar eclipse a calibrated photographic observation. The obtained value is 1.12×10^{-6} of the total brightness of the Sun in the same spectral region. The structure and photometry of the corona are included.

Contribution number: II.7p
Title: **Reexamination of the coronal index of solar activity before the year 1965**
Presenting author: **Rusin, Vojtech** (vrusin@ta3.sk)
Author(s): (1) Rusin, V., Minarovjech, M., Rybansky, M., (2) Cliver, E. W.
Affiliation(s): (1) Astronomical Institute, SAS, T. Lomnica, Slovakia, (2) Space Weather Center of Excellence, Hanscom, USA

Abstract: The coronal green line (530.3 nm, Fe XIV) intensity of the Sun is a very useful parameter to study activity in the emission corona. To do this, an integral brightness of the green corona for the Sun as a star, called the coronal index of solar activity (CI), is obtained over the period 1939-2002. The CI computation is based on the Lomnicky Stit photometric scale where observations began in 1965 only. Data before 1965 were unified to the Lomnicky Stit scale using a cross-calibration between Pic du Midi and Arosa coronal stations. Some problems with the photometric scale for both of these stations were found in a detailed analysis. Data from Climax (1943-1965) and Sacramento Peak (1957-1965) coronal stations are taken into an account for present reexamination. Good correlations between the CI, cosmic ray intensity, and the 2800 MHz radio flux and sunspot number in the period 1965-2002 were used to recompute CI for the

1939-1965 interval. Correlations between the sunspot number and CI in the period 1965-2002 allow reconstruction of CI back to 1850.

Contribution number: II.8p
Title: **The PICARD mission**
Presenting author: **Thuillier, Gerard, O.** (gerard.thuillier@aerov.jussieu.fr)
Author(s): Thuillier, G., PICARD-team
Affiliation(s): CNRS, Verrieres le Buisson, France

Abstract: The diameter change with solar activity is controversial subject as most of the observations were made from ground. During the Maunder minimum, jean Picard made the first diameter measurements using the Sun as target for determinig the Earth'orbit eccentricity (the diameter changes with the day of the year). Later these observations normalized at one AU showed a slightly greater diameter during the deep Maunder minimum than when the Sun resumed its activity by 1715. From transists of Mercury in front the Sun, and eclipses duration, similar results were obtained. However, inconsistencies from optical ground based measurements were found (correlation, anti correlation or constant value). But, observations from balloons confirmed the a possible relationship between solar activity and diameter. As the diameter variation was obtained during the Maunder minimum, that is to say when the Earth was experiencing a particular cold period, the relation between the sun connection with climate is raised. PICARD is a mission which has a double aim, solar physics and climatology. The measurements will consist in : - diameter measurement as a function of the heliographic latitude to determine the solar asphericity, the solar limbe shape and their variability with solar activity, - measurements of the total solar irradiance, - helioseismology observations to probe the solar interior, - several spectral domains. The precision of the diameter measurements is about 1 milliarcsecond. The diameter measurements from orbit will be also performed with the same instrument to understand the role of the Earth atmosphere. Diameter observations will be refered to star angular position allowing to derive a long term trend (the star movements are known with a precision of a few mas). The mission is foreseen to take place by 2007-2008.

Contribution number: II.9p
Title: **Variations of the soft X-ray background flux and its relation to flare occurrence**
Presenting author: **Veronig, Astrid, M.** (asv@igam.uni-graz.at)
Author(s): (1) Veronig, A., (1) Temmer, M., (1) Hanslmeier, A.
Affiliation(s): (1) Institute for Geophysics, Astrophysics and Meteorology, University of Graz, Austria

Abstract: At the extreme ends of the spectrum (radio, X-rays) solar irradiance is very low but the amplitude of solar variability is most pronounced, since the radiation of flares can be quite intense.We employ the full-disk soft X-ray flux recorded by GOES in the 1-8 Angstrom passband to study the global evolution of the X-ray background flux for solar cycles 21, 22 and 23. Since the soft X-ray background flux varies by several orders of magnitudes throughout a solar cycle, it provides a very sensitive means to solar activity. The background flux has been introduced in order to represent the slowly evolving flux level that is independent of strong flare effects. However, it has been noted in previous studies that the background flux is still dominated by the flare-related

soft X-ray emission. In this paper, we investigate in detail the contribution of flares (separately for weak and intense ones) to the background flux. Furthermore, in several studies it is reported that in solar cycle 21 the peak of the soft X-ray background flux was delayed by about 2-3 years with regard to the Sunspot Numbers, whereas this peculiarity could not be seen in cycle 22 (e.g., Wagner 1988, Aschwanden 1994, Wilson 1994). Revisiting cycles 21 and 22, we conclude that this phenomenon is closely related to the flare contribution in the background flux.

Contribution number: II.10p
Title: **On the possible mechanisms of the total solar irradiance variations**
Presenting author: **Veselovsky, Igor, S.** (veselov@dec1.sinp.msu.ru)
Author(s): Veselovsky, I.S.
Affiliation(s): Institute of Nuclear Physics, Moscow State University, Moscow, Russia

Abstract: The physical causes of the total solar irradiance (TSI) variations are not known, but they should be related to the available free energy sources on the Sun. Different hypotheses are discussed about the nature of the free energy of solar cycles. Some estimates are presented for the nuclear, gravity, radiation, thermal, mechanical and magnetic free energy reservoirs and corresponding time scales of their transformations on the Sun. Based on these estimates and considerations of known structures on the Sun we conclude that known solar activity manifestations associated with the magnetic energy dissipation does not look to be of a sufficient power for the complete explanation of the observed TSI variations of the order of 10^{-3} during solar cycles. More powerful reservoirs of the free energy are involved, but the variability of the Sun is still poorly investigated and understood.

Contribution number: II.11p
Title: **The Mg II Index: A 23-year record of solar chromospheric variability**
Presenting author: **Floyd, Linton** (linton.floyd@nrl.navy.mil)
Author(s): (1) Viereck, R., (2) Floyd, L., (2) Crane, P., (3) Woods, T.N., (3) Knapp, B., (3) Rottman, G., (4) Weber, M., (1) Puga, L., (5) DeLand, M.T.
Affiliation(s): (1) NOAA Space Environment Center, 325 Broadway, Boulder CO, USA, (2) Naval Research Lab., Washington DC, USA, (3) LASP, University of Colorado, Boulder Colorado, USA, (4)University of Bremen, Germany, (5) Science Systems and Applications, Inc. (SSAI), Lanham, MD, USA

Abstract: Monitoring the variations in solar output is critical to both investigations of the sun as well as studies of how the sun affects Earth. Long-term records of solar variability include Sunspot Numbers and the f10.7 index of radio emissions. The next longest continuous measurement of solar variability is the Mg II core-to-wing index. The Mg II Index represents one of the most robust measurements of solar chromospheric variability. The Mg II Index is derived from the ratio of spectral features which allows for the combination of data from different instruments with different parameters into a single time series. Despite the fact that the seven instruments measuring the solar flux near 280 nm have different spectral resolutions and sample rates, the various efforts at combining these datasets have been quite successful. The SUSIM, SOLSTICE, GOME and four SBUV datasets have been combined to provide nearly continuous set of daily Mg

II core-to-wing values from 1978 to the present. The process of how these data were selected and combined will be described. The 23-year time series will be compared with other long-term time series of solar variability. An update on the future of the Mg II Index will also be presented.

Contribution number:	II.12p
Title:	**Global Asymmetry of the Sun Observed in the Extreme Ultraviolet Radiation**
Presenting author:	**Zhukov, Andrei** (Andrei.Zhukov@oma.be)
Author(s):	(1)(2) Zhukov, A.N., (2) Veselovsky, I.S., (1) Hochedez, J.-F., (1) Clette, F., (2) Panasenco, O.A., (1) Cugnon, P.
Affiliation(s):	(1) Royal Observatory of Belgium, Brussels, Belgium, (2) Institute of Nuclear Physics, Moscow State University, Moscow, Russia

Abstract: We report on observations of the solar luminosity variations in four SOHO/EIT bandpasses over the period 1996 - 2001, which corresponds to the first half of the current 23rd solar cycle. Contributions of active regions, bright points and intermediate brightness features are evaluated. We find that a significant contribution to the longitudinal asymmetry, and thus to the 27-day variability of the solar EUV radiation, is produced by the numerous intermediate brightness elements that are globally distributed over large areas (up to about 2/3 of the whole surface of the Sun during the activity minimum) and correspond to the 'quiet Sun'. When activity is low, the contribution of this component to the rotational modulation of the integral solar disc intensity is comparable to the contribution from localized active regions and bright points. This suggests that weak magnetic field areas outside active regions constitute an important factor through which solar activity modulates the solar EUV luminosity. The average intensity of the 'quiet Sun' exhibits the rotational modulation at least throughout half of the solar cycle observed by SOHO.

Session III

SOLAR GLOBAL CHANGES: ATMOSPHERIC/CLIMATE EFFECTS OF SOLAR VARIABILITY

Conveners: Judit PAP / Claus FRÖHLICH

SESSION III: SOLAR GLOBAL CHANGES: ATMOSPHERIC/CLIMATE EFFECTS OF SOLAR VARIABILITY

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Session Chair: P. FOX

08:30 - 09:00 **L. Svalgaard**:
Determination of Interplanetary Magnetic Field Strength, Solar Wind Speed, and EUV Irradiance, 1890-Present (invited)

09:00 - 09:30 **I. Usoskin**:
Long-term Solar Cycle Evolution (invited)

09:30 - 10:00 **N. Krivova** and S. Solanki:
Solar Total and Spectral Irradiance: Modelling and a Possible Impact on Climate (invited)

10:00 - 10:15 Coffee break

Session Chair: G. THUILLIER

10:15 - 10:45 **R. Muscheler** and J. Beer:
Long-term Climate Variations and Solar Effects (invited)

10:45 - 11:15 **J. F. Gonzalez-Rouco**, E. Zorita, U. Cubasch, H. v. Storch, I. Fisher-Bruns and U. Schlese:
Simulating the Climate since 1000 AD with the AOGCM ECHO-G (invited)

11:15 - 11:30 **S. Duhau**:
Global Earth Surface Temperature Changes Induced by Solar Dynamo Mean Magnetic Field Variations

11:30 - 11:45 **K. Georgieva**, B. Kirov, J. Javaraiah:
Solar Asymmetry and Sun-Earth Connections

11:45 - 12:15 **H. Schmidt** and G. Brasseur:
HAMMONIA: A New Whole Atmosphere Model to Investigate the Climate Effect of Solar Variability (invited)

12:15 - 12:30 **N. Kilifarska** and J. Haigh:
Effect of Solar Variability on Chemical Composition and Thermal Structures in Stratosphere Derived from HALOE Measurements

Invited and Oral Contributions:

Title: **Determination of Interplanetary Magnetic Field Strength, Solar Wind Speed, and EUV Irradiance, 1890-Present (Invited talk)**

Presenting author: **Svalgaard, Leif** (iscs@leif.org)
Author(s): (1) Svalgaard, L., (2) Cliver, E.W., (3) Le Sager, P.
Affiliation(s): (1) Easy Tool Kit, Houston, USA, (2) Air Force Research Laboratory, USA, (3) Prairie View A&M University, USA

Abstract: A newly constructed long-term geomagnetic index, the inter-daily variability (IDV; defined to be the unsigned difference between hourly averages of the H-component of the field at local midnight at a mid-latitude station for consecutive days), has the useful property that its yearly averages are highly correlated with the solar wind magnetic field strength (B) and are independent of solar wind speed (V). Existing geomagnetic records allow us to construct IDV since 1890 and thus to determine solar wind B over that period. Once B is known, we use other long-term indices with known dependence on B and V to determine the variation of V since 1890. Average B from 1890-present was 6.5 nT with no long-term trend (apart from following the sunspot cycle) and average V was 440 km/s also with no apparent trend. These results are confirmed using polar cap index data available from 1926 to the present and magnetic observations of the Amundsen and Scott polar expeditions for years near 1900. Focusing on geomagnetic activity at local midnight hours cleanly separates the EUV-driven regular variation (Sr) of geomagnetic activity from the solar wind driven component, allowing us to determine EUV variability since 1890.

Title: **Long-term Solar Cycle Evolution (Review) (Invited talk)**

Presenting author: **Usoskin, Ilya, G.** (Ilya.Usoskin@oulu.fi)
Author(s): Usoskin, I.G.
Affiliation(s): Sodankyla Geophysical Observatory (Oulu unit), University of Oulu, Finland

Abstract: The sunspot number series forms the longest directly observed index of solar activity and allows to trace its variations on the time scale of about 400 years since 1610. This time interval covers the whole range from seemingly vanished sunspots during the Maunder minimum in 1645-1700 to the very high activity during the last 50 years. Although the sunspot number series has been studied for more than a century, new interesting features still can be found. In this paper I will give a review of the last decade achievements and new findings in long-term solar activity cyclic evolution such as, e.g., relations between determinism and chaos in sunspot activity cyclicity, cycles during the Maunder minimum, scenario of a great minimum, the phase catastrophe and the lost cycle in the beginning of the Dalton minimum in 1790s, persistent 22-year cyclicity. These findings shed new light on the underlying physical processes responsible for the sunspot activity and allow for better understanding of such empirical rules as Gnevyshev-Ohl rule and Waldmeier relations. Questions on whether the present high level activity is unusual, and if the sun is entering a new great minimum will be also discussed.

Title: **Solar total and spectral irradiance: modelling and a possible impact on climate (Invited talk)**

Presenting author: **Krivova, Natalie, A.** (natalie@linmpi.mpg.de)
Author(s): Krivova, N.A., Solanki, S.K.
Affiliation(s): Max Planck Institute for Aeronomy, Katlenburg-Lindau, Germany

Abstract: There is growing evidence that solar variability influences the Earth's climate, although the underlying mechanism is not yet understood. Variations in the solar total and spectral irradiance often play a central role within various processes that have been suggested. Whereas changes in the total irradiance can affect the overall energy balance of the Earth's atmosphere, variations in its spectral distribution, in particular in the UV, have a pronounced effect on stratospheric chemistry. Measurements of the solar total irradiance are only available since 1978 and the spectral irradiance record is even shorter. This calls for a reconstruction of irradiance variations for earlier times with the help of models. We first outline our current understanding of the main mechanism responsible for irradiance variations and describe the efforts to reconstruct them. The reconstructed total and UV irradiance is then employed to estimate the solar contribution to global warming, with particular emphasis to the period since 1970.

Title: **Long-term Climate Variations and Solar Effects (Invited talk)**

Presenting author: **Muscheler, Raimund** (raimund.muscheler@geol.lu.se)
Author(s): (1) Muscheler, R., (2) Beer, J.
Affiliation(s): (1) Quaternary Geology, Lund University, Sweden (2) EAWAG, Switzerland

Abstract: The cosmogenic radionuclides 14C, 10Be and 36Cl allow us to trace solar variability several tens of millennia back in time. Several approaches to reconstructing past solar variability based on radionuclide concentrations measured in ice cores will be presented. The similarity in the variability of measurements of solar magnetic activity and solar irradiance during the last 20 years makes cosmogenic radionuclides a promising tool for reconstructing the variability of solar irradiance in the past. The analysis of many well-dated, high-resolution climate records and the comparison with radionuclide records clearly indicates that solar forcing plays an important role in climate change. However, the mechanisms of how the sun influences climate are still a matter of debate and the climate records do not yet show a conclusive picture.

Title: **Simulating the Climate Since 1000 AD with the AOGCM ECHO-G (Invited talk)**

Presenting author: **Gonzalez-Rouco, Fidel, J.** (fidelgr@fis.ucm.es)
Author(s): (1) Gonzalez-Rouco, J.F., (2) Zorita, E., (3) Cubasch, U., (2) von Storch, H., (4) Fisher-Bruns I., (4) Schlese, U.
Affiliation(s): (1) Universidad Complutense Madrid, Spain, (2) GKSS Research Center, Germany, (3) Freie Universitaet Berlin, Germany, (4) Max Planck Institute, Hamburg, Germany

Abstract: Assessment of climate variability and changes through the last millennium is crucial for understanding and modeling current and future climate. Efforts have relied both in the statistical reconstruction of climate variability using proxy data and the numerical simulation of past climate states with the use of climate models. Numerical simulations have used models and experiments of varying complexity and design mostly focused on the impacts of solar variability on climate. This work explores the response of a 'state-of-the-art' global atmosphere-ocean climate model to changes in external forcing. The analysis focuses on two long climate integrations with the ECHO-G global climate model (MPI, Hamburg) in which the external forcing has been gradually changed along the simulations according to the estimations of changes in the solar irradiance, atmospheric reflectivity due to volcanic eruptions and the concentrations of greenhouse gases. One of this integrations (I1) covers the period AD 1500 to 1990 and a second integration (I2) has been started in year AD 1000 and will continue up to AD 1990. I1 simulates a global cooling during the Little Ice Age of about 0.6 K respect to the 1960-90 period. The coldest periods coincide in the timing with the Late Maunder Minimum and the Dalton Minimum with global temperatures on average 1 K colder than present. The spatial response pattern of temperatures is consistent with the greenhouse gasses scenario simulations and reproduces colder temperatures mainly over the continents and in the northern latitudes of the Northern Hemisphere. I2 reproduces a warmer climate during the 11th and 12th century compared to the Little Ice Age period in agreement with the existence of a Medieval Optimum. The response of simulated temperatures to the changes in the external forcing will be discussed in both integrations in comparison with a 1000 year long control integration.

Title: **Global Earth Surface Temperature Changes Induced by Solar Dynamo Mean Magnetic Field Variations**

Presenting author: **Duhau, Silvia, N.** (duhau@df.uba.ar)
Author(s): Duhau, S.
Affiliation(s): Departamento de FIsica, Facultad de Ciencias Exactas y Naturales, Universidad de Buenos Aires, Buenos Aires, Argentina

Abstract: There are some evidences that support global climatic change by cosmic rays and ionosphere-ground electrical circuit variations, in turn these variations are strongly linked to sudden commencement storms (SSC). Here we define a SSC index as the product of the amplitude by the duration time of each SSC. A wavelet multi-resolution analysis of yearly means of global temperature, radiative input and SSC index time series since 1868 is performed. It is found that for time scales larger than 60 years a 70% of the long term global change in earth surface temperature might be attributed to SSC index and the remainder 3% to solar irradiance. This finding is discussed in the light of long term evolution of solar magnetic dynamo field and related parameters. In particular it is shown that the long term surface temperature variation has its minimum value around 1995 and monotonically decreases afterward. This tendency could be maintained for the forthcoming years following the descending chaotic transition that solar dynamo system started around 1993.

Title: **Solar Asymmetry and Sun-Earth Connections**

Presenting author: **Georgieva, Katya, Y.** (kgeorg@bas.bg)
Author(s): (1) Georgieva, K., (1) Kirov, B., (2) Javaraiah, J.
Affiliation(s): (1) Solar-Terrestrial Influences Laboratory, Bulgaria, (2) Indian Institute of Astrophysics, India

Abstract: It has been found that the effect of solar activity on climate depends on the North-South solar activity asymmetry: when the Northern solar hemisphere is predominantly more active, the surface air temperature is higher in solar activity maximum, and when more active is the Southern solar hemisphere, higher temperatures are registered at solar minimum. A dependence has been also demonstrated of the long-term changes of the correlation between solar and geomagnetic activity, and between atmospheric circulation and Earth rotation rate on solar activity asymmetry. The dependence of terrestrial phenomena and solar-terrestrial connections on solar asymmetry implies that the two solar hemispheres affect the Earth in a different way. The different behavior of the interplanetary magnetic field originating from the Northern and Southern solar hemispheres has been shown earlier. An important element of the solar dynamo which is responsible for the solar magnetic field is the solar differential rotation. We study the variations in the solar equatorial rotation rate and in the latitudinal gradient of the differential rotation in the period 1881-1994. We find that the two hemispheres rotate differently, and show that the interplanetary magnetic field at the Earth's orbit is related to the differential rotation of the more active solar hemisphere. One feature that is persistently different in the two solar hemispheres is the prevailing magnetic helicity, which is carried to the Earth by magnetic clouds preserving the helicity of the source region of their origin. We show that the reaction of the atmosphere to the arrival of magnetic clouds depends on the helicity of the clouds.

Title: **HAMMONIA: A New Whole Atmosphere Model to Investigate the Climate Effect of Solar Variability (Invited talk)**

Presenting author: **Schmidt, Hauke** (hauke.schmidt@dkrz.de)
Author(s): Schmidt, H., Brasseur, G.P.
Affiliation(s): Max-Planck-Institute for Meteorology, Hamburg, germany

Abstract: The HAMMONIA general circulation and chemistry model is covering the atmospheric altitude range from the Earth's surface up to about 250 km. It is designed to study interactions between chemistry, dynamics and radiation in the mesosphere, lower thermosphere (MLT) region and the coupling between the atmospheric spheres. The realistic simulation of solar-terrestrial coupling and the identification of natural and anthropogenic causes of the observed climate trends will be major tasks for the model. Its physical part is based on the ECHAM5 general circulation model, extended by various physical parameterizations and a neutral chemistry scheme (MOZART3) to account for important processes in the upper atmosphere. This paper is intended to introduce the model formulation and to present first simulation results obtained with the model version including fully interactive chemistry and physics.

Title: **Effect of Solar Variability on Chemical Composition and Thermal Structures in Stratosphere Derived from HALOE measurements**
Presenting author: **Kilifarska, Natalya, A.** (n.kilifarska@ic.ac.uk)
Author(s): Kilifarska, N., Haigh, J.
Affiliation(s): Imperial College, London, UK

Abstract: 11 years data for H2O, O3, NOx and T from HALOE instrument, based on UARS satellite are analysed. A multi-regression procedure (M.R. Allen, 1999) is applied over deseazonalized zonal mean time series in order to extract the signal of solar variance as well as to separate it from effect of other factors (such as trend, QBO, ENSO, NAO, etc.) affecting chemical and thermal regime of the stratosphere. The possibility for modulation the UTLS (upper troposphere and lower stratosphere) H2O concentration and its likely role for amplifying the climate sensitivity to variations in solar irradiance will be discussed.

Posters:

Contribution number: III.1p
Title: **Effect of Solar Activity on Regional Climate Parameters**
Presenting author: **Almleaky, Yaseen, M.** (ymleaky@kaau.edu.sa)
Author(s): Almleaky, Y.M., Sharaf, M.A., Basurah, H.M., Malawi, A.A.
Affiliation(s): Astronomy Dept., Science Fac., KAAU, Jeddah 21589, Saudia Arabia

Abstract: In this paper we investigated the effect of solar activity on regional climate parameters in Jeddah. We mainly used a theoretical representation for the variations in the humidity, rain fall and mean temperature with sunspot number during the years from 1978 to 2001. By utilizing Fourier series, the results are shown to be very accurate indicating that the calculated and the observed variations for both climate parameters and sunspots are typically identical. A result which is optimistic for obtaining accurate prediction formulae for climatical parameters.

Contribution number: III.2p
Title: **Possible Connections Between Solar Activity Indices**
Presenting author: **Bebars, Esha, A.** (bebarsesha@ yahoo.com)
Author(s): Bebars, E.A.
Affiliation(s): National Research Institute of Astronomy & Geophysics, Egypt

Abstract: Recent researches have concluded that the highest response of the temperature variations to solar cyclic variations has been found over the desert around 30 degrees latitudes than Other higher geographical bands. The present work is a trial to investigate above statement. We analyze the variations of the annual mean temperature over three cities in Egypt located around +30 latitude. These cities represent coastal (Alexandria), in land (Cairo), and semitropical (Aswan) using different solar activity indices. Over these zones, the results have clarified the presence of surface temperature periodicity of about (10.0-11.7 year) closely similar to the

famous one of the solar activity cycles. A peak of about 5.2 year is also noticed. An acceptable correlationship between the periodical variations of the local temperature and the solar activity parameters isinvestigated,especially before the 90th.

Contribution number:	III.3p
Title:	**Ionization by Galactic Cosmic Rays in the Ionosphere and Atmosphere Depending on the Solar Activity**
Presenting author:	**Buchvarova, Marusja, B.** (marusjab@yahoo.com)
Author(s):	(1) Buchvarova, M., (2) Velinov, P.I.Y.
Affiliation(s):	(1) Space Research Institute,BAS, Sofia, Bulgaria, (2) Central Solar-Terrestrial Influences Laboratory, BAS, Sofia, Bulgaria

Abstract: Cosmic rays (CR) create the lower part of the planetary ionosphere. There are some methods for calculation of the ionization by galactic and solar CR. However, at the high latitudes and in the polar ionosphere the anomalous CR component and the solar CR have significant contribution. Considering this, we demonstrate a model for calculation of the differential CR spectrum D(E) on the basis of satellite measurements. Spectrums for the periods of solar maximum and solar minimum are shown. These D(E) are compared with the results of CAPRICE experiment. The integral CR spectra D(¿E) with account of anomalous component are obtained and compared also. Formulas for the electron production rate q (cm-3.s-1) at height h in the planetary ionosphere as a result of the penetration of energetic particles are deducted in this paper. For this purpose, a law of transformation of the energy of the particles in their penetration through the ionosphere - atmosphere system is obtained. Our analyses show that: 1. The ionization effect of the galactic CR is inverse to the level of the solar activity (expressed by sunspot number, or Wolf number W) because of the solar wind modulation of the high energetic particles. 2. The galactic CR have important influence on the solar-terrestrial relations during the solar minimum, while the solar CR during the solar maximum.

Contribution number:	III.4p
Title:	**Solar Activity, Geomagnetic Field Variations And Human Physiological State**
Presenting author:	**Dimitrova, Svetla, G.** (svetla-stil@abv.bg)
Author(s):	Dimitrova, S., Stoilova, I.
Affiliation(s):	Solar Terrestrial Influences Laboratory, Bulgarian Academy of Sciences. Spfia, Bulgaria

Abstract: We have studied the influence of changes in geomagnetic activity (different indices) on human physiological and psycho-physiological parameters and behavioral reactions. In this paper we present the results obtained from the investigations of changes in Dst-index and their influence on some physiological parameters - systolic and diastolic blood pressure and pulse-rate. In the experiment took part 86 working volunteers. Some of them were taking medicaments because of cardio-vascular complaints. The registrations of the physiological parameters were performed every day at one and the same time for each person during the autumn and spring equinox. Multi-way Analysis of Variance (MANOVA) was employed and the influence of the factors - Dst-index, medicaments, blood pressure disturbances and sex was investigated. The results obtained

suggest that most of the persons irrespectively to their health status could be sensitive to geomagnetic storms. When geomagnetic activity increases (Dst-index decreases) arterial blood pressure increases statistically significantly. The medicaments used make stable till some extend physiological parameters and decrease expected higher sensibility for the group taking medicaments.

Contribution number: III.5p
Title: **Solar Activity Influence on Climate in Indonesia**
Presenting author: **Djamaluddin, Thomas** (t-djamal@bdg.lapan.go.id, t-djamal@hotmail.com)
Author(s): Djamaluddin, T.
Affiliation(s): National Institute of Aeronautics and Space (LAPAN),Bandung, Indonesia

Abstract: As maritime continent in equator region, Indonesia is very important to be source of global atmospheric convection affecting climate. The role of solar activity in variation of climate parameters in Indonesia will be reported in this paper. The solar activity influence on climate has been analyzed by using available data. Cloud amount, rainfall, surface temperature, and pressure are analyzed by using weighted wavelet Z-transform to find indication of solar activity signal. It is found that solar cycle periodicities appear in periodicity spectral of some climate parameters, e. g. in cloud amount. Unfortunately, strong effect of ENSO and volcanic dust make the solar influence cannot be seen in direct correlation. The effect of solar activity on surface climate parameters appears to be different in one region to the others. Possible indirect mechanisms of solar-climate relationship in Indonesia will be discussed.

Contribution number: III.6p
Title: **On the Nature of the Steep Changes in Solar and Geomagnetic Activity after 1923 and 1993.**
Presenting author: **Duhau, Silvia, N.** (duhau@df.uba.ar)
Author(s): Duhau, S.
Affiliation(s): Departamento de Fsica, Facultad de Ciencias Exactas y Naturales, Universidad de Buenos Aires, Buenos Aires, Argentina

Abstract: It was shown that the 11-year cycle amplitude modulation has suffered an ascending chaotic transition after 1923, leading the solar mean magnetic field almost to duplicate in less than 30 years, and that a descending transition started at year 1993 (S. Duhau, Solar Phys., in press). To investigate the nature of these steep changes we perform a multi-resolution wavelet analysis of the relationship between long term evolution in Wolf sunspot number, geomagnetic index aa time series and 160-day periodicity in sunspots (1844-2002). The same methodology is applied to the study of the sudden commencement index (SSC) (1968-1993), defined for each storm as the product of its amplitude and duration time. We find that the chaotic ascending transition is synchronic with the strengthening of the 160-day periodicity, while the SSC index is inversely related to the 160 days periodicity and had reached during sunspot cycle 22 its largest value since 1868. In the light of dynamo theory we conclude that new magnetic flux has been injected to the dynamo layer from the convective region during the ascending transition wile during cycle 22 strong toroidal fields were ejected by the solar dynamo system leading to intense sudden commencement geomagnetic storms. The knowledge of SSC index time series after 1993 will help in long term forecasting of solar activity.

Contribution number: III.7p
Title: **Total Ozone Content Changes Associated to Solar Dynamo Magnetic Field Variations**
Presenting author: **Duhau, Silvia, N.** (duhau@df.uba.ar)
Author(s): Duhau, S., Martinez, E. A.
Affiliation(s): Departamento de Fsica, Facultad de Ciencias Exactas y Naturales, Universidad de Buenos Aires, Buenos Aires, Argentina

Abstract: There are some evidences that support the occurrence of total ozone content changes by high energetic particle flux intensity variations, in turn these last are strongly linked to sudden commencement storms (SSC). Therefore, a wavelet multi-resolution analysis of total ozone content in selected ground stations, radiative input and SSC index yearly means time series, the last defined as the product of the amplitude by the duration time of each storm, is performed. It is found that long term ozone variations are almost unrelated to radiative input and mostly related to SSC index long term variations in all the stations, with different behaviors that depend on geographical location. In particular, the strong decrease of total ozone content during cycle 22 is related to the very high SSC values that occurred during that sunspot cycle and is remarkably strong in Faraday and Halley Bay stations. In all the stations the minimum in total ozone content long term variation is reached around 1995 and is followed by an steady increase, that would continue along the forthcoming years following the descending chaotic transition that solar global magnetic field dynamo system started around 1993.

Contribution number: III.8p
Title: **Cosmic Ray Fluxes in the Atmospheric Processes**
Presenting author: **Stozhkov, Yuri, I.** (stozhkov@fian.fiandns.mipt.ru)
Author(s): (1) Ermakov, V.I., (2) Stozhkov. Y.I.
Affiliation(s): (1) Central Aerological Observatory, Rosgidromet, Dolgoprudny, Moscow Region, Russia, (2) P.N. Lebedev Physical Institute, Russian Academy of Sciences, Moscow, Russia

Abstract: The cosmic ray fluxes are the only source of ionization in the atmosphere at the altitudes h between 3 and 35 km. The cosmic rays define almost all electric properties in the atmosphere: ion production, electric conductivity of air, thundercloud formation, lightning production, etc. The atmospheric electricity plays important role in the weather and climate processes. Cosmic ray fluxes are modulated by solar activity. Thus, we have the following link: solar activity changes - cosmic ray flux modulation - atmospheric electricity changes - weather and climate formation. This link is discussed in the present paper.

Contribution number: III.9p
Title: **Possible origin of long-term changes in solar activity**
Presenting author: **Ferriz-Mas, Antonio** (antonio.ferriz@oulu.fi)
Author(s): Ferriz-Mas, A.
Affiliation(s): Universidad de Vigo, Facultad de Ciencias, Departamento de Fsica Aplicada, Orense, Spain

Abstract: A striking feature in the history of surface solar activity is a prolonged minimum between 1645 and 1715, known as the Maunder Minimum. Tracing back solar activity by means of proxy data (abundances of cosmogenic isotopes Be^{10} and C^{14} has shown that grand minima in magnetic activity are a recurrent feature. Grand minima seem also to occur in other cool stars with solar-like magnetic activity. The mean solar magnetic field behaves irregularly in time. Grand minima are the most prominent manifestation of this irregularity, albeit not the only one: it is also apparent in the length and amplitude variations of the 11-year sunspot cycle. Although the statistical and spectral properties of solar activity –as measured by the sunspot number– are still not well known, there is evidence for various modulations of the solar cycle. Although all theoretical models of the solar dynamo rely on mean-field dynamo theory, in which the small-scale turbulent motion is parametrized in order to compute large-scale effects, there are significant differences in the physical assumptions considered by different authors. An alternative scenario of a dynamo mechanism based on unstable magnetic flux tubes will be considered.

Contribution number: III.10p
Title: **Solar rotation, Earth rotation, and solar wind**
Presenting author: **Georgieva, Katya, Y.** (kgeorg@bas.bg)
Author(s): (1) Kirov, B., (1) Georgieva, K., (2) Javaraiah, J.
Affiliation(s): (1) Solar-Terrestrial Influences Laboratory, Bulgaria, (2) Indian Institute of Astrophysics, India

Abstract: It is generally accepted that the annual variation in the Earth's rotation rate is fully determined by large-scale seasonal changes in atmospheric circulation. Attempts have also been made to relate long-term changes in atmospheric circulation to decadal changes in the Earth rotation rate. We demonstrate that the relation between the two changes sign in the beginning of the 20th century, when the correlation between solar activity and climatic elements also changes sign, and show that the decadal changes in Earth's rotation are closely correlated to the North-South asymmetry in solar equatorial rotation. On time-scales of solar activity cycle, we find that the oscillations of both the Earth's and the solar rotation rates are different in cycles with negative end positive solar polarity. We find that differences between positive and negative polarity solar cycles exist also in solar wind velocity and interplanetary magnetic field parameters, and suggest that the solar wind mediates the transfer of angular momentum from the Sun to the Earth.

Contribution number: III.11p

Title: **Variation of the aerosol structure and the ambient ozone concentration during the 11 August 1999 solar ECLIPSE**

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Abstract: In the present paper the results from lidar observation of aerosol structure and surface ozone content in the Planetary Boundary Layer of the atmosphere over the Sofia region during the solar Eclipse 11 August 1999 are presented. The observation data are obtained during time interval at 11:57 to 15:57 LST (Local standard time). The totality of Solar Eclipse occurred between 14:11h and 14:13h LST during two minutes in the region of Shabla (Bulgaria). Lidar measurements of aerosol distribution in the Planetary Boundary Layer of the atmosphere and surface ozone in situ measurements are compared with meteorological observation close to time of standard meteorological measurements of meteorological parameters of the atmosphere. They are produced of NIMH, which is placed nearby the Institute of Electronics. Nevertheless that the measurement are provided in the region of Sofia and the Solar Eclipse is about 94% the processes in the atmosphere showed interesting evolution. The temperature decrease about 4C and relative humidity increase about 16% ,the changes began about 20 min. after the first contact and the corresponding maximums were achieved about 4 min. after the totality. The maximum reduction of ozone was detected approximately 10 min. after totality and was 32% of surface ozone concentration before eclipse. The mixing layer height is observed in the atmosphere during Solar Eclipse by lidar. Maximum height subsidence of the mixing layer was about 600 m and these is observed about 80 minutes after totality. The weather over Sofia was suitable without clouds or fronts for observation of these phenomena. Remote sensing and in situ measurements in the PBL of the atmosphere are presented. The changes of the meteorological parameters, surface ozone concentration and the height of mixing layer. are started after the first contact and are continued after the forth contact of the solar eclipse. The experimental results are in a good agreement with measurements in the regions of Stara Zagora, Shabla (Bulgaria) and Tchessaloniki (Greece).

Contribution number: III.12p

Title: **On The Prediction of El Nio 2002 Based On the Peak Of Sunspot Number in 2000**

Presenting author: **Kunjaya, Chatief** (kunjaya@as.itb.ac.id)

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Abstract: The correlation between solar activity, in which sunspot number was used as indicator, and SOI as one of El Nino / La Nina indicator was investigated. Fifty years of monthly

averaged Sunspot number and SOI has been used. The data was selected according to El Nino / La Nina criteria. Calculation was done for several length of delay in El Nino / La Nina indicator with respect to Solar indicator. The result is that low correlation coeficient (effectively no correlation) if no delay introduced in the calculation. When delay was introduced, correlation begin to appear. The strongest correlation, with coeficient 0.256, occur at 27 month delay. The delay and the peak of sunspot number in 2000 was used to predict the appearance of El Nino phenomena in 2002. The result was quite good. The peak of Sunspot occurred July 2000, when we take the average duration of El Nino during the last fifty years, that is 10 month, as the predicted duration of El Nino 2002 then El Nino was predicted to begin at May 2002 and will finish at February 2003. The accuracy of prediction was good. This result provide an additional hope for El Nino prediction long before it happen. However, it cannot predict its duration and strength.

Contribution number:	III.13p
Title:	**The Relationship Between the Heliogeophysical Activity and Changes in the Ozone Layer and Troposphere.**
Presenting author:	**Lyakhov, Nikolay** (lyakhov@sgd.iriit.irk.ru)
Author(s):	Lyakhov, N.
Affiliation(s):	Chair of Physics, State railroad university, Irkutsk, Russia

Abstract: Some solar irradiance indexes have been estimated in the paper in comparison with geomagnetic activity and variability of ozone layer and troposphere. The heliogeophysical factors (space weather factors) used to be CaII-index, soft X-ray flux and cosmic ray flux. By methods of correlation and spectral analysis it was shown, that a changes in ozone layer and atmospheric characteristics are probably caused by space weather factors for the 23 cycle.

Contribution number:	III.14p
Title:	**Comparison between the terrestrial response of solar cycles No. 21 and 22**
Presenting author:	**Bebars, Esha, A.** (bebarsesha@ yahoo.com)
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Abstract: Solar emissions affect the geomagnetic processes are investigated during the concerned solar cycles cycles. Although both of solar cycles 21, and 22 have produced higher level of sunspot and flare activity than previous cycles, it is noticed that each of them have got a different response in the Earths environment. This may be attributed to the variance in types of the energetic particles ejected by different solar magnetic configurations dominated during each of them. Coronal Mass Ejection plays a major role in fastening and enlarging the observed proton flux. The filament disappearances, as one of CMEs sources is analyzed, it shows an incomparable level between solar cycles 21 and 22, this leads to observe very large proton flux during the second cycle. Inversely the 21st solar cycle have shown rich production of electron dominated flare enhancements with impulsive profile, but low level of Coronal mass ejections. The Sudden Storm Commencements have shown a marked different level between the two cycles. The geomagnetic storms (Ap index) correlates with the detected number of occurrence of proton events.

Contribution number: III.15p
Title: **Solar Activity and the Climate of Prebaikalia**
Presenting author: **Molodykh, Sergy, I.** (sim@iszf.irk.ru)
Author(s): Molodykh, S.I., Zherebtsov, G.A., Kovalenko, V.A.
Affiliation(s): Institute of Solar-Terrestrial Physics SB RAS, Irkutsk, Russia

Abstract: This paper presents convincing evidence for the reality of manifestations of solar variability in climate characteristics of the Prebaikalia (Irkutsk, Bratsk, Zima). A numerical estimate is obtained of this influence on ground air temperature. A high degree of correlation (the correlation coefficients 0.97) is established between the mean power of a solar activity cycle and ground air temperature of the Prebaikalia, averaged over the period of a solar cycle. It is shown that the main meaningful variations in air temperature in the region for the period 1881-1960 were caused by solar activity. Since the 1960s till the present, with the influence of solar variability continuing, a clear-cut influence of another factor has been observed, the role of which has been steadily increasing, and in the last decade it has now exceeded the contribution of solar variability. Research results on the variations in hydrological characteristics of Lake Baikal and the Angara river and their connection with solar activity are presented. It is shown that these characteristics are closely correlated with the duration of solar cycles. The high, stable level of correlation of climatic variations of the Prebaikalia and solar activity parameters is attributed to the fact that additional factors that enhance this correlation are at work in inland regions. Such a factor is the presence in the Prebaikalia of the Siberian (Asian) anticyclone and its sensitivity to changes in the global atmospheric circulation which, in turn, subtly responds to changes in the thermal balance of the atmosphere caused by both solar activity and the anthropogenic factor.

Contribution number: III.16p
Title: **The Influence of Different Q-index Values of H alpha Flares for Moths**
Presenting author: **Puskas, Janos** (pjanos@deimos.bdtf.hu)
Author(s): (1) Nowinszky, L., (2) Puskas, J.
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Abstract: The connection between Ha flare activity and collected quantity of insects flying at night is examined in present study. The data of European corn borer (Ostrinia nubilalis Hbn.), coming from the data of light-trap network in Hungary between 1976 and 1997, were worked up. The daily Q-index data were got from Tamer Atac (Bogazici University, Kandilli Obser-vatory and Earthquake Research Institute, Istanbul), we hereby express our gratitude to him. Relative catch (RC) values were calculated for each observation sites and days from the European corn borer data. RC is the quotient of the number of individuals caught during the sampling interval (1 night), and the mean values of the number of individuals of one generation counted for the sample interval. In this way, in the case of expected mean number of individuals, the value of relative catch is 1. In different years there was significant difference among the daily values of Q-index, so they were shown in average percent of swarming periods. First the influence of flares for daily light trapping was examined. There was made a comparison for each day in collecting period between the RC values, coming from different light-traps, and the values of Q/Q average for demonstration of this influence. The values of Q/Q average were contracted into groups, and the RC data, belonging to them, were averaged in all the groups. Later there was also examined,

has the flare activity, deviated strongly in each year, influence for the European corn borer species number trapped in several years. Only those collecting data of observation sites were used in this examination, which were at least operated in all the years of one of the solar activity cycle (1976-1986 or 1986-1997). There were two light-traps operating in both cycles. Collecting data were given from the whole period by 11 light-traps in the first cycle and 1 trap in the second one. There was made a comparison between the whole number of caught specimen and average specimen number of the 11 years for each observation site, so really relative catch (RCy) values were calculated for each year. These values were compared yearly with the Q-index average. There were used t-test to determine the significance level of RC value differences (RCy), belonging to years with low (Q-index average = 1-3), middle (Q-index average = 3-10) and high (Q-index average is more then 10) flare activity. Our results prove both the daily quantity of light-trap catch and the yearly caught specimen number are influenced significantly by the Q-index, which is determined by intensity and length of time of flares. There is a significant decrease on those days, when the Q-index value is higher than in the average in swarming period. If the Q-index average value is high, in those years the number of caught moths is less about with 30% compared with the averaged specimen number calculated for the whole solar cycle (11 years). There is a contrasted tendency in those years, when the Q-index average value is lower, because there is a 45% increase in number of caught moths. During taking into consideration of the light-trap catch data we have to think of the strong modifying influence of flares.

Contribution number:	III.17p
Title:	**Multi-scale Aspects of Solar Cycle Variability**
Presenting author:	**Pastorek, Ladislav** (pastorek@suh.sk)
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Abstract: Modern time series analysis methods are used to study the dynamical multi-scale features present in daily sunspot number data and susnspot area data. The results are discussed in terms of solar dynamo models incorporating turbulent gas motions within convective regions.

Contribution number:	III.18p
Title:	**High-speed solar wind, auroral electrojets and atmospheric gravity waves: A link to the Earth atmosphere**
Presenting author:	**Prikryl, Paul** (paul.prikryl@crc.ca)
Author(s):	(1) Prikryl, P., (2) Sofko, G.J.
Affiliation(s):	(1) Communications Research Centre, Ottawa, ON, Canada, (2) University of Saskatchewan, Saskatoon, SK, Canada

Abstract: High-speed solar wind streams from coronal holes and coronal mass ejections are the major sources of energy flow towards the Earth. The solar wind energy that couples to the magnetosphere is deposited in the polar ionosphere where it drives ionospheric convection and auroral electrojets. The bulk of this highly variable energy input is channeled to the auroral ovals and deposited in the upper atmosphere in the form of the Joule heating. On time scales from tens of minutes to a few hours the electrojet fluctuations generate atmospheric gravity waves that interact

with neutral winds and deposit their momentum in the neutral atmosphere. A link between the solar wind, auroral ionosphere and neutral atmosphere with a possible impact on tropospheric weather is examined.

Contribution number: III.19p
Title: **How Can Change UV-B Radiation of the Sun the Light Trapping of the European Corn Borer?**
Presenting author: **Puskas, Janos** (pjanos@deimos.bdtf.hu)
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Abstract: Biological systems are extremely sensitive to changes in ultraviolet radiation reaching the Earth's surface. Atmospheric ozone absorbs considerable part of the UV radiation coming from the Sun and harmful for biosphere so only a very small part of it can reach the Earth's surface thus organisms adapted to that intensity. The light-trap success of European corn borer (Ostrinia nubilalis Hbn.) was examined at those nights when during the previous day the UV-B radiation had different intensity. UV-B data used for examination come from measurements in the Keszthely observatory of the Hungarian Meteorological Service by Robertson-Berger UV-Biometers. The light-trap catch data of European corn borer originated from the national light-trap network between 1994-1998. Relative catch (RC) values were calculated from the daily data of UV-B radiation relating to the summer half-year. The daily data were divided with the weighted average values of previous, actual and following ten days. We calculated RC values from daily light-trap results of European corn borer for all observing stations and swarming times. The RC values were categorised into UV-B groups belonging to each day. Three points moving averages were made from average values of the 14 groups with using our own method. We made correlation calculation between the related values of UV-B and RC. Our results prove light-trap catch is low if the values of UV-B radiation are significantly lower considering to the average. Currently we cannot explain how the nocturnal insects can take notice of low UV-B radiation measured during the previous day. The RC is similar to the expectable value if the value of UV-B radiation is more than the average, but the RC has a little bit decreasing tendency. These results can be well valuable for the plant protection prognostic.

Contribution number: III.20p
Title: **Possible Manifestation of Solar Activity and Cosmic Ray Intensity Influence on State of Wheat Market in the Medieval England (1200-1700 Years)**
Presenting author: **Pustilnik, Lev, A.** (levpust@ccsg.tau.ac.il)
Author(s): (1) Pustilnik, L., (2) Yom-Din, G.
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Abstract: The database of Professor Rogers, which includes wheat prices in England in the Middle Ages (1249-1703) was used to search for possible manifestations of solar activity and cosmic ray intensity variations. Our approach was based on: 1. Negative correlation between solar activity

(number of sunspots) and a flux in the galactic cosmic rays on the Earth orbit; 2. Link between cosmic ray flux penetrated into the Earth's atmosphere and cloudiness/cloud temperature; 3. Nonlinear dependence between wheat production and extreme weather conditions (abnormal rains, severe winters, or hot summers with droughts); 4. Nonlinear sensitivity of wheat prices in a market with a limited supply (as in medieval England), greatly influenced by shortage or overproduction of wheat. Our study shows that, as a result of the above-mentioned nonlinear causal links, bursts and troughs of wheat prices can take place at extreme states (maximums or minimums) of solar activity cycles. We present a conceptual model of possible modes for sensitivity of wheat prices to weather conditions, caused by solar cycle variations, and compare the expected price fluctuations with wheat price variations recorded in the Medieval England (1259-1702). A new sample of time intervals between price bursts was obtained from the initial sample of price bursts, selected from Rogers data. We compared statistical properties of the intervals between price bursts with statistical properties of the intervals between extremes (minimums) of solar cycles during the years 1700-2000. We show that statistical properties of these two samples are similar, both for mean values / standard deviations of intervals and for interval distribution. In additional we analyzed direct links between wheat prices and solar activity in the 17th Century, for which wheat prices and solar activity data as well as cosmic ray intensity (derived from 10Be isotope) are available. We show that for all detected solar activity minimums the observed prices were higher than prices for the maximal solar activity state (significance level ¡1%). This result, combined with the conclusion of similarity of statistical properties of the price and solar activity extremes can be considered as direct evidence of a causal connection between wheat prices bursts and solar activity/cosmic ray intensity.

Contribution number: III.21p

Title: **Effects of 11-year Solar Cycle and Quasi Biennial Oscillation (QBO) on the Energetics in the Equatorial Lower Stratosphere, and Large-Scale Tropical Circulations**

Presenting author: **Reddy, Remata, S.** (rsreddy@ccaix.jsums.edu)

Author(s): Reddy, R.

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Abstract: Since recent past years, Solar-Terrestrial Physics and Meteorology (STP-M) is a growing subject for better understanding the solar-terrestrial relations. Also, the equatorial processes including the coupling (EPIC) are very important for understanding of the dynamics of the lower atmosphere. In the present study, we investigate an 11-year solar cycle in the energetics (kinetic energy) of the equatorial lower stratosphere. We also investigate the possible influence of QBO on the large-scale tropical circulations including Indian summer monsoon and tropical cyclones over the Gulf of Mexico. The data used in the study for the period 1954-2000, were (a) 50 mb winds over the equatorial station, Singapore (1 degree 18 minutes N; 103 degrees 50 minutes E), (b) rainfall data over the Indian sub-continent during June-September; (c) total number of tropical cyclones during October over the Gulf of Mexico; and (d) solar flux (10.7 cm). The study has suggested the following: (i) an evidence of 11-year solar cycle in the energetics of the lower stratosphere, (ii) energetics were maximum/minimum during sunspot maximum/minimum, (iii) floods/droughts over the Indian sub-continent during the westerly/easterly phases of the QBO and the large-scale droughts enhance during the ENSO events, (iv) tropical cyclone frequency and intensity were maximum/minimum during the westerly/easterly phases of the QBO, (v) The possible physical mechanisms include the following: During the easterly QBO phase, the mean

wind direction within a few degrees of latitude of the equator is easterly in both troposphere and stratosphere. This allows near equator convection to be enhanced in the vertical. This will be enhanced by ENSO activity. During the westerly phase however, the near equator stratospheric winds are westerly, in opposition to those of the troposphere. This forms a dynamical boundary for vertical enhancement of convection, and allows off-equator convection to be preferred. The monsoon areas being off equator are therefore enhanced during westerly phase. Activation of 30-40 oscillation (Dry) during strong ENSO and Easterly Phase of QBO. Activation of 15-20 day oscillation (Wet) during Westerly phase of QBO.

Contribution number: III.22p
Title: **Solar Activity and the Terrestrial Thermosphere**
Presenting author: **Wade, Gregg, A.** (wade-g@rmc.ca)
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Abstract: Atmospheric drag represents the single largest uncertainty in position determination of artificial terrestrial satellites (RSOs). Punctuated thermospheric density variations of up to 500% are associated with major solar activity events and geomagnetic storms, leading to significant acceleration of RSOs with semimajor axes in the 500-1000 km range (e.g. Knowles et al. 2001). The sensitivity of the kinematics of low orbit satellites to variations in thermospheric density makes them ideal probes of outer atmospheric conditions (e.g. Jacchia 1970). In this poster, we present preliminary results of a study aimed at investigating the response of the thermospheric density field to changes in a wide range of solar and geomagnetic parameters.

Contribution number: III.23p
Title: **The Anticipated Natural Revival of the Dead Sea - Plans for its Joining with Mediterranian or Red Seas Should Be Terminatted**
Presenting author: **Shahinaz, Yousef, M.** (bebarsesha@yahoo.com)
Author(s): Shahinaz, Y.
Affiliation(s): Astronomy & Meteorology Dept, Faculty of Science, Cairo university, Cairo, Egypt

Abstract: The level of the Dead Sea is an indicator to solar induced climate changes over the ages. The variation of Dead Sea level in response to the 80-120 yr. Solar Wolf-Gleissberg cycles is impressive. In 1800 the level dropped and rose in coherence with this solar cycle. During the next Wolf Gleissberg cycle the level remained around 399m below sea level B.S.L. as this cycle was not very active. In 1878 this cycle was terminated and weak 12 years duration Solar cycles started and a climate change did occur as manifested for example by sharp rises in the levels of both Dead Sea (about 8 meters rise) and Lake Victoria. In the late fifties, early sixties around the maximum of the Wolf-Gleissberg cycle, climate change did occur with a change in the general wind circulation. This climate change caused for instance several meters up rise of equatorial African lakes and depression in several other lakes. The Dead Sea level dropped considerably ever since and general drought conditions prevailed in the area at that time. Major Solar cycles of the range of thousand of years are reconstructed from radiocarbon in ancient tree rings. The level of the Dead Sea is compared with those long ranges major Solar cycles. Between 40 BC and 100 AD the Dead Sea rose by about 70 meters in coherence with the peak of a major solar cycle. Another tens of meters

of Dead Sea rise occurred also contemporary with the maximum of the following medieval major Solar cycle. There are some indications that it is likely that a major climate change is about to occur leading to heavy rain over the middle east and the Holy Land and eventually the Dead Sea should rise considerably. At present, the Dead Sea is declining at rate of about 80 cm - 1 m every year. Taberia Lake at present is also shrinking under drought conditions prevailing in the area. The rise and fall of the Dead Sea is not accidental but it has been going on over the ages reflecting climate changes. The Dead Sea is a global indicator of climate changes. It is a universal heritage to all humanities and should be kept always as a natural reserve. However, the Jordan river should be allowed to re-feed the Dead Sea in full capacity and plans for joining the Dead Sea with either Red or Mediterranean Seas should be stopped in order not to spoil this natural record of Solar induced climate changes and eventually with God's will the Dead Sea will re-rise in due time.

Contribution number:	III.24p
Title:	**The Sharp Rise of Lake Victoria, a Positive Indicator to Solar Wolf-Gleissberg Cycles Turning Points.**
Presenting author:	**Shahinaz, Yousef, M.** (bebarsesha@yahoo.com)
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Abstract: The Sun experiences long range cycles of the order (80-120) years known as the Wolf-Gleissberg cycles. 1877-1878 marks the end of one of those cycles and the beginning of a series of three low activity 12 years solar cycles. 1878 was also characterized by a sharp rise in Lake Victoria level followed by continuous drop till 1890. Later on, the lake level rose and fall in sympathy with solar cycles till the end of the low activity period around 1922 when such correlation ceased to exist. The maximum of the following Wolf-Gleissberg cycle occurred around 1959 , followed by another 2.5 meters sharp rise in lake Victoria level in the early sixties. Again 1997 marked the end of the past Wolf-Gleissberg cycle and the beginning of a new era of lower activity solar cycles. As a consequence, the level of lake Victoria rose sharply by 1.6 meters and at present dropping down is in progress. Such drop is expected to last up till the end of the present 12 year solar cycle in the same fashion as the similar 1887 case, leading to drought conditions around 20092-3 years. This condition is expected to be followed by a cyclic rise and fall of the Equatorial lakes level in response to solar cycle forcing, perhaps for two or three solar cycles leading to alternate floods and droughts. Attention is made to Nile Basin countries in the Equatorial Lake plateau , several years of drought conditions similar to those that happened around 1900 (When swum south of the Sobat connection to the Nile were dried, similar dryness were also observed in Bahr - El-Zaraf) are likely to prevail over Uganda and other Equatorial Lake countries at 20092-3 years, 2021 2-3 years and perhaps 2033 2-3 years. Similar Lake Victoria rise to the sixties is to be expected at the maximum of the following Wolf-Gleissberg cycle. Similar lake Victoria and other Equatorial lakes rise must have happened at earlier Wolf-Gleissberg turning points , some of them were at 1779(max turning point, 1797(min)and 1838-1840(max). The abrupt rise of Lake Victoria level is a positive indicator to the Wolf-Gleissberg cycles turning points and can be taken as an indicator to their confirmation.

Contribution number: III.25p

Title: **Investigation of absorption of solar EUV-radiation in the Earth's atmosphere at altitudes of 100-500 km using solar images in the experiments TEREK-C (Coronas-I) and SPIRIT (Coronas-F)**

Presenting author: **Slemzin, Vladimir, A.** (slem@sci.lebedev.ru)

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Abstract: The results of measurements of absorption of solar XUV-radiation in the Earth's atmosphere using solar images obtained in occultation by the TEREK-C telescope on-board the Coronas-I satellite (1994) and by the SPIRIT telescope and spectroheliograph assembly on board the Coronas-F satellite (2001-2002) are presented. Measurements were made in the EUV spectral range: with the TEREK- telescope in the 175 and 304 bands, with the SPIRIT telescope/ spectroheliograph in the 8.42, 175 and 304 bands. Observations on the Coronas-F satellite include regular measurements during the set and rise phases of the occulted satellite orbit (height 500 km, inclination 82,50, period 92,5 min) as well as special sessions during periods of non-occulted orbits (20 days every 3 months), when the line of sight crosses the atmosphere at altitude of 500-200 km. Processing of solar images with high angular resolution obtained in presence of absorption allows to determine as value of absorption and direction and value of the absorption gradient. Using this method, an accuracy of the absorption height profile may be increased up to 1 km and higher. Height profiles of absorption obtained in different conditions characterize a variability of the upper atmosphere with solar activity, temporal and spatial factors. The work was partly supported by the Russian Foundation for Basic Research, grant N 02-02-17272.

Contribution number: III.26p

Title: **Possible correlation between solar and volcanic activity in a long-term scale**

Presenting author: **Strestik, Jaroslav** (jstr@ig.cas.cz)

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Abstract: Volcanic activity on the whole Earth has been described by special annual indices available since 1500. These indices have been compared with annual sunspot numbers. Volcanic activity displays no periodicity corresponding to the 11-yr solar cycles. But using running averages in the interval of 21 years a striking similarity between these two series is clearly seen. Volcanic activity is generally lower in periods of prolonged maxima of solar activity and higher in periods of prolonged solar minima (correlation coefficient being -0.37). There is also a similarity between the spectra of these series for periods longer than 50 years. Main peaks are located in nearly the same periods for both time series (200-215 yr, 100-105 yr, 80-90 yr, and possibly some longer periods). The influence of volcanic activity on the climate is indubitable. Long-term annual means of surface air temperature display similar periods as the volcanic activity indices including the lack

of the 11-yr periodicity.

Contribution number: III.27p
Title: **The lost sunspot cycle: Sunspot statistics analysis**
Presenting author: **Usoskin, Ilya, G.** (Ilya.Usoskin@oulu.fi)
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Affiliation(s): (1) Sodankyla Geophysical Observatory (Oulu unit), University of Oulu, Finland, (2) Department of Physical Sciences, University of Oulu, Finland, (3) Ioffe Physical-Technical Institute, St.Petersburg, Russia

Abstract: We have recently suggested (Usoskin et al., 2000) that one low sunspot cycle was possibly lost in 1790s and argued (Usoskin et al., 2002) that the existence of such a cycle does not contradict to available solar proxy data (auroral observations and cosmogenic isotopes). There are, however, some arguments, based on statistical analysis of sunspot activity, that disfavor the lost cycle (Krivova et al., 2002). Since consequences of the new cycle would be significant for the solar cycle study, it is important to estimate the probability of this cycle to exist. Here we present the results of a rigorous statistical analysis of all available sunspot observations around the suggested additional cycle minimum in 1792-1793. First we estimate the uncertainty of a monthly mean sunspot number reconstructed from a single daily observation. Then we compare, using quantitative statistical tests, the average level of sunspot activity in 1792-1793 with the average activity during the minimum, mid-declining and maximum phases of cycles in the well-measured reference period 1850-1996. We show that the level of sunspot activity in 1792-1793 is statistically similar to that in the minimum phase, and significantly different from that in the mid-declining and maximum phases. Using the estimated uncertainties, we also calculate new, weighted annual values of group sunspot numbers in 1790-1796 which show a clear minimum in 1792-1793 and a maximum in 1794-1795, supporting the idea of an additional weak cycle in 1790's.

Contribution number: III.28p
Title: **On the reliability of monthly/yearly means calculated from sparse daily sunspot numbers**
Presenting author: **Usoskin, Ilya, G.** (Ilya.Usoskin@oulu.fi)
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Affiliation(s): (1) Sodankyla Geophysical Observatory (Oulu unit), University of Oulu, Finland, (2) Department of Physical Sciences, University of Oulu, Finland, (3) Ioffe Physical-Technical Institute, St.Petersburg, Russia

Abstract: Some periods before 1850 are quite poorly covered by sunspot observations. In addition to clear observational gaps, there are also periods when there are only few sparse daily sunspot observations during a long time. It is important to estimate the reliability of the simple arithmetic monthly/yearly mean values obtained from sparse daily data. Here we suggest a new method to estimate the reliability of individual monthly means. The method is based on comparing the actual sparse data (sample population) to the well-measured sunspot data in 1850-1996 (reference population) and employs two assumptions: (i) the statistical properties of sunspot activity are similar throughout the entire period and (ii) individual sparse daily observations are distributed random in time. First, for each sample population we found months in the reference population containing the same data set and built the statistical distribution of the corresponding monthly

means. Then we calculated from this distribution the weighted mean and its standard error which gives the uncertainty of a monthly mean sunspot number reconstructed from sparse daily observation. Simple arithmetic mean can be adequately applied for months containing more than 4-5 evenly distributed daily observations. However, the reliability of monthly means for less covered months should be estimated individually. Using the estimated monthly values, we can calculate also weighted annual sunspot numbers and their uncertainties for poorly covered periods. The method has been successfully applied to the group sunspot numbers in 1790s.

Contribution number: III.29p
Title: **Solar activity on the millennium scale: Quantitative reconstruction**
Presenting author: **Usoskin, Ilya, G.** (Ilya.Usoskin@oulu.fi)
Author(s): (1) Usoskin, I.G., (2) Mursula, K., (3) Solanki, S.K., (3) Schuessler, M., (2) Alanko, K.
Affiliation(s): (1) Sodankyla Geophysical Observatory (Oulu unit), University of Oulu, Finland; (2) Dept. of Physical Sciences, University of Oulu, Finland; (3) Max-Planck Institute for Aeronomie, Katlenburg-Lindau, Germany

Abstract: In this paper we present a physical reconstruction of sunspot activity level from the measured concentration of cosmogenic radionuclide 10Be in polar ice, on the millennium time scale. Starting from the 10Be concentration measured in ice cores from Antarctica and Greenland, we calculate to corresponding flux of cosmic rays in the Earths vicinity, using a model of 10Be production in the Earth's atmosphere. From the obtained cosmic ray variations we can estimate the evolution of the Sun's open magnetic flux in order to reconstruct the 11-year average of the sunspot number back to 850 AD. The effect of long-term changes of the geomagnetic field is estimated. Since this approach uses physical models at each step, it allows to reconstruct the 11-year cycle averaged sunspot activity quantitatively. The method is validated by comparing with the directly observed sunspot record since 1610. The reconstructed sunspot record clearly indicates that the present level is enormously high and that the cycle averaged sunspot activity has never exceeded a half of it during the last millennium before 1940s.

Contribution number: III.30p
Title: **The Earth's Magnetosphere During the Event of Solar Wind Disappearance**
Presenting author: **Shahinaz, Yousef, M.** (shahinazyousef@yahoo.com)
Author(s): (1) Yousef, M., (2) Shahinaz, Y., (2) El-Nawawy, M.
Affiliation(s): (1) National Research Institute of Astronomy and Geophysics, Egypt (2) Astronomy and Meteorology Dept., Faculty of Science, Cairo University, Egypt

Abstract: On May 10-12 1999, the solar wind almost disappeared. Studying this event provides natural circumstances as if switching off the solar wind and watching the expansion of the Earth's atmosphere to the moon's orbit in an almost unique event and mapping out the natural magnetosphere in the absence of solar wind pressure. We study physical parameters of the solar wind and the magnetosphere prior, during and after this event. The solar wind density was rather low prior to this event , however it built up considerably after the event . Eventually the bow shock

positions from the starting position of zero solar wind on 11-12 May and as it was pushed towards the Earth on the following days is of vital importance. The decrease of plasma sheet density in response to the decrease of solar wind density is investigated.

Session IV

PARALLEL ISCS WG1 AND WG2/3 SESSIONS

Conveners: Judit PAP, David WEBB, George SIMNETT

SESSION IV: PARALLEL ISCS WG1 AND WG2/3 SESSIONS

Conveners: Judit PAP, David WEBB, George SIMNETT

08:30 - 12.30 WG1: Data calibration and validation
Models and techniques
Climate models and what has to be done
WG2/WG3: Space weather aspects of CMEs; forecasting tools
Interplaneatry CMEs: remote sensing and in-situ signatures, magnetic clouds, modeling
The importance of multiple eruptions of magnetic structures

Session V

COMPARISON OF CME ACTIVITY: SOLAR CYCLE MAXIMUM

Convener: Simon PLUNKETT

SESSION V: COMPARISON OF CME ACTIVITY: SOLAR CYCLE MAXIMUM AND MINIMUM

Convener: Simon PLUNKETT

14:00 - 14:30 **N. Gopalswamy**:
Coronal Mass Ejections Activity during Solar Cycle 23 (invited)

14:30 - 14:45 **A.N. Zhukov**, I.S. Veselovsky, V. Bothmer, A.V. Dmitriev, F. Clette, J.-F. Hochedez, E.P. Romashets, P. Cargill:
Solar Wind Disturbances and their Sources in the EUV Solar Corona

14:45 - 15:15 **A.C. Sterling**:
A Near-Solar-Cycle's Worth of CME Studies with Yohkoh (invited)

15:15 - 15:45 Coffee break

15:45 - 16:15 **V. Bothmer**:
Sources of Magnetic Helicity over the Solar Cycle (invited)

16:15 - 16:30 **C.C. Wu**, R.P. Lepping, N. Gopalswamy:
The Occurrence Anomalies of Magnetic Clouds and CMEs Vary with Solar Activity

16:30 - 16:45 **A. Dal Lago**, L.E.A. Vieira, E. Echer, W.D. Gonzalez, A.L. Clua de Gonzalez, F.L. Guarnieri, L. Balmaceda, J. Santos, R. Schwenn, N.J. Schuch:
Solar and Interplanetary Causes of Super Storms in the Period of 1997-2001

Invited and Oral Contributions:

Title: **Coronal Mass Ejections Activity during Solar Cycle 23 (Invited talk)**
Presenting author: **Gopalswamy, Nat** (gopals@fugee.gsfc.nasa.gov)
Author(s): Gopalswamy, N.
Affiliation(s): NASA Goddard Space Flight Center, Greenbelt, USA

Abstract: We studied the solar cycle variation of the daily rate of coronal mass ejections (CMEs), mean and median speeds of CMEs, and the rate of type II radiobursts in the metric and DH domains for cycle 23 (1996-2002). We find that (1)there is an order of magnitude increase in CME rate from the solar minimum (0.5/day) to maximum (5/day), (2) the maximum rate is significantly higher than previous estimates, (3) the mean and median speeds of CMEs also increase from minimum to maximum, but by a smaller factor of 2, (4) number of metric type II bursts (summed over CR) tracks CME rate, but the CME speed seems to be only of secondary importance, and (5) for DH type II bursts the CME speed is important. We also studied the annual distributions of a number of different populations of CMEs. We found that only a small fraction (2%) of all the CMEs are important for space weather purposes: these are the front-side halo CMEs that originate from close to the central meridian (for geomagnetic storms) and the fast and wide CMEs that cause large SEP events. Since CMEs associated with DH type II bursts are fast and wide, the latter may be good indicators of SEP-producing CMEs.

Title: **Solar Wind Disturbances and Their Sources in the EUV Solar Corona**
Presenting author: **Zhukov, Andrei** (Andrei.Zhukov@oma.be)
Author(s): (1)(2) Zhukov, A.N., (2) Veselovsky, I.S., (3) Bothmer, V., (2) Dmitriev, A.V., (1) Clette, F., (1) Hochedez, J.-F., (4) Romashets, E., (5) Cargill, P.
Affiliation(s): (1) Royal Observatory of Belgium, Brussels, Belgium, (2) Institute of Nuclear Physics, Moscow State University, Moscow, Russia, (3) Max-Planck Institut fur Aeronomie, Germany, (4) IZMIRAN, Russia, (5) Imperial College of Science, Technology and Medicine, UK

Abstract: We investigate possible links between the activity manifestations in the solar corona and conditions in the solar wind. For the reduction of this immense task we have selected 255 events in the solar wind in 1997 - 2001 corresponding to geomagnetic events with Ap above 20 (compiled into a database at http://alpha.sinp.msu.ru/apev). The solar wind conditions monitored by ACE and WIND spacecraft were traced back to the solar corona observed by SOHO/EIT. The search for coronal signatures that are probably associated with the disturbed solar wind conditions was performed. The coronal sources of the events are identified, namely: eruptions in active regions, filament eruptions and coronal holes. It is shown that halo and partial halo CMEs observed within the SOHO/LASCO sensitivity limits are not necessary indicators of Earth-directed eruptions, and coronal EUV dimmings can be used as a complementary indicator. We also found that a structure now conventionally called a "sigmoid" cannot be represented as a single S-shaped loop (flux tube), but exhibits an assembly of many smaller structures. It could be formed and destroyed via eruptions.

Title: **A Near-Solar-Cycle's Worth of CME Studies with Yohkoh (Invited talk)**

Presenting author: **Sterling, Alphonse, C.** (asterling@solar.stanford.edu)
Author(s): Sterling, A.C.
Affiliation(s): ISAS, Japan; NASA/MSFC/NSSTC/UAT, USA

Abstract: Yohkoh observed the Sun virtually continuously between August 1991 and December 2001, covering nearly a complete solar cycle. Among the instruments on board was the Soft X-ray Telescope (SXT), which gave us fresh perspectives on the dynamic nature of the solar corona. In this talk I will review how data from Yohkoh, and from SXT in particular, are helping us understand the nature of Coronal Mass Ejections (CMEs). Although CMEs were a topic of interest from the start of the mission, major progress in relating Yohkoh observations to CMEs began in late 1996, following the start of observations of CMEs with the instruments on SOHO. Since then we have learned much by combining the direct and indirect observations of CMEs from SOHO, with the coronal observations from SXT. We now have both an improved understanding of, and new questions about: the coronal source regions of CMEs, the nature of the material ejected in CMEs, the relation between CMEs and soft X-ray flares, and the underlying mechanism driving general solar eruptions.

Title: **Sources of Magnetic Helicity over the Solar Cycle (Invited talk)**

Presenting author: **Bothmer, Volker** (bothmer@linmpi.mpg.de)
Author(s): Bothmer, V.
Affiliation(s): Max-Planck-Institut fur Aeronomie

Abstract: It has been proposed that coronal mass ejections (CMEs) carry opposite magnetic helicity into interplanetary space depending on the hemisphere they originate from. A unique set of in situ plasma and IMF measurements as well as optical observations of the sun's corona in white-light and at EUV wavelengths is available for the current solar cycle. This combined data set offers the ideal opportunity to directly compare the magnetic field properties of CMEs in the solar wind with their solar source regions and to compare these results with those obtained for previous cycles.

Title: **The occurrence anomalies of magnetic clouds and CMEs vary with solar activity**

Presenting author: **Wu, Chin-Chun** (ccwu@lepccwu.gsfc.nasa.gov)
Author(s): (1) Wu, C.-C., (2) Lepping, R. P., Gopalswamy, N.
Affiliation(s): (1) CSPAR/University of Alabama in Huntsville, USA, (2) NASA/GSFC, USA

Abstract: It is well known that CMEs are generally observed more often in the active period than in the quiet period [St.Cyr et al., 2000]. Solar wind plasma and interplanetary magnetic field observations preliminarilly show that there are 68 magnetic clouds observed from Wind during 1996-2001 (55% of a solar cycle) and 66% of the magnetic clouds are associated with ICMEs. There were at least 4 (16, 11, 4, 12, 9) magnetic clouds observed in the year of 1996 (1997, 1998, 1999, 2000, 2001). The average occurrence rate is 9.3 magnetic clouds per year for this period

(56 events/6 years). It is found that some frequency of occurrence anomalies occurred during the early part of solar cycle 23, 1995-2001: (i) only a few clouds (4 events) were observed in 1999 in the increasing phase of solar maximum, (ii) an unusually large number of clouds (15 events) were observed in 1997 in which the Sun was starting to leave solar minimum, and (iii) there is an inconsistency in the occurrence of magnetic clouds and ICMEs. In this study these anomalies will be discussed. (St.Cyr et al., Properties of coronal mass ejections: SOHO LASCO observations from January to June 1998, J. Geophys. Res., 105, 18169, 2000)

Title: **Solar and interplanetary causes of super storms in the period of 1997-2001**

Presenting author: **Dal Lago, Alisson** (dallago@dge.inpe.br)
Author(s): (1) Dal Lago, A., (1) Vieira, L.E.A., (1) Echer, E., (1) Gonzalez, W.D., (1) Clua de Gonzalez, A.L., (1) Guarnieri, F.L., (1) Balmaceda, L., (1) Santos, J., (2) Schwenn, R., (3) Schuch, N.J.
Affiliation(s): (1) Instituto Nacional de Pesquisas Espaciais, Sao Jose dos Campos, SP, Brazil, (2) Max-Planck-Institut fuer Aeronomie, Lindau, Germany, (3) Centro Regional Sul de Pesquisas Espaciais, Santa Maria, RS, Brazil

Abstract: We have analyzed solar and interplanetary causes of all the 9 super storms (peak Dst below -200 nT) observed during the period of January 1997 to April 2001. Apart of one storm occurred during the period without SOHO observations, all of them were related to coronal mass ejections observed by LASCO. The main sources of interplanetary southward magnetic field Bs responsible for the occurrence of the storms were related to the intensified shock/sheath field (3 events), interplanetary magnetic clouds field (1 events), or the combination of sheath-cloud or sheath-ejecta field (4 events). Interplanetary magnetic clouds were observed in 5 of the events, and their intrinsic magnetic field participated in the storm in 4 of them. Only one of the events was related to a slow CME, with CME expansion speed not greater than 550 km/s. In this case, the strong Bs was a result of the interaction of the ejecta with a high speed stream following it. This was also the only CME which didnt show a full halo in the LASCO images, covering only 210 degrees around the sun. The details of these 9 events will be discussed in this paper.

Posters:

Contribution number: V.1p
Title: **Study of Short Period Coronal Waves**

Presenting author: **Ajabshirizadeh, Ali** (a-adjab@tabrizu.ac.ir)
Author(s): Ajabshirizadeh, A., Mahmoudzadeh, A.
Affiliation(s): Tabriz University, Center for applied Physics research and Astronomy, Iran

Abstract: The study of short period coronal waves from observations performed using the 16 coronagraph of Sacramento Peak Observatory (USA) are described. The line of FeXIV at 530.3 nm is measured along a time sequence. The subtraction of sky. Aureola fluctuations of the nearby continuum in the scattered-light spectrum has been done .The observations presented were obtained on Apr. 19,1988, during an excellent 'Coronal' day and low activity level on the Sun. Spectra were taken at constant height above the limb with a slit width of 100 micron, 40" above the limb. We took a large enough portion of the spectra around 530.3 nm, with a dispersion of .252 nm/

mm and an equivalent instrumental spectral width of 0.025 nm, every 5s of time. Simultanously, slit-jaw pictures were taken every 5s in Ha. We have used the Image Processing Method and Image Tools software for the analysis. Such studies have been performed already by S.Koutchmy et al., 1983, but using another method. The method is now based on the obvious quasi-linear relationship of the line wing intensity modulations and the line shifts. As a result, coronal waves in the short period range (30s) have been obtained. These waves are considered as good candidates for the problem of coronal heating which has not yet received a satisfactory answer. Also, power spectrum of the central intensity variations of the 530.3 line and power spectrum of the velocity variations deduced from Doppler shift measurements have been obtained.

Contribution number: V.2p
Title: **Manifestations of CME-Associated Dimmings at Four EUV Wavelengths of SOHO/EIT**
Presenting author: **Chertok, Ilya, M.** (ichertok@izmiran.troitsk.ru)
Author(s): (1) Chertok, I.M., (2) Grechnev, V.V.
Affiliation(s): (1) IZMIRAN, Troitsk, Moscow Region, Russia, (2) ISTP SD RAS, Irkutsk, Russia

Abstract: Strong reconfiguration of the magnetic fields during coronal mass ejections (CMEs) is accompanied by appearance of large-scale areas and structures of reduced brightness (dimmings) of the EUV and soft X-ray emission persisting for several hours. We analyze SOHO/EIT observations of dimmings simultaneously in three coronal lines Fe IX/X (171 A), Fe XII (195 A) and Fe IX (284 A) sensitive to temperatures 1.2, 1.5 and 2.0 MK, respectively, as well as at 304 A filter passing a transition region line He II (0.02-0.08 MK) and somewhat weaker coronal line Si XI (1 MK). The analysis of rerotated difference images shows that usually the dimmings are most pronounced and have similar large-scale structures in the moderate-temperature coronal lines 171 and 195 A, while in the higher-temperature 284 A line the deepest dimming fragments are mainly visible. Many on-disk CME events show also clear, but relatively small-area dimming manifestations in 304 A line particularly at the background regions joining to the main eruption source. Moreover, there are events displaying dimming patches that have no dimming counterparts in the coronal lines. These results suggest that in course of a CME process, the opening of the magnetic field lines (and/or volume expansion) resulting in density depletion can also extend into cooler plasma of the transition region. Effects of temperature variations also cannot be excluded for some dimming structures.

Contribution number: V.3p
Title: **An atempt to the colour determination of selected coronal streams**
Presenting author: **Lukac, Bohuslav** (lukac@suh.sk)
Author(s): (1) Lukac, B., (2) Minarovjech, M., (2) Rybansky, M.
Affiliation(s): (1) Slovak Central Observatory, Hurbanovo, Slovakia, (2) Astronomical Institutte, Slovak Academy of Sciences, Tatranska Lomnica, Slovakia

Abstract: By the hypothesis S.Koutchmy and A.G.Nikoghossian (Astron & Astroph.,395,983) exist in the solar corona the linear thread-like suprethermal streams. These streams would have a different colour. We have atempted to determine this colour in CCD pictures of the corona, which

we have gained by 2001 solar eclipse. The results are not unambiguous.

Contribution number:	V.4p
Title:	**Geomagnetic activity during the Dalton minimum: New evidence for the lost cycle**
Presenting author:	**Mursula, Kalevi** (kalevi.mursula@oulu.fi)
Author(s):	(1) Mursula, K., (2) Usoskin, I., (3) Nevanlinna, H.
Affiliation(s):	(1) University of Oulu, Finland, (2) Sodankyla Geophysical Observatory (Oulu unit), Oulu, Finland, (3) Finnish Meteorological Institute, Helsinki, Finland

Abstract: The Dalton Minimum (DM) is a period of low sunspot activity extending from 1790's until 1820's. Its existence has also been supported by a number of studies of auroral activity. Moreover, in addition to these visual studies that are vulnerable for various observational limitations, the reality of the Dalton Minimum has been verified by measurements of the geomagnetic field declination. Here we make a detailed analysis of the geomagnetic and auroral observations during the DM period. We find a good overall correlation between the declination data and the most reliable auroral observations, in support of dramatic changes in solar and heliospheric conditions during DM. The annually averaged declination data depict a clear maximum in 1797, simultaneously with a similar maximum in auroral data. Moreover, the monthly declination data depict a prior minimum in 1793 and another clear maximum in 1795. The latter agrees with a maximum in the group sunspot number series while the minimum agrees with the recently suggested additional minimum in sunspot activity related to a lost cycle (Usoskin et al., 2001). Accordingly, geomagnetic declination data give support for the idea of the lost cycle in 1790s. This cycle has two maxima in geomagnetic activity as most other solar cycles, the first coindicing with sunspot maximum and the second with the maximum of recurrent high speed streams in the declining phase.

Session VI

INITIATION OF CMEs

Convener: Volker BOTHMER

SESSION VI: INITIATION OF CMEs

Convener: Volker BOTHMER

08:30 - 08:45 **D. Maricic**, B. Vrsnak, D. Rosa, B. Hrzina:
Initiation and Development of Two Coronal Mass Ejections

08:45 - 09:15 **P. Heinzel**:
EUV Filaments and their Mass Loading (invited)

09:15 - 09:30 L. Wei, P.Z. Xue, **S.T. Wu**, P. Scherrer:
Effects of Magnetic Topology on CME Kinematic Properties

09:30 - 09:45 **M. Tomczak**:
Kinematics of X-ray Ejections

09:45 - 10:00 **M. Bárta** and M. Karlický:
Radio Manifestation of Reconnection Outflow Jets

10:00 - 10:30 Coffee break

10:30 - 10:45 **A. Nindos**, J. Zhang, H. Zhang:
Patterns of photospheric evolution and the initiation and magnetic helicity of CMEs

10:45 - 11:00 **C. Foullon**:
Automated Detection and 3D Reconstruction of EUV Prominences

11:00 - 11:15 **B. Sylwester** and J. Sylwester:
Analysis of Yohkoh-observed Limb Flare Accompanying Strong CME/SEP Events

11:15 - 11:30 **D.K. Callebaut**, V.I. Makarov, A.G. Tlatov:
Relation between 'Solar Magnetic Dipole' and Filament Bands

11:30 - 11:45 **B.A. Lindblad**:
Solar Control of Meteor Radar Rates

Invited and Oral Contributions:

Title: **Initiation and development of two coronal mass ejections**
Presenting author: **Maricic, Darije** (darije.maricic@zg.hinet.hr)
Author(s): (1) Maricic, D., (2) Vrsnak, B., (1) Rosa, D., (2) Hrzina, B.
Affiliation(s): (1) Zagreb Astronomical Observatory, Zagreb, Croatia, (2) Hvar Observatory, Croatia

Abstract: Initiation and development of coronal mass ejections (CMEs) launched on 2001 May 15 and 2001 May 25 is analysed utilizing data obtained by LASCO-C2/C3 instruments, MK-IV coronagraph of Mauna Loa Observatory, and FeXII 195A EIT. Both CMEs show clearly recognizable three-part structure already at low heights, during the initial slow rise in the pre-eruptive phase. This provides kinematical measurements of different features within the three-part structure from the very beginning of the eruption up to the post-acceleration phase observed in the LASCO-C3 field of view. Kinematics at the onset of eruption shows a complex behaviour, revealing different acceleration-time curves for different elements of the three-part structure. In the former CME the main acceleration phase of the leading edge and the prominence was synchronized, yet the leading edge showed a slight pre-acceleration about half an hour before the main acceleration phase. In the later CME the acceleration of the prominence was delayed for about 20 min after the main acceleration of the leading edge. The former CME attained acceleration maximum at R=1.4 solar radii from the Sun's centre and the later one at R=2.4. In both cases the leading edge of CME and the prominence show the acceleration maximum at approximately the same time. Observations clearly evidence that the eruptions caused a global restructuring of the coronal magnetic field.

Title: **EUV Filaments and their Mass Loading (Invited talk)**
Presenting author: **Heinzel, Petr** (pheinzel@asu.cas.cz)
Author(s): Heinzel, P.
Affiliation(s): Astronomical Institute, Ondrejov, Czech Republic

Abstract: It was found recently (Heinzel et al., 2001, ApJ 561: L223) that solar filaments observed in EUV lines by SOHO/CDS are much more extended than their H-alpha counterparts. This was explained by a large difference between the hydrogen Lyman-continuum and H-alpha opacities. Two different MHD models were suggested to explain the EUV filament extensions: the model based on parasitic polarities (Aulanier & Schmieder, 2002, A&A 386, 1106) and the model with twisted flux tubes (Anzer & Heinzel, 2003,A&A, submitted). The latter model can explain our recent findings that at least some parts of the EUV extension are located relatively high in the corona. These heights can be computed using a new spectroscopic model of EUV filaments. The mass which is loaded into the EUV filament extensions is then estimated on the basis of detailed non-LTE transfer calculations. The total filament mass is larger than that derived for the H-alpha filament itself and this may have consequences for the structure and mass loading of CME's whenever they form from such filaments - this may answer the question how the extended CME structures can form from rather narrow H-alpha filaments. We summarize the basic properties of EUV filaments, present their spectroscopic analysis and give our latest estimates for mass loading. We then discuss possible relations between EUV filaments and CME's, in particular the problems of their densitiydistribution and their total masses.

Title: **Effects of Magnetic Topology on CME Kinematic Properties**
Presenting author: **Wu, Shi, Tsan.** (wus@cspar.uah.edu)
Author(s): (1) Wei, L., (1) Xue, P.Z., (2) Wu, S.T., (1) Scherrer, P.
Affiliation(s): (1) W.W.Hansen Experimental Physics Laboratory, Stanford University, Stanford, CA 94305-4083 USA, (2) University of Alabama, Huntsville, Alabama, USA

Abstract: The coronal mass ejections (CMEs) observed by the Skylab, Solar Maximum Mission, Solwind, Mauna Lao and SOHO coronagraphs all show two characteristic speed-height profiles (Gosling, et al. 1976; MacQueen and Fisher, 1983; St Cry et al. 1999, 2000; Andrews and Howard, 2001). These observations further indicate that CMEs originating from active regions and accompanied by flares tend to have higher speeds without acceleration and CMEs that do not originate from active regions but are accompanied by prominence eruptions show gradual acceleration with lower propagation speeds. Recently, Low and Zhang (2002) proposed that these two types of CME dynamical characteristics are caused by two types of initial magnetic field topologies: (i) normal and (ii) inverse quiescent prominences (Tandberg-Hanssen, 1995), respectively. To test their theory and further explore the effects of these two types of magnetic topologies on the two types of CMEs, we used a MHD streamer and flux-rope model (Guo, et al. 1996; Wu and Guo, 1995) to simulate the evolution of CMEs in the normal and inverse prominence environments. The numerical results show that CMEs originating from a normal prominence environment do have higher speeds than those from an inverse one. In addition, the present simulations demonstrate the distinct roles played by magnetic reconnections in these two topologically different magnetic environments to produce the two different CME height-time profiles as suggested by Low and Zhang (2002).

Title: **Kinematics of X-ray ejections**
Presenting author: **Tomczak, Michal** (tomczak@astro.uni.wroc.pl)
Author(s): Tomczak, M.
Affiliation(s): Astronomical Institute, University of Wroclaw, Wroclaw, Poland

Abstract: One of the direct signatures which can be connected with a CME onset seems to be a flare-associated X-ray ejection (XRE) of hot plasma. A majority of XREs, observed with the Soft X-ray Telescope onboard Yohkoh, was imaged with a poor quality due to a flare emission dominance. For the behind-the-limb flares, it is possible to make a more comprehensive analysis of XREs than usual. Several such events have been investigated. Their kinematics from height-time maps have been obtained. A relationship between XREs and CMEs has been discussed.

Title: **Radio manifestation of reconnection outflow jets**
Presenting author: **Barta, Miroslav** (barta@wave.asu.cas.cz)
Author(s): Barta, M., Karlicky, M.
Affiliation(s): Astronomical Institute, Ondrejov, Czech republic

Abstract: As was already suggested in our previous models of the lace bursts and the narrowband dm-spikes both these spectral types are formed in radio sources with MHD turbulence. Since

such conditions are, as commonly accepted, in the reconnection outflow jets, it is reasonable to locate radio sources of these bursts just there. The purpose of this paper is to present global view on relevant plasma processes. Starting from a 2-D MHD reconnection model the plasma density and magnetic field are determined. Assuming a propagation of an unstable distribution function outwards from the reconnection diffusion region along chosen magnetic field lines, contributions to the radio flux due to the double-resonance instability are computed. Integrating over an entire source volume the artificial radio spectra are obtained. It is shown that depending on MHD turbulence properties either the lace-burst or the dm-spikes are observed. Finally, a diagnostics of MHD turbulence - and reconnection outflows generally - based on the model is discussed.

Title: **Patterns of Photospheric Evolution and the Initiation and Magnetic Helicity of CMEs**

Presenting author: **Nindos, Alexander** (anindos@cc.uoi.gr)
Author(s): (1) Nindos, A., (2) Zhang, J., (3) Zhang, H.
Affiliation(s): (1) Section of Astrogeophysics, Physics Department, University of Ioannina, Ioannina GR-45110, Greece (2) Center for Earth Observing and Space Research, George Mason University, Fairfax VA22030, USA (3) National Astronomical Observatories, Chinese Academy of Sciences, Beijing 10012, PR China

Abstract: We compute the magnetic helicity injected by transient horizontal flows in 6 solar active regions associated with halo coronal mass ejections (CMEs) that produced major geomagnetic storms and magnetic clouds (MCs) at 1 AU. The computations cover time intervals of 110–150 hours and in 5 active regions the accumulated helicity is of the same sign as the chirality of the active regions. In 4 active regions the accumulated helicity due to transient flows is a factor of 3–14 larger than the corresponding helicity produced by differential rotation. However, the injection rate of helicity change due to transient flows is spatially and temporally incoherent and the accumulated helicities are a factor of 4.2–9 lower than the helicities ejected by the CMEs that originate from the active regions during our observations. We suggest that the bulk of the helicity carried away by the CMEs comes from magnetic flux that emerges twisted from the convective zone. Note that this conclusion does not change for at least 5 of the 6 active regions even if we consider realistic lower limits for the CME helicities. The study of the photospheric magnetic evolution of the active regions shows that there is not a unique pattern of photospheric evolution leading up to CMEs; the photospheric evolution several hours to a few days before CMEs may include combinations of flux emergence, shearing, twisting and converging motions. The fact that horizontal motions are inefficient helicity generators compared to flux emergence does not necessarily imply that such motions cannot play an important role in the initiation of the instability leading up to CME because when a system is close to its stability threshold even the injection of small amounts of helicity by such motions may be crucial in destabilizing the system. Our observations imply that among helicity–producing photospheric flows the most potentially efficient patterns in terms of the instability initiation include a fast–moving sunspot whose motion is a combination of shearing and converging motion and also rotating sunspots. The sunspot rotation is counterclockwise in active regions having negative helicity and clockwise in regions having positive helicity. Such transient motions between succesive CMEs may inject as much as 20–65% of the helicity carried away by the CME within 13–60 hr.

Title: **Automated detection and 3D reconstruction of EUV prominences**
Presenting author: **Foullon, Claire** (claire.foullon@oma.be)
Author(s): Foullon, C.
Affiliation(s): Royal Observatory of Belgium, Brussels, Belgium

Abstract: Developments to automatically detect and reconstruct in 3D EUV prominences are presented. The primary set of data used are the synoptic images taken by the Extreme-ultraviolet Imaging Telescope (EIT) on board SoHO. The analysis provides characteristics of the reconstructed volumes of EUV prominences for a given Carrington rotation. This is the first step for future case studies of important events and for extracting statistical properties over longer periods, which, given the size of the present EIT archive ranging over more than half of a solar cycle, could provide valuable and complementary studies to the H-alpha filament studies. The ultimate goal of this work is to give information on the mass loading of prominences, their probability to erupt and an evaluation of the risk for daily monitoring space weather.

Title: **Analysis of Yohkoh-observed Limb Flares Accompanying Strong CME/SEP Events**
Presenting author: **Sylwester, Barbara** (bs@cbk.pan.wroc.pl)
Author(s): Sylwester, B., Sylwester, J.
Affiliation(s): Solar Physics Division, Space Research Centre, Polish Academy of Sciences, Wroclaw, Poland

Abstract: We have made literature/web search in order to find well observed limb flares seen by Yohkoh instruments. For the purpose of this study we have looked for flares associated with significant SEP or CME counterparts. Only few such events have been found and analysed (including compact and arcade type flares as seen by SXT instrument). In this contribution we present results illustrating several aspects of flare evolution. They concern the morphology (SXT deconvolved images, HXT reconstructed images) and flaring plasma dynamics as seen in transversal (from image cadences) and radial directions (from BCS spectra analysis). Deconvolution reveals more details and allows to study maps of plasma temperature (above 5 MK) with the resolution down to 1 arcsec. As the analysis deals with the limb flares, detailed investigation of vertical motions of the hot plasma is possible. Corresponding movies will show details of the evolution patterns studied.

Title: **Relation between "solar magnetic dipole" and filament bands**
Presenting author: **Callebaut, Dirk, K.** (dirk.callebaut@ua.ac.be)
Author(s): (1) Callebaut, D.K., (2) Makarov, V.I., (2) Tlatov, A.G.
Affiliation(s): (1) U. of Antwerp, Antwerp, Belgium, (2) Pulkovo Astronomical Observatory, Saint Petersburg, Russia

Abstract: The polar plumes on pictures of solar eclipses may be used to define a concept like a solar 'virtual magnetic dipole. Indeed the tangents to the plumes are practically concurrent in

a 'north pole and a 'south pole inside the Sun. The evolution of this solar dipole during many solar cycles has been studied by us, although the observations are obviously discontinuous in time. However from SOHO observations (nearly 400 days of the reel!) the evolution of this virtual dipole was followed daily yielding a practically continuous set. The filament bands which separate the large-scale unipolar magnetic regions carry currents up to 10^{11} ampere and are separated from each other by about half a solar radius. It is suggested that these huge currents affect the polar plumes and thus indirectly the virtual solar dipole. In fact the latter may consist of two parts. A) The main part is caused by the filament bands (in particular the nearest one together with the enclosed large-scale unipolar field region). This causes the polarity reversal(s) during a cycle. B) In addition there may be a much smaller part (a dipole or rather a multipole). If present it is inherent to the Sun and will evolve barely during a solar cycle. The fact that the observations yield a dipole which coincides practically with the rotation axis is a further indication of the weakness of this part (cf. Cowlings theorem). References: 1) Callebaut, D. K. and Makarov, V. I., 1992, Solar Phys., 141, 381, 2) Makarov, V. I., Tlatov, A. G., Callebaut, D. K. and Obridko, V.N., 2002, Solar Phys., 206, 383.

Title: **Solar Control of Meteor Radar Rates**

Presenting author: **Lindblad, B.A.** (linasu@gemini.ldc.lu.se)
Author(s): Lindblad, B.A.
Affiliation(s): Lund Observatory, Lund, Sweden

Abstract: Based on a three decade long series of meteor radar observations carried out in August-September 1953-1983 at the Onsala Space Observatory in Sweden long-term, intermediate-term and short-term variations in meteor radar rates have been studied. An inverse correlation is found between meteor radar rates and the solar cycle. The magnitude of this effect is quite large; about twice as many radar echoes are observed at solar minimum as at solar maximum. We propose that this long-term inverse correlation with the sunspot cycle is caused by a solar cycle controlled variation of the atmospheric density gradient at meteor ablation heights (90-110 km), with highest values of the density gradient being observed at solar minimum conditions. A search for day-to-day variations in meteor radar rates, which correlate with short-term solar activity, was also made. A superposed epoch analysis based on solar wind sector boundaries as key dates showed that a minimum in Onsala metero radar rates occured about 3 days after the Earth's passage of a solar wind sector bounddary. At the same time the geomagnetic indices Kp and Cp showed a pronounced maximum. These results are compared with similar short-term meteor radar studies made elsewhere.

Posters:

Contribution number: VI.1p
Title: **Relationship between solar radio spikes observed at 1420 MHz and solar active phenomena**
Presenting author: **Rompolt, Bogdan** (rompolt@astro.uni.wroc.pl)
Author(s): (1) Dabrowski, B., (2) Rompolt, B., (2) Falewicz, R., (2) Rudawy, P., (3) Siarkowski, M.
Affiliation(s): (1) Centrum Astronomii UMK, 87-100 Torun, ul. Gagarina 11, Poland (2) Astronomical Institute of Wroclaw University, 51-622 Wroclaw, ul. Kopernika (3) Space Research Centre, Polish Academy of Sciences, 51-622 Wroclaw, ul. Kopernika, Poland

Abstract: Numerous solar radio narrow-band spikes have been observed by one of us (DB) with the RT-15 radio telescope of Torun Observatory between March 15, 2000 and May 14, 2001. The observations were made in 1352-1490 MHz band with very high time resolution (12500 measurements per second) and with moderate frequency resolution (3 MHz per channel). We are presenting here a short review of collected events and results of an analysis of a relationship between the spikes, solar flares and coronal mass ejections. Using X-ray data collected with Yohkoh, Interball, MTI and GOES satellites, UV data taken with TRACE and SOHO satellites and ground based observations made in H-alpha line we have analysed correlations of the occurrences of the radio narrow-band spikes with various solar active events. We have found that most of the solar spikes were observed during the various phases of the solar flares, starting from impulsive phases up to late gradual phases, but numerous spikes were not correlated in time with any solar flare recorded by GOES or Yohkoh. Using this data we considered also various mechanisms of the narrow-band radio spikes generation.

Contribution number: VI.2p
Title: **Regular variations of 3 GHz radio flux and current-loop coalescence model of solar flares**
Presenting author: **Jiricka, Karel** (jiricka@asu.cas.cz)
Author(s): Jiricka, K., Karlicky, M.
Affiliation(s): Ondrejov Observatory, Czech Republic

Abstract: The 3 GHz radio flux records of two solar flares with regular variations are presented. While the 3 GHz flux record of the April 7, 1997 flare shows double-peaks periodicity, the 3 GHz record of the March 29, 2001 flare reveals regular radio flux steps at the ascending part of the radio burst. We interpret the observed phenomena using the current loop coalescence model of solar flares. In the April 7, 1997 event, we suggest that the main period of the 3 GHz radio flux (about 100 s) corresponds to the repetition of the current loop coalescence, and the radio double peaks are associated with the maxima of the electric field component perpendicular to the interaction plane. In this case the plasma beta parameter in the current loop coalescence process is estimated to be 0.63. An increase of the beta parameter during the flare is recognized. On the other hand, the steps-form of the 3 GHz flux record of the March 29, 2001 event expresses an

increasing amount of accelerated electrons during periodic coalescence accelerations.

Contribution number: VI.3p
Title: **Complex analysis of two eruptive prominences associated by CMEs observed on 2 August 2000**
Presenting author: **Radziszewski, Krzysztof** (radziszewski@astro.uni.wroc.pl)
Author(s): Radziszewski, K., Rompolt, B.
Affiliation(s): Astronomical Institute of the Wroclaw University, Wroclaw, Poland

Abstract: We present the results of a detailed analysis of eruptions of two prominences and accompanied CMEs occurred at the eastern solar limb on 2 August 2000. The analysis was performed on the basis of observations taken at the Astronomical Institute of Wroclaw University (H-alpha), SOHO/LASCO (C2 and C3), SOHO/EIT (UV and EUV), TRACE (UV and EUV), Pic du Midi (H-alpha) and Meudon (H-alpha and Ca II). The first eruption which started at about 08:30 UT was associated with a solar flare of GOES class C7.9 and produced a faint and not very conspicuous CME. After this eruption a large quiescent prominence situated to the North from the flare on the eastern limb, was activated and strongly changed. The observed destabilization of the activated prominence, evidently caused by the first eruption, brought about to the eruption of this prominence and a large-scale CME. This second eruption occurred at about 19:00 UT. After the C7.9 the GOES X-ray level was rather low and oscillated between B7 and C1 (GOES class) through the next twenty or so hours. This evidences that the second large-scale CME was associated with the eruption of the prominence but not with a strong flare.

Contribution number: VI.4p
Title: **3D Evolution of an Eruptive Prominence of 15 May 2000 and the Associated Active Phenomena**
Presenting author: **Rompolt, Bogdan** (rompolt@astro.uni.wroc.pl)
Author(s): Rudawy, P., Cader-Sroka, B., Garczynska, I.N., Rompolt, B., Szuszakiewicz, E.
Affiliation(s): Astronomical Institute of Wroclaw University, 51-622 Wroclaw, ul. Kopernika 11 , Poland

Abstract: An interesting eruptive prominence was observed on 15 May 2000 at the eastern part of the solar limb with the Small Coronagraph, Large Coronagraph and the MSDP (spectral imagery) at the Wroclaw Astronomical Institute. The prominence as observed in H-alpha hydrogen line gained quite considerable height and velocity and was associated with a flare and coronal mass ejection (CME). A 3D evolution of the prominence was established on the basis of our H-alpha images and spectra. Start of the prominence eruption occurred exactly at the time of the estimated onset of the accompanying CME.

Contribution number: VI.5p
Title: **3D-topology of an EUV-filament Observed by CDS/SoHO and VTT**
Presenting author: **Schwartz, Pavol** (schwartz@asu.cas.cz)
Author(s): (1) Schwartz, P., (1) Heinzel, P., (2) Schmieder, B., (3) Anzer, U.
Affiliation(s): (1) Astronomical Institute, Academy of Sciiences, Czech Republic, (2) Observatoire de Paris, Section Meudon, LESIA, France, (3) Max-Plank-Institut fuer Astrophysik, Karl-Schwarzschild-Strasse 1, Garching, Germany

Abstract: We have constructed spatial models of an extended EUV-filament observed on October 15th 1999 (polar crown N 38 deg) by CDS/SoHO. The narrow Hα counterparts were observed by VTT. As found by Heinzel et al. (2001, Ap.J., 561, L223), EUV-filaments are much more extended than those parts visible in H-alpha. We have computed the bottom and top heights of this EUV-filament for the whole CDS raster for different values of the optical thickness. We have used CDS measurements of two coronal lines (MgX 624.94 A and SiXII 520.60 A) and one transition-region line (OV 629.73 A). We used a new model of Heinzel et al. (2003, Sol. Phys., submitted) for our computations, but we included the hydrogen Lyman-continuum opacity dependence on the Gaunt factor. For the scale height of the MgX line we used the value of Fludra et al. (1999, J. Geoph. Res., 104, 9709), assuming that this line is not solar cycle and activity dependent. Because of the inhomogeneity in the OV 629.37 line intensity distribution within the CDS raster it was impossible to estimate the optical thickness of the EUV-filament. However, the intensity distribution of another transition-region line, e.g. OVI observed by SUMER, with wavelenght greater than the hydrogen Lyman-continuum head (this line is therefore not absorbed by the EUV-filament), could be useful for determining the intensity distribution of the OV line under the EUV-filament. The knowledge of the heights of the lower and upper borders of an EUV-filament gives us the EUV-filament thickness. Then the density of the EUV-filament plasma can be computed using our non-LTE radiative transfer code.

Session VII

CMEs, ICMEs AND SPACE WEATHER

Convener: David WEBB

SESSION VII: CMEs, ICMEs AND SPACE WEATHER
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14:00 - 14:30 **B. Jackson**, P.P. Hick, A. Buffington:
Remote Sensing of Heliospheric Structures Using IPS and Thomson Scattering Observations (invited)

14:30 - 14:45 **B. Vrsnak**, D. Ruzdjak, D. Sudar, N. Gopalswamy:
Dynamics of Coronal Mass Ejections in the Near-Sun Interplanetary Space

14:45 - 15:00 Y. Feldstein, B. Tsurutani, W. Gonzalez, **A. Prigancová**, A. Levitin, J. Kozyra, L. Alperovich, U. Mall, L. Gromova, L.A. Dremukhina:
Space Weather Signatures of the 1-7 May 1998 Global Disturbances and their Quantification in Terms of Magnetospheric Contributions into Dst Development

15:00 - 15:30 **R. von Steiger** and T.H. Zurbuchen:
Composition Signatures of Interplanetary Coronal Mass Ejections (invited)

15:30 - 16:00 Coffee break

16:00 - 16:15 **J. Richardson:**, J.C. Kasper, A.J. Lazarus, C. Wang:
Solar Cycle and/or Helium Variations in the Solar Wind

16:15 - 16:30 **E. Romashets** and M. Vandas:
Interplanetary Magnetic Clouds of Toroidal Shapes

16:30 - 17:00 **M. Vandas**:
Interplanetary Modeling of ICMEs (invited)

17:00 - 17:15 **D. Odstrčil**, J.A. Linker, R. Lionello, Z. Mikic, P. Riley, V.J. Pizzo, J.G. Luhmann:
3-D Simulations of ICMEs by Coupled Coronal and Heliospheric Models

17:15 - 17:30 **Z. Smith**, T. Detman, M. Dryer, C.D. Fry, C.-C. Wu:
Study of Solar-based Inputs into Space Weather Models that Predict Interplanetary Shock Arrivals at Earth

17:30 - 17:45 **V.N. Ishkov**:
Short Term Forecast of Solar Geoeffective Flare Events

Invited and Oral Contributions:

Title: **Remote Sensing of Heliospheric Structures Using IPS and Thomson Scattering Observations (Invited talk)**

Presenting author: **Jackson, Bernard, V.** (bvjackson@ucsd.edu)
Author(s): Jackson, B., Hick, P.P., Buffington, A.
Affiliation(s): Center for Astrophysics and Space Sciences/University of California at San Diego, USA

Abstract: The Air Force/NASA Solar Mass Ejection Imager (SMEI) launched January 6, 2003 is now recording whole sky data on each 100-minute orbit. Precise photometric images of the heliosphere around Earth are expected from these data. To optimize the information available from this and similar instruments, we are developing a tomographic technique for analyzing remote sensing observations of the heliosphere using both interplanetary scintillation (IPS) and Thomson scattering data. The technique provides three-dimensional reconstruction of heliospheric velocities and densities. We have refined our tomography program to analyze time-dependent phenomena such as evolving corotating heliospheric structures and more discrete events such as coronal mass ejections (CMEs).

Title: **Dynamics of coronal mass ejections in the near-Sun interplanetary space**

Presenting author: **Vrsnak, Bojan** (bvrsnak@geodet.geof.hr)
Author(s): (1) Vrsnak, B., (1) Ruzdjak, D., (1) Sudar, D., (2) Gopalswamy, N.
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Abstract: Kinematics of more than 5000 coronal mass ejections (CMEs) measured between 2 and 30 solar radii is investigated. A distinct relationship between the late-phase acceleration of CMEs and their velocities is found. It can be represented in the form a=-0.02 (v-400), where the velocity v is expressed in km/s and the acceleration a in m/s2. The relationship is interpreted in terms of coupling of the CME motion and the solar wind, i.e., by the action of the aerodynamic drag. The results indicate that in the considered radial distance range the Lorentz force acceleration becomes weak, in the majority of the events spanning between 0 and 10 m/s2. The dependence of the a(v) relationship on the CMEs widths and radial distances is investigated in detail. It is found that, on average, the influence of the ambient plasma on the motion of CMEs decreases with the radial distance, and depends on the CME width. Implications for the interplanetary motion of CMEs are discussed, emphasising the prediction of the 1 a.u. arrival time.

Title: **Space Weather Signatures of the 1-7 May 1998 Global Disturbances and their Quantification in Terms of Magnetospheric Contributions into Dst Development**

Presenting author: **Prigancova, Alina** (geofpri@savba.sk)

Author(s): (1) Feldstein, Y., (2) Tsurutani, B., (3) Gonzalez, W.D., (4) Prigancova, A., (1) Levitin, A., (5) Kozyra, J., (6) Alperovich, L., (7) Mall, U., (1) Gromova, L., (1) Dremukhina, L.

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Abstract: At present there is no complete understanding of the relationships between a complex chain of interplanetary space weather signatures and geoeffective impacts on the magnetosphere/ionosphere system. In this paper, we apply the unique data-based Paraboloid model to several magnetic storms. One key feature of this model is that it uses high time resolution DMPS data on high latitude auroral particle precipitation boundaries to establish both the instantaneous size of the magnetotail lobe and geocentric distance to the tail current inner edge. The two storms (a weak one on 2 May and an intense one on 4 May 1998 with peak Dst of -85 nT and -205 nT, respectively) are quantified in terms of various magnetospheric contributions to the Dst index. A number of magnetospheric large scale current systems influencing Dst development are considered. Using the Paraboloid model for the magnetospheric magnetic field, the magnetic variation profile on the Earth's surface during the storm main phase is shown to be significantly influenced not only by the ring current but also by the magnetotail current. The relative contributions will be discussed. Our results will be compared with those from other models. The model variation profile will also be compared with satellite measurements of the magnetic field at geosynchronous orbit. The Paraboloid model predicts that the current sheet will penetrate to distances much closer to the Earth than other models do. This critical test has yet to be performed. Finally some aspects of the magnetic storm energization and ring/tail current system dynamics will be discussed. The approach applied here not only enables one to model the Dst index more accurately, but will also be useful in making space weather predictions.

Title: **Composition Signatures of Interplanetary Coronal Mass Ejections (Invited talk)**

Presenting author: **von Steiger, Rudolf** (vsteiger@issi.unibe.ch)

Author(s): (1) von Steiger, R., (2) Zurbuchen, T. H.

Affiliation(s): (1) ISSI, Bern, Switzerland, (2) Univ. of Michigan, Ann Arbor, MI, USA

Abstract: The interplanetary counterparts of coronal mass ejections (ICMEs) are complex phenomena that are not recognised or characterised easily. Many signatures have been defined and used to identify them: kinetic, magnetic, thermal, energetic particles, etc., but hardly any ICME event shows a signal in all of them. Another classical ICME identifier is the abundance of alpha

particles. It was shown that an alpha-to-proton ration of ¿8% is a sufficient criterion for ICME detection, albeit not a necessary one. In recent years more composition signatures for ICMEs were defined using the time-of-flight instruments on Ulysses and ACE, and it could be shown that a high average iron charge state is also a sufficient but not necessary ICME signature. The same is probably true for an increased oxygen or carbon freezing-in temperature above a certain threshold value. Composition signatures are particularly attractive since they are unlikely to change once the CME has left the Sun, making them a robust tool for ICME identification. Using the data obtained with Ulysses SWICS we assess which of the composition signatures are observed in ICMEs defined by the classical signatures. Conversely, we search for occurrences of composition signatures and assess whether or not an ICME is associated with it. As a result we obtain a quality measure for each composition signature.

Title: **Solar cycle and/or helium variations in the solar wind**
Presenting author: **Richardson, John** (jdr@space.mit.edu)
Author(s): Richardson, J.D., Kasper, J.C., Lazarus, A.J., Wang, C.
Affiliation(s): M.I.T., Cambridge, MA, USA

Abstract: The solar input to Earth's magnetosphere varies on scales from seconds to solar cycles. We now have sufficient spacecraft data to discuss variations on all of these scales. We will discuss solar cycle variation of solar wind parameters, shock parameters, and helium abundances. Helium abundances are one signature by which CMEs are identified, although these abundances are quite variable between different CMEs and even within and individual CME. We compare helium/proton density ratios observed by ACE and Wind. Preliminary results suggest that when these ratios are low the spacecraft observations agree well, but when high different structures are often observed at the two spacecraft. This result suggests that scale sizes of helium features within CMEs are small.

Title: **Interplanetary magnetic clouds of toroidal shapes**
Presenting author: **Romashets, Eugene** (romash@izmiran.rssi.ru)
Author(s): (1) Romashets, E., (2) Vandas, M.
Affiliation(s): (1) IZMIRAN, Troitsk, Russia, (2) Astronomical Institute, Praha, Czech Republic

Abstract: An analytical solution of force-free magnetic field inside a toroid with an arbitrary aspect ratio was found. A scalar equation was derived which when solved gives the heart of the solution of the vector field in toroidal coordinates, in close form in terms hypergeometric functions. The solution is used for interpretation of magnetic cloud measurements near the Earth's orbit. It is assumed that a magnetic cloud is a large loop with its roots at the Sun, then its part interacting with the Earth's magnetosphere can be treated as a part of toroid. The former solution by Miller and Turner (1981) was limited only to larger aspect ratios. The presented solution coincides with Lundquist (1950) one for cylindrrical clouds in case of a very large aspect ratio torus.

Title: **Interplanetary modeling of ICMEs (Invited talk)**

Presenting author: **Vandas, Marek** (vandas@ig.cas.cz)
Author(s): Vandas, M.
Affiliation(s): Astronomical Institute, Academy of Sciences, Czech republic

Abstract: Coronal mass ejections (CMEs) are transient expulsions of solar plasma from the gravitational field of the Sun as seen in white light coronagraph observations. Their interplanetary manifestations are called interplanetary coronal mass ejections (ICMEs). This review is concerned with ICMEs from a theoretical point of view. During recent years a significant progress in numerical modeling of ICMEs has been achieved. This is caused by increasing power of computational resources, which enables to perform three dimensional magnetohydrodynamic simulations. These simulations of ICME evolution help us to better understand observations of interplanetary transient events. And the same is true for various analytical or semi-analytical models of ICMEs, which will be also briefly described.

Title: **3-D MHD Simulations of ICMEs by Coupled Coronal and Heliospheric Models**

Presenting author: **Odstrcil, Dusan** (Dusan.Odstrcil@noaa.gov)
Author(s): (1) Odstrcil, D., (2) Linker, J.A., (2) Lionello, R., (2) Mikic, Z., (2) Riley, P., (1) Pizzo, V.J., (3) Luhmann, J.G.
Affiliation(s): (1) Univ. of Colorado and NOAA/SEC, Boulder, USA, (2) SAIC, San Diego, USA, (3) Univ. of California, Berkeley, USA

Abstract: Space weather research and forecasting involves a complex chain of dynamic phenomena occurring simultaneously on various spatial and temporal scales. Specialized physically-based numerical models have been developed to address particular aspects of the entire system; however, coupled simulations are necessary to understand and eventually predict heliospheric events. We will review recent progress in this area achieved at the Center for Integrated Space Weather Modeling (a new consortium supported by the National Science Foundation). Special attention will be given to the three-dimensional computations of formation, propagation, and interaction of coronal mass ejections and shocks in a non-homogeneous solar wind.

Title: **Study of solar-based inputs into space weather models that predict interplanetary shock-arrivals at Earth**

Presenting author: **Smith, Zdenka** (zdenka.smith@NOAA.gov)
Author(s): (1) Smith, Z., (1) Detman, T., (1) Dryer, M., (2)(3) Fry, C.D., (3)(4) Wu, C.-C.
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Abstract: We compare interplanetary shocks observed at Earth in the time period January through May 2002 with shock-arrivals predicted, in the operational environment, by an ensemble of numerical models. Inputs to the models include metric type II radio burst and halo/partial halo CME observations. We assess the consequences of the arrival of these interplanetary shocks at Earth by the strength of the geomagnetic activity, measured by Kp, that follows the shocks. The aim of this work is to provide information on how solar observations can be parameterized for input into fully time dependent, 3D, MHD modeling codes for forecasting purposes.

Title: **Short Term Forecast of Solar Geoeffective Flare Events**
Presenting author: **Ishkov, Vitaly, N.** (ishkov@izmiran.rssi.ru)
Author(s): Ishkov, V.N.
Affiliation(s): IZMIRAN, Troitsk, RUSSIA

Abstract: The method for utilizing solar observational data to predict of the geoeffective solar flare events, that a large solar flare and solar filament ejection, is presented. Both phenomena are result of the new emergent flux distinct powerful and rate of emergence. The process of new magnetic flux emergence, its evolution and its interaction with already existing magnetic flux is sufficiently determined that allows us to predict as a period of flare energy release (PFER) so an importance of most solar flare in the flare set of this period. All large solar flares are always accompanied by a series of weaker events. They formed together the PFER confined within the time intervals about 55±20 hours, when the bulk of the middle and large solar flare are accomplished. Taking into account physical and geometrical parameters of the own flare event, the active region and characteristics accompanying CME makes possible to predict the parameters of solar proton event, the characteristics of geomagnetic activity and other space weather phenomena. The method of solar flare event predictions has been put to test on Russian scientific satellites suh as GRANAT, GAMMA, CORONAS-I and CORONAS-F.

Posters:

Contribution number: VII.1p
Title: **Semiannual behaviour of monthly mean of Bz component of geoeffective (Kp¿3) ICMEs**
Presenting author: **Ludmany, Andras** (ludmany@tigris.klte.hu)
Author(s): Baranyi, T., Ludmany, A.
Affiliation(s): Heliophysical Observatory, H-4010 Debrecen P.O. Box 30. Hungary

Abstract: The annual/semiannual behaviour of monthly mean IMF Bz component as well as the number of hours spent by the Earth in domains of either positive or negative By component were studied in the case of geoeffective (Kp¿3) CMEs. The maximum and minimum years of consecutive solar dipole cycles were separated, and definite differences were found between the annual variations of the mean values. When the solar dipole is opposite to the terrestrial one, the mean Bz does not exhibit the Russell-McPherron effect in the GSM system because there are strong inverse annual variations in the GSE system. However, the Russell-McPherron effect can be detected in the occurrence of the negative and positive GSM By values. The case is opposite in those years when the solar and terrestrial dipoles are parallel: the Russell-McPherron effect is detectable

in the opposite annual variations of the mean GSM Bz but not in the occurrence of GSM By values.

Contribution number: VII.2p
Title: **Preliminary analysis of a CME observed by SOHO and Ulysses experiments**
Presenting author: **Bemporad, Alessandro** (bempy76@arcetri.astro.it)
Author(s): (1) Bemporad, A.,(2) Poletto, G., (1) Romoli, M., (3) Suess, S.T.
Affiliation(s): (1) Dipartimento di Astronomia e scienza dello spazio, Universita di Firenze, Firenze, Italy, (2) Osservatorio Astrofisico di Arcetri, Firenze, Italy, (3) NASA-MSFC, USA

Abstract: Over the last week of November 2002 SOHO/LASCO observed several Coronal Mass Ejections, most of which occurring in the NW quadrant and probably related with Active Regions 10197 and 10199. SOHO/UVCS observed most of them: in this presentation we focus on the analysis of the event which started on November 26 at 15:30 UT and continued for nearly 20 hours. The UVCS slit was set normal to the Sun-Ulysses direction at an altitude of 1.7 solar radii and was centered at a latitude of 27 degrees in the NW quadrant. Data were acquired with a grating positiion which includes lines from low and high excitation ions, such as the CIII and Ni III lines at, respectively, 977 and 991 Angstrom, the OVI doublet at 1032 - 1037 Angstrom, the Si XII doublet at 499 - 520 Angstrom, and the 943 and 974 lines from, respectively, Ca XIV and Fe XVIII lines. During the CME evolution line intensities show a high spatial and temporal variability which depends on whether lines are emitted from low or high ionization ions. A spectroscopic analysis of UVCS data is presented here and CME physical parameters are given both in the corona and in situ.

Contribution number: VII.3p
Title: **Geomagnetic activity onset predictions: problems with possible signatures in cosmic rays.**
Presenting author: **Kudela, Karel** (kkudela@kosice.upjs.sk)
Author(s): (1) Bingsen, X., Guiming Le, J. M., (2) Kudela, K., (3) Andrejkova, G.
Affiliation(s): (1) Center for Space Science and Applied Research, Chinese Acad. Sci., Beijing, China, (2) Institute of Experimental Physics, Slovak Acad. Sci., Kosice, Slovakia, (3) Faculty of Sciences, P.J. Safarik University, Kosice, Slovakia

Abstract: Predictions of geomagnetic activity marked by strong sudden decreases of Dst are mainly based on time series of solar wind velocity and density and on Bz component of IMF. These characteristics are of 'local' interplanetary character and predictions are of relatively short time. In addition, for several strong geomagnetic disturbances in the past, these parameters are not available. Cosmic ray particles with their large gyroradius and mean free path for scattering on IMF inhomogenities, are intuitively of some interest for eventual geomagnetic disturbances predictions. The redistribution of IMF structures, as CMEs are, can be in principle 'seen' by cosmic rays at Earth's orbit well before CME is reaching it. The anisotropy of cosmic rays and its simplified measures according to the variability observed at neutron monitors with different asymptotic directions are discussed. For the largest geomagnetic disturbances in the period 1982-2002 the behaviour of cosmic rays at selected neutron monitors are summarized before the onset

of geoeffective events. Different approaches to the problem of using cosmic ray characteristics as a possible predictor of storms are critically reviewed. The results of ANN and Bayesian neural network predictions with using simplified measure of CR anisotropy as an additional parameter to the IMF and solar wind are presented.

Contribution number:	VII.4p
Title:	**CMEs, geomagnetic storms and height profile of the ionospheric response over the Europe**
Presenting author:	**Buresova, Dalia** (buresd@ufa.cas.cz)
Author(s):	Buresova, D.
Affiliation(s):	Institute of Atmospheric Physics, Academy of Sciences of the Czech Republic

Abstract: CMEs are often seen as spectacular eruptions of matter from the Sun propagating outward the heliosphere and often interacting with the Earth's magnetosphere.The variability of the ionospheric parameters increases substantially during geomagnetic storms initiated by solar disturbances. Considering different composition and the spectrum of the UV and energetic particles reaching each ionospheric region according to altitude, the D, E, F1 and F2 regions all have their own unique structural characteristics and a different response of each region to storm-induced disturbances could be expected. This contribution deals with the ionospheric parameters analysis at different altitudes during geomagnetic storms and super storms associated with CME events. All available data for selected events from several European ionospheric stations (Lerwick, Chilton, Pruhonice, Warsaw, Ebro, Arenosillo, Athens) were analysed. The geomagnetic storm effects on F1 region (150 200 km) are substantially weaker than those in the F2 region (above 200 km) and in the lower ionosphere (below about 100 km). Independent of the sign of the geomagnetic storm effects on NmF2, the effect on the electron density, if any at all, in the upper F1 region, has been always negative for European high-middle latitudes. At European lower middle latitudes (Ebro, Arenosillo, Athens), the geomagnetic storm effects at F1 region heights are weaker and less regular. Seasonal variation of the F1 region response to geomagnetic storms is well detectable at European higher middle latitudes.

Contribution number:	VII.5p
Title:	**Interplanetary Energetic Particles and Space Weather**
Presenting author:	**Getselev, Igor, V.** (getselev@taspd.sinp.msu.ru)
Author(s):	Getselev, I., Podzolko, M.
Affiliation(s):	Skobeltsin Institute of Nuclear Physics, Moscow State University, Moscow, Russia

Abstract: Energetic particles of solar and galactic cosmic rays play an important part in forming the space weather. We suggest to take the total fluences of solar and galactic cosmic rays over long enough time intervals as one of the parameters of the space weather. For this purpose parameters of the sequences of data on fluences of interplanetary protons of energies higher than 10, 30 MeV and so on over half a year, 1 year, 2 years etc. measured in 21-23 solar cycles have been calculated and their peculiarities have been considered. Data on interplanetary protons in 19-23 solar cycles have been calculated. Energy and frequency spectra of solar and galactic protons have been estimated. The obtained results are being discussed and the ways of their application are

suggested.

Contribution number:	VII.6p
Title:	**Characteristics of upstream particle fluxes near and far from the Earth's bow shock**
Presenting author:	**Kecskemety, Karoly** (kecske@rmki.kfki.hu)
Author(s):	(1) Kecskemety, K., (2) Kudela, K., (3) McKenna-Lawlor, S.
Affiliation(s):	(1) KFKI Research Institute for Particle and Nuclear Physics, Budapest, Hungary (2) Institute of Experimental Physics, Kosice, Slovakia, (3) Space Technology Ireland, National University of Ireland, Maynooth, Ireland

Abstract: A study of more than 2000 upstream ion increases observed aboard SOHO and Interball-1 in 1996-1997 is presented. The measurements cover the energy range ¿20 keV to a few MeV for protons. LION on SOHO measures upstream ions at distances of 200-250 Re from the Earth while DOK2 on INTERBALL-1 provides complementary energy spectra and particle fluxes within 30 Re of the Earth's bow shock. The upstream ion increases at SOHO are classified according to their duration and energy spectra. Upstream events consisting of short duration (¡10 min) spikes at SOHO are statistically correlated with solar wind velocity, Kp and with their magnetic connectivity to the model bow shock, thereby indicating a bow-shock origin. A comparison of the distribution of proton fluxes observed at L1 with those close to the Earth suggests that the latter are larger by a factor of about 20-30. Gradual events (¿10 min) with harder energy spectra, are better correlated with Kp and with solar wind speed than are short spikes with soft spectra, which are identified to be of interplanetary

Contribution number:	VII.7p
Title:	**Neutron Monitor Data Base in Real Time**
Presenting author:	**Kudela, Karel** (kkudela@kosice.upjs.sk)
Author(s):	(1) Kozlov, V.I., (2) Kudela, K., (1) Starodubtsev, S.A., (1) Turpanov, A.A., (3) Usoskin, I.G., (4) Yanke, V.G.
Affiliation(s):	(1) IKFIA SB RAS, Yakutsk, Russia, (2) IEP SAS Kosice, Slovakia, (3) SGO, Univ. Oulu, Finland, (4) IZMIRAN, Troitsk, Russia

Abstract: We present a first distributed Real Time Cosmic Ray Database using measurements of several neutron monitors. The aim of the project is to develop a unified database with data from different neutron monitors collected together, in unified format and to provide a user with several commonly used data access methods. The database contains original cosmic ray as well as all housekeeping and technical data necessary for scientific data analysis. Currently the database includes Lomnicky Stit, Moscow, Oulu, Tixie Bay, Yakutsk stations and it is opened for other neutron monitors. The main database server is located in IKFIA SB RAS (Yakutsk) but there will be several mirrors of the database. The database and all its mirrors are updated on the nearly real-time (1 hour) basis. The data access software includes WWW-interface, Perl scripts and C library, which may be linked to a user program. Most of frequently used functions are implemented to make it operable to users without SQL language knowledge. A draft of the data representation standard is suggested, based on common practice of neutron monitor community. The database engine is freely distributed open-sourced PostgreSQL server coupled with a set of

replication tools developed at Bioengineering division of the IRCCS E.Medea, Italy.

Contribution number: VII.8p
Title: **Sun-Earth Transit Times of Geoeffective Solar Disturbances**
Presenting author: **Park, YoungDeuk** (ydpark@kao.re.kr)
Author(s): (1) Park, Y.D., (1) Moon, Y.-J., (2) Kim, Iraida S., (3) Yun, H. S.
Affiliation(s): (1) Korea Astronomy Observatory, Daejeon, Korea, (2) Sternberg State Astronomical Institute, Moscow, Russia, (3) Seoul National University, Seoul, Korea

Abstract: We have examined delay times between solar disturbances (X-ray flares and DSFs) and storm sudden commencements(SSC) as well as between SSC and major geomagnetic storms. To carry out cross-correlation analysis of these point series data, we have introduced a new correlation measure. We have confirmed from the correlation analyses that (1) the most probable traveling time of a solar disturbance from the Sun to the Earth is estimated to be about 2 days for a disturbance associated with major (X and M class) solar flares, and about 3 days for a disturbance associated with DSFs, (2) long-duration flares are better correlated with SSCs than short-duration flares, (3) travelling times of solar disturbances strongly depend on the heliolongitude where they originate, and (4) solar disturbances associated with flares and DSFs at the western limb can hardly reach the Earth. On the other hand, the results of this paper were discussed in terms of two types of CMEs.

Contribution number: VII.9p
Title: **Medium-Scale Magnetic Flux Rope in the Solar Wind**
Presenting author: **Song, Qiwu** (songqw@163.com)
Author(s): (1) Song, Q.W., (2) Wu, D.J., (2) Chao, J.K.
Affiliation(s): (1) Purple Mountain Observatory, Nanjing, PRC, (2) National Center University, Taiwan

Abstract: A magnetic cloud is a region of relatively strong magnetic fields in the solar wind, where magnetic fields rotate smoothly over approximately 0.25 AU at 1AU [Burlaga et al., 1981]. A simple magnetic cloud has a flux rope geometry. Such transient probably arise from magnetic reconnection in the solar corona [e.g., Kopp and Pneuman. 1976; Hiei et al. 1993]. In a recent work, Moldwin et al. [2000] report six small-scale magnetic flux ropes identified from the data of IMP 8 and WIND spacecraft. Different from magnetic clouds, these small- scale magnetic flux ropes(diameter of 270 Re on average) have a smaller size , dont expand at 1AU and haven't a low proton temperature. They suggested that the size distribution of solar wind magnetic flux ropes might be discrete, these events must be signatures of magnetic reconnection in the heliospheric current sheet (HCS) opposed to the solar corona. This paper describes several medium -scale magnetic flux ropes(diameters of 484 C 3900 Re) identified from the data of ACE(from 1998 through 2001) and WIND(from 1995 through 2001) spacecraft at 1 AU, suggests that solar wind magnetic flux ropes are of a continuous size distribution , part of the medium-scale magnetic flux ropes origin in the solar corona.

Contribution number: VII.10p
Title: **Modeling magnetic fields around magnetic clouds of different geometries**
Presenting author: **Vandas, Marek** (vandas@ig.cas.cz)
Author(s): (1) Vandas, M., (2) Romashets, E., (3) Watari, S.
Affiliation(s): (1) Astronomical Institute, Academy of Sciences, Prague, Czech republic (2) Institute of Terrestrial Magnetism, Ionosphere, and Radio Wave Propagation, Russian Academy of Sciences, Troitsk, Russia (3) Communications Research Laboratory, Tokyo, Japan

Abstract: In-situ observations show that the maximum strength of the magnetic field draping around a magnetic cloud is of the order of the field inside the cloud. We investigate theoretically how this strength depends on geometrical parameters of magnetically closed bodies like cylinders, spheroids, or toroids. These bodies are inserted into an initially homogeneous ambient magnetic field and then a distortion of the external field is calculated under the assumption that the normal field component vanishes at the boundary of the body. If the external field is supposed to be potential, then the maximum increase in the magnetic field magnitude is around 2 times. Non-potential fields yield larger maxima and such increases may explain a trigger of a strong geomagnetic storm only by the Bz component of the draped field, even if there is no strong Bz component inside the cloud.

Contribution number: VII.11p
Title: **Fields around magnetic clouds: Comparison between theoretical solutions and measurements**
Presenting author: **Vandas, Marek** (vandas@ig.cas.cz)
Author(s): (1) Vandas, M., (2) Watari, S., (3) Romashets, E.
Affiliation(s): (1) Astronomical Institute, Academy of Sciences, Prague, Czech republic, (2) Communications Research Laboratory, Tokyo , Japan, (3) Institute of Terrestrial Magnetism, Ionosphere, and Radio Wave Propagation, Russian Academy of Sciences, Troitsk, Russia

Abstract: Magnetic clouds are known as a possible source of strong geomagnetic storms due to a large southward Bz component located in their interior. Magnetic clouds as magnetically isolated bodies also disturb the ambient magnetic field around them during their propagation. This draped field may contain significantly large southward Bz component and thus it may also cause a geomagnetic storm. Therefore the knowledge on the draped field is important for space weather predictions. We have found an analytical solution for draped magnetic fields around a magnetic cloud, which is modeled as a cylinder with an arbitrary inclination to the ambient magnetic field, assumed to be potential. Theoretical magnetic field profiles are compared with real measurements of magnetic fields near magnetic clouds for several events. From 15 analyzed cases about one half was found to be consistent with the model, one fifth not, and remaining cases were not able to be evaluated due to large fluctuations.

Contribution number: VII.12p
Title: **Accelerated current sheets in the heliosphere**
Presenting author: **Veselovsky, Igor, S.** (veselov@dec1.sinp.msu.ru)
Author(s): Veselovsky, I.S.
Affiliation(s): Institute of Nuclear Physics, Moscow State University, Russia

Abstract: Current sheets in the field of external forces (e.g. gravity, magnetic stresses, thermal plasma pressure gradients) are accelerated and their quasi-stationary structure is changed. Self-consistent analytical solutions of the governing Vlasov and Maxwell equations are considered for such non-inertial current sheets. The results can explain the observed cases when thin heliospheric current sheet positions do not coincide with the plasma sheet central cores in the spacecraft measurements. Similar situations are possible in the magnetosphere and other dynamical laboratory and astrophysical plasma objects.

Session VIII

INTERPLANETARY SHOCK WAVES AND SOLAR ENERGETIC PARTICLES

Convener: George SIMNETT

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Convener: George SIMNETT

08:30 - 09:00 **I.A. Robinson**:
Low Energy Proton Signatures of Halo CMEs at L1 (invited)

09:00 - 09:30 **M. Reiner**:
Radio Signatures of Solar Energetic Particle Acceleration (invited)

09:30 - 10:00 **S. Poedts**, B. Van der Holst, I. Chattopadhyay, D. Shergelashvili, D. Banerjee, R. Keppens, H. Deconinck:
Simulations of Shock Waves in the Interplanetary Medium (invited)

10:00 - 10:15 **G.M. Simnett**:
A New Concept For Solar Flares

10:15 - 10:30 **J. Magdalenic**, P. Zlobec, B. Vrsnak, M. Messerotti, H. Aurass:
Radio Signatures of Fast Oscillatory Phenomena in the Solar Corona

10:30 - 10:45 **L.I. Miroshnichenko**:
Multiple Particle Acceleration at the Sun: New Approach to Separation of the Sources

Invited and Oral Contributions:

Title: **Low Energy Proton Signatures of Halo CMEs at L1 (Invited talk)**
Presenting author: **Robinson, Ian, M.** (imr@star.sr.bham.ac.uk)
Author(s): Robinson, I.M.
Affiliation(s): University of Birmingham, UK

Abstract: We study the 100-4000 keV proton intensities for 20 interplanetary disturbances at L1, most of which are clearly associated with halo coronal mass ejections (CMEs). In the majority of cases we observe characteristic variations in the intensity-time profiles and energy-spectra, apparently as a result of these disturbances. By scanning 3 years of low energy proton data we find these same signatures can be observed even with particularly mild interplanetary disturbances. The relevant implications for the potency of shock acceleration at these energies and the order imposed upon the interplanetary medium by shocks is discussed.

Title: **Radio Signatures of Solar Energetic Particle Acceleration (Invited talk)**
Presenting author: **Reiner, Michael, J.** (reiner@urap.gsfc.nasa.gov)
Author(s): Reiner, M. J.
Affiliation(s): Catholic University & NASA/GSFC, USA

Abstract: One of the important problems of solar physics is the acceleration and transport of energetic particles (protons and electrons) produced during solar energetic processes. One of the difficulties with solar particle measurements is that they are usually made far from the sun (usually at 1 AU). Extrapolating such in-situ observations back to an origin on the sun can involve many uncertainties. On the other hand, solar radio emissions, such as type II and type III bursts and decimeter/microwave emissions, are believed to be signatures of the acceleration of solar electrons. Since these radio emissions are observed remotely, such radio observations can facilitate tracing the signatures of solar energetic particles back to their solar origin, as well as providing information on the location of the acceleration regions in the corona. Recent comparisons of these radio observations with in-situ particle observations have in fact indicated that the acceleration and/or transport of solar energetic particles may be more complex than previously expected. For example, there is recent evidence for different classes of solar proton and electron events in the corona that may involve very different acceleration times, different acceleration locations, and different acceleration mechanisms, even during the same solar event. In this talk I will review some aspects of how the remotely observed solar radio emissions and in-situ particle observations are challenging our views of particle acceleration and transport at the sun.

Title: **Simulations Of Shock Waves In The Interplanetary Medium (Invited talk)**

Presenting author: **Poedts, Stefaan** (Stefaan.Poedts@wis.kuleuven.ac.be)
Author(s): (1) Poedts, S., Van der Holst, B., Chattopadhyay, I., Shergelashvili, D., Banerjee, D., (2) Keppens, R., (3) Deconinck, H.
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Abstract: The shocks in the solar corona caused by fast Coronal Mass Ejections (CMEs) are studied in the framework of computational magnetohydrodynamics (MHD). Numerical simulations show that CME shocks (generated in the lower corona) can have a complex structure including secondary shock fronts, over-compressive and compound shocks, etc.. The evolution of these CME shocks is followed during their propagation through the solar wind and, in particular, though the critical points in the wind. Particular attention is given to complex IP events involving two CME shocks colliding to each other, as often observed. Moreover, an analysis based on a parameter study of the impact of the resulting IP magnetic clouds on the Earth's bow shock involving 3D MHD simulations is presented and discussed. In addition, time accurate MHD simulations show how the magnetic reconnection at the Earth's bow shock is affected dramatically by the magnetic cloud impact. The CME shocks are important for 'space weather' because they can easily be observed in radio wavelengths. This makes it possible to track the position of the CMEs/magnetic clouds and, hence, to follow their propagation through the corona. The topology of the shock at the Earth's magnetosphere at the impact of a magnetic cloud is important for the 'geo-effectiveness' of the magnetic storms.

Title: **A New Concept For Solar Flares**

Presenting author: **Simnett, G.M.** (gms@star.sr.bham.ac.uk)
Author(s): Simnett, G.M.
Affiliation(s): University of Birmingham, Edgbaston, Birmingham B15 2TT, UK

Abstract: Up to now, solar flare theories fail on two counts to model the observations; both the total power and the number of particles required to explain the emissions are beyond the scope of the active region to deliver. The new concept invokes a more global view, where a large erupting magnetic structure plays the central role, and the active region plays a minor role. Typically the erupting magnetic structures are visible as CMEs, but NOT NECESSARILY. Magnetic reconnection in the high corona gradually "pumps up" the erupting structure with mildly energetic particles, mainly protons, and eventually the stability of the structure is destroyed, and it erupts. The trigger for this is probably magnetic reconnection in the active region itself. At this time, the contents of the structure are dumped into the evolving active region, where they serve as a seed population for further acceleration, by the mechanism of choice, to produce the very high energy flare protons, and the remaining flare emissions. The energy and matter supplied by the erupting structure is more than sufficient to overcome the active region deficit.

Title: **Radio signatures of fast oscillatory phenomena in the solar corona**

Presenting author: **Magdalenic, Jasmina** (mjasmina@geof.hr)
Author(s): (1)(2) Magdalenic, J., (2) Zlobec, P., (1) Vrsnak, B., (2) Messerotti M., (3) Aurass, H.
Affiliation(s): (1) Hvar Observatory, Zagreb, Croatia, (2) Trieste Astronomical Observatory, Trieste, Italy, (3) Astrophysical Institute Potsdam, Potsdam, Germany

Abstract: Type IV solar radio bursts are directly related to global phenomena as flares and CMEs. During such events different types of periodic fine structures (PFSs) are sometimes observed, which can be interpreted as radio signatures of fast oscillatory phenomena in the coronal plasma. To get insights of the generation mechanism and local plasma conditions, we analyzed a large data set of PFSs superimposed on the continuum of type IV bursts recorded with high time resolution at single frequencies in the metric and decimetric bands by the Trieste Solar Radio System. In the analysis a complementary data set of dynamic spectra recorded by the radio spectrograph of the Astrophysical Institute Potsdam was utilized. Properties of PFSs, such as period, amplitude, polarization degree and involved bandwidth are systematized, revealing different classes of PFSs. In this framework the association with Halpha; and SXR flares, and position of the related radio sources were inspected as well. The results provide an insight into possible (different) driving processes and radiation mechanisms involved.

Title: **Multiple Particle Acceleration at the Sun: New Approach to Separation of the Sources**

Presenting author: **Miroshnichenko, Leonty, I.** (leonty@izmiran.troitsk.ru)
Author(s): Miroshnichenko, L.I.
Affiliation(s): IZMIRAN,Troitsk, Moscow Region, 142190 Russia

Abstract: It is suggested a new method for the separation and localization of the sources of particles accelerated at/near the Sun. The method is relied upon the analysis of the data on source spectra of the interacting and escaping protons. The source spectra are reconstructed by two ways. For the interacting particles that interact with the solar atmosphere one can use the data on gamma-ray line emission. The source spectra of particles escaping from the Sun may be reconstructed by the data of direct particle observations near the Earth's orbit with the subsequent reverse extrapolation of the intensity-time profiles to the moment of particle injection from the source. When comparing the spectra for escaping and interacting particles, a possibility arises to separate their sources (impulsive flares and/or coronal mass ejections, etc.). It is shown that such a separation is possible in some long lasting solar events. Those spectra seem to be treated in terms of the concept of multiple acceleration processes at the Sun.

Posters:

Contribution number: VIII.1p

Title: **Cosmic ray spectrum at 1 AU outside magnetosphere: a transmission function approach.**

Presenting author: **Bobik, Pavol** (bobik@mib.infn.it)

Author(s): (1)(2) Bobik, P., (1)(3) Boschini, M., (1)(4) Gervasi, M., (1)(4) Grandi, D., (1)(2) Kudela, K., (1) Micelotta, E., (1) Rancoita, P.G.

Affiliation(s): (1) INFN sezione di Milano, Milano, Italy, (2) Institute of Experimental Physics, Kosice, Slovakia, (3) CILEA, Segrate, Italy, (4) Universita di Milano-Bicocca, Milano, Italy

Abstract: We have used a method based on the transmission function to recover the galactic cosmic rays spectrum at 1AU outside of magnetsphere. The approach is based on calculation of trajectories (backtracing) of particles in a model of geomagnetic field. Transmission function between AMS-01 orbit, at an altitude of 400 km, and the magnetopause was been built. In this paper we present spectra at 1AU outside the magnetosphere based on AMS-01 data, taken in June 1998. A comparison with CREME96 model and the evaluation of the transmission function for 2005 are also presented.

Contribution number: VIII.2p

Title: **Geomagnetic Effects of Interplanetary Shock Waves During Solar Minimum (1995-1996) and Solar Maximum (2000)**

Presenting author: **Echer, Ezequiel** (ezequiel@dge.inpe.br)

Author(s): (1) Echer, E., (1) Gonzalez, W.D., (1) Alves, M.V., (1) Gonzalez, A.L.C., (1) Dal Lago, A., (1) Vieira, L.E.A., (1) Guarnieri, F.L., (2) Schuch, N.J.

Affiliation(s): (1) Instituto Nacional de Pesquisas Espaciais, Sao Jose dos Campos, Brasil, (2)Centro Regional Sul de Pesquisas Espaciais/INPE, Santa Maria, Brazil

Abstract: In this paper an evaluation of interplanetary shock waves on geomagnetic activity is evaluated through correlations between shock parameters and geomagnetic indices Dst and ap maximum values after the shock. Total magnetic field, proton temperature, speed and density variations through shocks as well Mach numbers are correlated with geomagnetic indices. The distribution of Dst and ap indices after shocks is also analyzed and compared with their distributions for the whole period.

Contribution number: VIII.3p
Title: **Distribution function of energetic particles in the radial regular magnetic field**
Presenting author: **Fedorov, Yurij, I.** (fedorov@mao.kiev.ua)
Author(s): (1) Fedorov, Y.I., (2) Stehlik, M.
Affiliation(s): (1) Main Astronomical Observatory NASU, Kiev, Ukraine, (2) Institute of Experimental Physics SAS, Kosice, Slovakia

Abstract: The transport of cosmic rays in the interplanetary medium is considered in terms of the kinetic equation describing the energetic particle scattering by magnetic irregularities and their focusing by the regular interplanetary magnetic field. The analytical expression for solar cosmic ray distribution function in the approximation of radial regular magnetic field is obtained and the evolution of energetic particle angular distribution is analysed. The obtained results can be used for the analysis of ground level enhancements of cosmic ray intensity.

Contribution number: VIII.4p
Title: **The evolution of solar cosmic ray energetic spectrum**
Presenting author: **Fedorov, Yurij, I.** (fedorov@mao.kiev.ua)
Author(s): Fedorov, Y.I., Nosov, S.F., Shakhov, B.A.
Affiliation(s): Main Astronomical Observatory, Kiev, Ukraine

Abstract: The rigorous description of cosmic ray (CR) propagation in an interplanetary medium is based on the kinetic equation. This equation describes the scattering of energetic charged particles on magnetic irregularities and their focusing in a regular interplanetary magnetic field. In the present article in the approximation of a radial regular magnetic field the analytical expressions for solar CR density and anisotropy are obtained under instantaneous and prolonged particle injection in an interplanetary medium. On the basis of kinetic equation solutions the evolution of solar CR energetic spectra are analyzed for a number of solar proton events. The proposed approach allows on the base of experimental data, obtained on an initial phase of solar CR event, to carry out the short-term prognosis of periods, dangerous relative to space radiation, and to determine the levels of energetic particle fluxes in the interplanetary medium and magnitosphere of the Earth. This work is supported by the INTAS grant 0810.

Contribution number: VIII.5p
Title: **2D Stochastic Simulation Model of Cosmic Ray Modulation: Comparison with Experimental Data**
Presenting author: **Bobik, Pavol** (bobik@castore.mib.infn.it)
Author(s): (1) Gervasi, M., (1) Rancoita, P.G., (1)(2) Bobik, P., (3) Usoskin, I.G., (1) Grandi, D.
Affiliation(s): (1) INFN sezione di Milano, Milano, Italy, (2) Institute of Experimental Physics, Kosice, Slovakia, (3) Sodankyla Geophysical Observatory, Oulu, Finland

Abstract: We developed 2D stochatic simulation model of heliospheric propagation of Galactic cosmic rays. The model solves numerically the transport equation of particles in the Helisophere. In the calculation we use also drift effects which are included through analytical effective drift velocities. We estimated the cosmic rays spectrum at 1Au using this model formalism. Calculated spectra are compared with those by CREME96 model and with experimental data (IMP8) for positive (A¿0) and negative (A¡0) solar period.

Contribution number: VIII.6p
Title: **Cutoff energy of nonthermal electrons in solar microwave and hard X-ray bursts**
Presenting author: **Huang, Guangli** (huangguangli@hotmail.com)
Author(s): Huang, G.
Affiliation(s): Purple Mountain Observatory

Abstract: The cutoff energy is an important parameter of nonthermal electrons in solar microwave and hard X-ray bursts. However, it is impossible to measure this parameter directly from the observations. The method to estimate the low and high cutoff energy of nonthermal electrons in solar microwave and hard X-ray bursts is discussed in this paper. At first, for a given radiation mechanism, the ratio between two frequency (or energy) channels is calculated with different value of the cutoff to fit the observational data. Secondly, the cross point of the spectral profiles at different time for a given burst may provide the information of the low or high cutoff energy of nonthermal electrons. Two events on June 3 and 10, 2000 are studied with data of OVSA and YOHKOH, the results are compared with the previous papers.

Contribution number: VIII.7p
Title: **Statistical properties of the decay phase of SEP-events**
Presenting author: **Kecskemety, Karoly** (kecske@rmki.kfki.hu)
Author(s): (1) Kecskemety, K., (2) Daibog, E.I., (3) Kahler, S., (2) Logachev, Y.I.
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Abstract: Generalized parameters characterizing the state of the interplanetary medium (IM) include the functional form and the rate of decline of charged particle flux in solar energetic particle (SEP) events. The shape of the particle flux decline is of particular importance: power-law time dependence indicates the dominance of diffusive propagation, whereas exponential-law decline emphasizes convection transport. Depending on the solar wind speed both exponential (at ¡10 MeV) and power-law (¿30 MeV) declines can be present in the same event. A statistical investigation of SEP events extended for a long period suggests that about 90% of SEP decays are characterised by exponential declines. Distributions of the total durations, T, of exponential declines with and without shocks differ insignificantly for T¿10 hrs. Values of the decay time obtained theoretically are reasonably close to the fitted slopes in nearly half of all cases if one uses the average V solar wind speed values measured when the corresponding plasma in which particles were convected arrives to the observer. Dependences as the variation of the decay time with energy and angular

distance of the observer from the flare heliolongitude are considered as well.

Contribution number:	VIII.8p
Title:	**The study of relations between kilometric radiobursts and energetic electrons during powerful solar flares**
Presenting author:	**Prokudina, Valentine, S.** (prok@sai.msu.ru)
Author(s):	(1) Kudela, K., (1) Slivka, M., (2) Kurilchik, V., (2) Prokudina, V.
Affiliation(s):	(1) Slovak Academy of Science, Institute of Experimental Physics, Kosice, Slovak Republik, (2) Sternberg Astronomical Institute, Moscow, Russia

Abstract: The observational data of the long wave radiobursts and energetic electrons, registered on satellite INTERBALL-1 during large chromospheric flares have been analysed. Radioemission was observed at the frequency range 100-1500 kHz with multi-channal spectroanalyser with pass-band 10 kHz. Electrons have been registered with DOK-2 at energy range E= 10-1000 keV. The temporal profiles of solar radiobursts and electron fluxes and spectra were investigated.The onset and increase of radiobursts coincided with explosive phase of the flare and characterized by high drift velocity, typical to the radiobursts of III type and the duration within several minutes. It is known that the generation of radiobursts was caused by the energetic electrons, accelerated at solar flare and spreading to the outer corona up to the Earth orbit.The energetic electrons after solar flares, which we analysed, have been observed near the Earth with energy E 100 keV, that suffised to generate the kilometric radiobursts at near-solar space. For some events we valued the time of spreading of electrons to the Earth. Also the question about possible origin of long wave radioemission from accelerated electrons in connection with CME was considered. Besides the solar events we analysed the AKR, the radioemission of magnetospheric origin, observed during the geomagnetic disturbances after analysed solar flares.

Contribution number:	VIII.9p
Title:	**Determination of vertical profile for the solar plasma density by the data on 2.223 MeV gamma-ray line**
Presenting author:	**Miroshnichenko, Leonty, I.** (leonty@izmiran.troitsk.ru)
Author(s):	(1) Kuzhevskii, B.M., (2) Miroshnichenko, L.I., (1) Troitskaya, E.V.
Affiliation(s):	(1) D.V. Skobeltsyn Institute of Nuclear Physics, Moscow State University, Vorobjevy Gory, Moscow, 119899, Russia, (2) IZMIRAN, Troitsk, Moscow Region, 142190, Russia

Abstract: We have made new calculations of temporal profiles for the 2.223 MeV neutron capture line from solar flare. The results of calculations are applied to analyze the observed 2.223 MeV line temporal profiles, in particular, for the flares of 6 November 1997 and 22 March 1991, registered at Yohkoh and GRANAT satellites, respectively. The main goal of this study is to derive vertical density profiles in the solar atmosphere under disturbed conditions. In both cases, the density was found to be enhanced in comparison with standard (undisturbed) solar atmosphere model. During the first flare, the enhancement took place rather deeply in the photosphere, in second case - at sub-photospheric level. We also deduce the enhanced density in the deep photosphere in the period of the flare of 16 December 1988, like it was previously found for two other flares that mentioned above.

Contribution number: VIII.10p
Title: **X-ray and gamma-ray emission solar flare catalogue obtained by SONG on board CORONAS-F satellite**
Presenting author: **Myagkova, Irina, N.** (irina@srd.sinp.msu.ru)
Author(s): (1) Kuznetsov, S.N., (1) Myagkova, I.N., (1) Yushkov, B.Y., (2) Kudela, K.
Affiliation(s): (1) SINP MSU, Moscow, Russia, (2) IEP SAS Kosice, Slovakia

Abstract: The CORONAS-F satellite was launched on July 31, 2001 into a circular orbit with altitude about 500 km and 82.5 degree inclination. The satellite was oriented towards the Sun and was equipped with a set of instruments studying the solar flares and corresponding solar energetic particle (SEP) events. The instruments are intended for various energetic particles measurements, namely x-ray and gamma-ray emissions, neutrons, electrons, protons, alpha particles, and heavy nuclei (up to Si). From August 14, 2001 (when the first data from CORONAS-F were received) until now the significant number of solar flares took place. More than some tens of them were registered as M3 or higher class in GOES satellite classification. About 25-30% of these flares (M3 or higher) were detected by SONG instrument. Some of these flares have led to SEP events observed by different experiments (including those on board of CORONAS-F satellite), but many of them did not. For example, the most intensive and high energy solar gamma-ray flare detected by SONG instrument on August 25, 2001 (X5.3 flare) was not accompanied by any significant flux of energetic charged particles. In this work the catalog of x- and gamma-ray emission flares, detected by SONG instrument, is presented. The temporal and spectral dependencies of emissions observed for the solar flares along with their connection to solar charged particle enhancements are discussed.

Contribution number: VIII.11p
Title: **Coronal magnetic field and Alfven velocity inferred from type II bursts**
Presenting author: **Magdalenic, Jasmina** (mjasmina@geof.hr)
Author(s): (1) Magdalenic, J., (1) Vrsnak, B., (2) Aurass, H., (2) Mann, G.
Affiliation(s): (1) Hvar Observatory, Zagreb, Croatia, (2) Astrophysical Institute Potsdam, Potsdam, Germany

Abstract: Type II solar radio bursts are slowly drifting narrowband emission patterns observed in radio dynamic spectra. They are excited by MHD shocks traveling through the solar corona up to interplanetary space (m-km range). The fundamental and harmonic emission bands of type II bursts are frequently split in two parallel lanes that show a similar frequency drifts and intensity behaviour. Such characteristics could be a consequence of the plasma emission from the upstream and downstream shock regions. After justifying this assumption, the split is used to evaluate the density jump at the shock front, providing an estimate of the shock Mach number. Inferring the shock speed from the frequency drift of bursts, the Alfvn velocity and magnetic field in the ambient plasma are estimated. The results show a local minimum of the Alfvn velocity of vA approx. 300 km/s at the radial distance approx. 3 solar radii (R approx. 3) and a broad local maximum of vA approx. 350-450 km/s at 4 ¡ R ¡ 7. The results are compared with other estimates of the coronal magnetic field and combined data show that below R approx. 2 the magnetic field is dominated by active region fields, whereas above R approx. 3 it becomes radial, behaving roughly as $B = 2/R^2$, giving a plausible value of B approx. 4 nT at 1 a.u.

Contribution number: VIII.12p
Title: **Temporal Variability of Cosmic Ray Intensity Time-series (1955-2001)**
Presenting author: **Mavromichalaki, Helen** (emavromi@cc.uoa.gr)
Author(s): Mavromichalaki, H., Choudalakis, G.
Affiliation(s): Physics Department, University of Athens, Athens, Greece

Abstract: Temporal variability of the cosmic-ray intensity recorded on Neutron Monitor stations at the Earth over the epoch of more than four cycles (1955-2001) is presented. Using Fast Fourier and Wavelet Transforms, the short and long-term periodicities in the daily and monthly cosmic-ray intensity time- series are determined. Occurrence of different peaks at 21.8, 10.9, 7.3, 5.4, 3.11, 2.1, 1.68 years and 354, 279, 154 and 27 days are obtained during this time interval. A comparison of the results of the Fourier transform and the time-frequency wavelet transform has clarified the importance of different periodicities. The application of the wavelet transform approach enables one to find the possible temporal changes of the cosmic-ray intensity over a broad range of periods and connect these with the phase of solar magnetic activity of the Sun.

Contribution number: VIII.13p
Title: **Astrophysical Aspects in the Studies of Solar Cosmic Rays**
Presenting author: **Miroshnichenko, Leonty, I.** (leonty@izmiran.troitsk.ru)
Author(s): Miroshnichenko, L.I.
Affiliation(s): IZMIRAN, Troitsk, Moscow Region, 142190 Russia

Abstract: This short review comprises main concepts, available observational data and recent theoretical results related to astrophysical aspects of particle acceleration at/near the Sun. A list of the aspects under discussion includes: 1) extreme capacities of the solar accelerator(s), upper limit intensity and maximum energy (rigidity), Em (Rm), for solar cosmic rays SCR); 2) production of the flare neutrinos; 4) energetics of SCR and solar flares; 5) gamma rays, charge states and elemental abundances of accelerated solar ions; 6) coronal mass ejections (CMEs) and extended coronal structures in acceleration models; 7) magnetic reconnection in acceleration scenarios; 8) size (frequency) distributions of solar proton events (SPE) and stellar flares; 9) occurrence probability of giant flares; 10) archaeology of solar cosmic rays. The discussion outlines a set of interesting conceptual and physical associations of SCR generation with the high-energy processes at other stars; several promising lines of future studies are highlighted.

Contribution number: VIII.14p
Title: **Effects of Hysteresis Between Flare Index and Cosmic Rays**
Presenting author: **Ozguc, Atila** (ozguc@boun.edu.tr)
Author(s): Ozguc, A., Atac, T.
Affiliation(s): Kandilli Observatory and ERI, Bogazici Univ. Istanbul, Turkey

Abstract: We study the hysteresis effect between the solar flare index and cosmic ray intensity for the past 37 years from January 1, 1965 to December 31, 2001 on a daily basis. We show that

smoothed time series of flare index and the daily Calgary Galactic Cosmic Ray intensity values exhibit significant solar cycle dependent differences in their relative variations during the studied period. The shapes of these differences vary from cycle to cycle. So we investigate the momentary time lags between the two time series for the odd and even cycles.

Contribution number: VIII.15p
Title: **The Influence of the Interplanetary Shock on a Propagation of the Solar Energetic Particles.**
Presenting author: **Petukhov, Ivan** (i-van@ikfia.ykt.ru)
Author(s): Petukhov, I.S.
Affiliation(s): Institute of Cosmophysical Research and Aeronomy, Yakutsk, Russia

Abstract: We suppose that the solar energetic particles (SEP) with a given spectrum formed as a result of acceleration in a corona of the Sun, are injected impulsively in time in interplanetary space. From the analysis of problem solutions on propagation of SEP at the presence of a plane shock depicted by a diffusive-convection transport equation have been determined a condition and manifestation of influence of a shock on SEP propagation in the solar wind. It is established that SEP, whose a diffusion coefficient satisfies the condition $ta = k(e)/(Vs - w)^2$, where $te = re/Vs$, are exposed by the shock influence: 1) the shape of a spectrum is flatten at low energies and it is steeper at high energies in comparison with a shape of injected SEP spectrum; 2) the time of maximum of SEP intensity coincides with the moment of arrival of a shock front. Here ta, te are the acceleration time and the duration of process; k(e) is the diffusion coefficient of SEP in the upstream region of the shock; w, Vs - are the speeds of solar wind and shock respectively; re is a radius of the Earth orbit. The shock does not effect on SEP of higher energy: 1) the shape of a spectrum does not vary; 2) the time of maximum of SEP intensity essentially overtakes the moment of arrival of a shock front. In the events accompanied by the considerable increase of the Alven turbulence level, the effect of a shock together with corresponding manifestations in the SEP intensity changes. The conclusions obtained qualitatively correspond to temporary particle intensity profiles of different energy SEP registered in interplanetary space at the presence of a shock.

Contribution number: VIII.16p
Title: **The alpha-effect and particle acceleration in developed MHD turbulence.**
Presenting author: **Stehlik, Milan** (stehlik@saske.sk)
Author(s): Stehlik, M.
Affiliation(s): Institute of Experimental Physics , Kosice, SK

Abstract: The correlation and response functions of velocity and magnetic fluctuations are studied in the frame of the quantum field model of helical full developed MHD turbulence driven by gaussian random forces with mixed noise correlators. Instabilities of the theory related to the exponential increasing of the magnetic fluctuations in the large scales range are stabilized by spontaneous symmetry breaking mechanism which leads to the creation of homogeneous stationary magnetic field H_0. In the helical MHD model the non-zero α effect appears due creation of a mean electromotive force parallel with H_0. The maximal value of α is determined in the Kolmogorov universal regime, and, its contribution into the charged particle acceleration is estimated.

Its contribution on 100 Mev protons acceleration is discussed and compared with the 2nd Fermi acceleration mechanism.

Contribution number:	VIII.17p
Title:	**Analysis of loop top and footpoint sources in two mocrowave bursts**
Presenting author:	**Su, Yingna** (huangguangli@hotmail.com)
Author(s):	(1) Su, Y., (2) Huang, G.
Affiliation(s):	Purple Mountain Observatory

Abstract: Two limb events on July 10, 2000, and Aug 24, 2002 are selected from the data of Nobeyama Heliograph with evident source structure of a loop top and two footpoints, which are confirmed by the YOHKOH/SXT or SOHO/EIT images. The brightness temperature at 17 and 34 GHz, the Stokes V at 17 GHz, the spectral index calculated from 17 and 34 GHz, as well as the time evolution of these parameters are analyzed comparatively at different subsources. The results may be helpful for understand the flare model, the radiation mechanism and particle acceleration.

Session IX

FUTURE ACTIVITIES

Conveners: Shi Tsan WU / Brigitte SCHMIEDER

SESSION IX: FUTURE ACTIVITIES

Conveners: Shi Tsan WU / Brigitte SCHMIEDER

11:00 - 11:30 **B. Schmieder**:
Climate and Weather of the Sun-Earth System (CAWSES) (invited)

11:30 - 12:00 **J.L. Bougeret**:
Future Programs in Solar and Heliospheric Radio Astronomy (invited)

12:00 - 12:30 **R.A. Howard**:
STEREO Mission (invited)

Invited and Oral Contributions:

Title: **Climate and Weather of the Sun Earth System: Cawses (Invited talk)**

Presenting author: **Schmieder, Brigitte** (brigitte.schmieder@obspm.fr)
Author(s): (1)(2) Schmieder, B., (3) Basu, S.
Affiliation(s): (1) Observatoire de Paris, 92195 Meudon, France, (2) ITA, University of Oslo, Blindern, N-0315 Oslo, Norway, (3) Air Force Laboratory, Washington DC, USA

Abstract: During 2004-2008, CAWSES (Climate and Weather of the Sun-Earth System), Scostep's new international scientific program, will link the world's scientists in a cooperative effort to study the entire interactive Sun-Earth system. This new program seeks to mobilize the international solar-terrestrial science community to fully utilize past, present and future data; to produce improvements in space weather forcasting, design of space- and Earth-based technological systems, and understanding the role of solar-terrestrial influence on Global Change. The CAWSES Science Steering Group with its 7 members (chairman: S.Basu) has organized around four themes: Solar Influence on Climate (chairman: M.Lockwood), Space Weather: Science and Applications (chairmen: J. Kozyra, T.Shibata), Atmospheric Coupling Processes (chairman: F.J.Luebken), Space Climatology (chairman: C.Frohlich), For more informations visit the SCOSTEP website http://www.ngdc.noaa.gov/stp/SCOSTEP/scostep.html

Title: **Future Programs in Solar and Heliospheric Radio Astronomy (Invited talk)**

Presenting author: **Bougeret, Jean-Louis** (jean-louis.bougeret@obspm.fr)
Author(s): Bougeret, J.-L.
Affiliation(s): LESIA - UMR CNRS 8109 - Observatoire de Paris. France

Abstract: Radio Astronomy provides three major approaches to study the solar corona and the interplanetary medium: (i) the analysis of the scintillation of radio stars (a technique known as IPS or InterPlanetary Scintillation), (ii) the active sounding of interplanetary inhomogeneities and discontinuities by the analysis of radar echoes, and (iii) the observation of sporadic radio sources located in the solar corona and interplanetary medium. The first approach yields unique information on the background solar wind, its large scale structure and time variation. The second approach and its prospects will be briefly presented. The third approach, namely the observation of radio sources of solar and interplanetary origin, provides a unique means to remotely detect and track energetic electrons in the solar corona and interplanetary medium. This will be the main focus of this review. Radio observations allow us to trace energetic electrons propagating along magnetic fields lines (type III bursts), accelerated at shock fronts (type II), or trapped in magnetic traps (type I, type IV). Recent observations performed with sensitive imaging instruments have demonstrated that thermal signals (emission or absorption) associated with erupting filaments and loops can also be detected. In this paper we will review and present existing programs covering both ground-based arrays (FASR, LOFAR,...) and space-based instruments and arrays (SIRA/ALFA, Swarms, ...). We will emphasize unique aspects that can be studied using these techniques.

Title: **STEREO Mission (Invited talk)**
Presenting author: **Howard, Russell, A.** (russell.howard@nrl.navy.mil)
Author(s): Russell, R.A.
Affiliation(s): Naval Research Lab., Washington DC, USA

Abstract: TBD

Posters:

Contribution number: IX.1p
Title: **Tracking of apparent motion in EIT observational sequences**
Presenting author: **Gissot, Samuel** (sgissot@oma.be)
Author(s): (1) Gissot, S., (1) Hochedez, J.-F., (2) Jacques, L., (2) Antoine, J.P.
Affiliation(s): (1) Royal Observatory of Belgium, Brussels, Belgium, (2) Universite Catholique de Louvain, Louvain-La-Neuve, Belgium

Abstract: The EIT observations cover more than seven years of the 23rd solar cycle. The main synoptic dataset, usually referred to as the "CME Watch", is a nearly uninterrupted sequence of images taken in the FeXII bandpass at a cadence of four images per hour. Countless transient events crop up in the series; they require an objective analysis. Most features maintain some level of persistency across several images, leading to the definition of their lifetime. In this work we study motion tracking methods in order to estimate displacements and distortions from frame to frame. We have implemented an optical flow algorithm, and we have linked the apparent motion of the coronal objects to other parameters such as their lifetime or expected rotation rate. The information is subsequently processed to reveal statistical distribution of their physical parameters.

Session X

JOINT ORGANISATION FOR SOLAR OBSERVATIONS (JOSO)

Instruments/Missions/Eclipse Results and Business Meeting

Convener: Arnold HANSLMEIER

SESSION X: JOSO – JOINT ORGANISATION FOR SOLAR OBSERVATIONS

New Instruments/Missions/Eclipse Results and Business Meeting

Convener: Arnold HANSLMEIER

14:00 - 14:20 Györi, L., Baranyi, T., Mezö, G., **Ludmány, A.**:
Current Status of Debrecen Photoheliographic Data

14:20 - 14:40 **Kotrč, P.**:
Problems of Measurement of Linear Polarization in Solar Flares

14:40 - 15:00 Kotrč, P., **Kschioneck, K.**:
From Czerny-Turner to a Multichannel Spectrograph, from Photografic to CCD Detectors

15:00 - 15:20 **Lefebvre, S.**, Rozelot, J.-P.:
An Original Contribution Inside the Whole PICARD Program: the MIRESOL Instrumentation

15:20 - 15:40 Otruba, W., Poetzi, W., **Hanslmeier, A.**:
Instrumentation Upgrade at Kanzelhöhe Solar Observatory

15:40 - 16:00 **Sylwester, J.**, Sylwester, B.
Patterns of X-ray Line Emission Variability as Observed by RESIK Bragg Spectrometer

16:00 - 16:30 Coffee break

16:30 - 18:30 JOSO Business Meeting

Invited and Oral Contributions:

Title: **Current status of Debrecen Photoheliographic Data**
Presenting author: **Ludmany, Andras** (ludmany@tigris.klte.hu)
Author(s): Gyori, L., Baranyi, T., Mezo, G., Ludmany, A.
Affiliation(s): Heliophysical Observatory, H-4010 Debrecen, P.O.Box 30., Hungary

Abstract: Several recent advances have been made in the procedure and presentation of the Debrecen Photoheliographic Data. We summarize the present status of the catalogue, and the available forms of the access to the data and images of sunspot groups. We also report the present and further steps to speed up the procedure of evaluation.

Title: **Problems of Measurement od Linear Polarization in Solar Flares**
Presenting author: **Kotrc, Pavel** (pkotrc@asu.cas.cz)
Author(s): Kotrc, P.
Affiliation(s): Astronomical Institute, Academy of Sciences of the Czech Republic

Abstract: Linear polarization of spectral lines in solar flares is mostly interpreted as an impact polarization resulting from line excitation by protons or electrons with an anisotropic velocity distribution. Detection of impact linear polarization encounters many difficulties both in the instrumental and the interpretation levels. We summarize the current status in the field of measurements and processing of data and put some limits and constraints on the acurracy of the measurements and used methods. Particularly we discuss the possibility of measurements the impact linear polarization on the reconstructed horizontal solar telescope at Ondrejov.

Title: **From Czerny-Turner to a Multichannel Spectrograph, from Photografic to CCD Detectors**
Presenting author: **Kschioneck, Kirsten** (kschioneck@gmx.de)
Author(s): (1) Kotrc, P., (1)(2) Kschioneck, K.
Affiliation(s): (1) Astronomical Institute of the Academy of Sciences of the Czech Republic, Ondrejov, Czech republic, (2) Technische Fachhochschule, Berlin, Germany

Abstract: In 1980s two medium size horizonal solar telescopes 50/35000 cm with large spectrographs Czerny-Turner made by Carl Zeiss Jena were installed in the Ondrejov observatory. After two decades of utilization the electronics and all the control system of both the instruments were replaced by an up-to-date technique. According to the recent scientific plans, one of the spectrographs instead of a one-branch Czerny-Turner type will be used as a multichannel one. Then, instead of a large scale photographic detector, up to 5 CCD cameras will be used working in Hydrogen, Calcium and other species spectral lines that are diagnostically important. Therefore, a substantial reconstruction of the camera objective system is being done. We present results of the performed detailed calculations of the new optical schema of the spectrograph and of the CCD detectors used. The optimal variants of the spectrograph camera objective configurations, used spectral orders are discussed from the point of view of spatial and spectral resolution, and

field of view, as well as the estimated exposure times to fulfill the scientific demands put on the modernized instrument.

Title: **An original contribution inside the whole PICARD program: the MIRESOL instrumentation**
Presenting author: **Lefebvre, Sandrine** (sandrine.lefebvre@obs-azur.fr)
Author(s): Lefebvre, S., Rozelot, J.P.
Affiliation(s): Observatoire de la Cote d'Azur , Grasse, France

Abstract: The MIRESOL program aims to automatically detect plages, faculae and spots at the solar limb, mainly in the CaII line, a line known to be very sensitive to the photospheric activity. This program is complementary to the space PICARD mission whose one of the major goals is to accurately measure the diameter of the Sun, in every directions. Such measurements must be sort according to spots or faculae which may occur at the solar limb. MIRESOL is complementary to other ground-based instruments which form a complete ground-based and space synergy around the scientific PICARD mission. The accurate determination of the heliographic latitude at limb where the spots (or faculae) begin and end is essential to separate diameters which are free from contamination. Their automatic detection and the development of an improved algorithm is a capital point in the future analysis of the space data. We will first describe the whole program, including the cooperation with the PSPT network (Rome Astronomical Observatory and HAO-Boulder). We will then focus on the MIRESOL apparatus and we will present the results.

Title: **Instrumentation upgrade at Kanzelhöhe Solar Observatory**
Presenting author: **Hanslmeier, Arnold** (arh@igam.uni-graz.at)
Author(s): Otruba, W., Poetzi, W., Hanslmeier, A.
Affiliation(s): Institute for Geophysics, Astrophysics and Meteorology, University of Graz, Austria

Abstract: KSO upgraded its instrumentation and updated the observing program to meet the scientific interests of SoPhy/IGAM and external collaborating partners like BBSO, Max Millenium, Astronomical Institute of the Czech Academy of Sciences, AIP, OAT, Fac. of Geodesy Univ. Zageb....The scientific objective of dynamics of the Solar atmosphere (Flare initiation processes, wave propagation,..) requires mutli-spectral full disk observations with high temporal resolution. - Daily Sunspot Drawings - Daily WL (continuum) photohheliographs - Chromospheric observations in Halpha (6 images/min) with optional images in the line wings and/or very high cadence of 30 images/min in line center triggered by GOES X-ray flux based complement during high Solar activity a standard rate of 1 image/min. - Observations in Na-D lines with the MOF which yield also Dopplergrams and Magnetograms will be resumed soon after the replacement of optical components. - For data mining a searchable online catalogue provides access to the archive. Currents projects in instrumentations are - upgrading the Halpha system by supplying a new fast CCD cam with 1kx1kx10 bit and a new frame grabber and improving the image processing techniques - increasing the spatial resolution of the MOF telescope by replacing the CCD cam and the front lens.

Title: **Patterns of X-ray Line Emission Variability as Observed by RESIK Bragg Spectrometer**

Presenting author: **Sylwester, Janusz** (bs@cbk.pan.wroc.pl)
Author(s): Sylwester, J., Sylwester, B.
Affiliation(s): Solar Physics Division, Space Research Centre, Polish Academy of Sciences, Wroclaw, Poland

Abstract: RESIK is the unique Bragg bent crystal solar spectrometer operating continuously since August 2001 aboard the CORONAS-F satellite. By now, it has collected tens of gigabytes of flare and active region spectra in a very much unexplored spectral region between 3.2 A and 6.1 A. In this paper we present a number of representative observations covering periods of various solar activity: from the most active level (X-flares) to exceptionally inactive corona. In the wavelength range observed by RESIK there are a number of strong emission lines corresponding to H- and He-like resonance transitions of Si, S, Ar and K ions. These lines are supposedly formed in thermal plasma of temperature between 5 MK and 50 MK, and therefore their analysis reveals the distribution of hot plasma over this interval. In addition, the K and Ar first ionisation potentials are different by a factor of 4 with potassium belonging to low FIP and argon to high FIP elements. We observe substantial variations of the K/Ar line ratio, and the respective line/continuum ratios. These variations can be best explained by allowing for changes in the chemical composition of the coronal plasma.

Posters:

Contribution number: X.1p
Title: **Faint coronal structures and the possibilities of visualization**

Presenting author: **Belik, Marcel** (belik@obsupice.cz)
Author(s): (1) Belik, M., (2) Druckmuller, M., (1) Markova, E., (1) Krivsky, L.
Affiliation(s): (1) Observatory Upice, Czech Republic, (2) VUT Brno, Czech Republic

Abstract: The pictures obtained during total solar eclipses on both digital and analog recording media contain a lot of information invisible for human eye. There exist several, let us say, classical solutions of visualization them. Unfortunately, even if these methods are useful in many branches of science their abilities are very limited. The imaging method described on this paper called 'adaptive filters' used algorithm according to the human eye method of spatial resolution. The possibilities of mentioned method are demonstrated on some total solar eclipse pictures.

Contribution number: X.2p
Title: **About some chromospheric and coronal structures during the 'cloudy' eclipse on December 4th, 2002 in South Africa**
Presenting author: **Markova, Eva** (markova@obsupice.cz)
Author(s): Markova, E., Krivsky, L., Belik, M.
Affiliation(s): Observatory Upice, Czech Republic

Abstract: The December 4th, 2002 total solar eclipse was observed by group of Observatory Upice on South Africa. Although the clouds disallowed to realize all of planned experiments, very small 'partly cloudy' hole in the dullness allows to obtain some pictures. Even if the quality of the pictures is degraded, we could find some faint structures, especially on the short time exposure snapshots of chromosphere. Description of observing place, methods and some results are shown on this paper.

Contribution number: X.3p
Title: **The 1st of April 2470 BC Total Solar Eclipse Witnessed by the Prophhet Abaham in Babel on the Border of the Totality**
Presenting author: **Shahinaz, Yousef, M.** (shahinazyousef@yahoo.com)
Author(s): Shahinaz, Y.
Affiliation(s): Astronomy & Meteorology Dept., Faculty of Science, Cairo University

Abstract: The holy Quran reports an astronomical phenomena which is termed the hidden kingdom of the heavens and earth which was seen by the prophet Abraham. This phenomena started by the coverage of the shadow ,then the visibility of a planet followed by its disappearance ,then the visibility of the limb of the moon as the Baily's beads then its disappearance and finally by the visibility of the solar crescent and its disappearance(setting) after becoming fully cleared following the last contact. Two conditions were put for this solar eclipse termed the hidden kingdom(sun, moon and the planet were hidden at first but were rendered visible in steps to the prophet Abraham) namely; lack of visual corona and the visibility of a lonely planet. Six solar eclipses passed over Babel between 2860 and 1405 BC. Only the eclipse of the first of April 2470 BC satisfies those two criteria. Being on the border of the totality zone, the sky over Babel during this total eclipse was not dark enough to allow coronal visibility and thus all the time of totality only the moon was visible just appearing as the solar rays were scattered on the valleys of the moon. Secondly this is the only eclipse when only one planet was seen namely Venus. Witnessing this eclipse was the starting moment for recognizing the creator by young Abraham. It provided a scientific means for checking the assumed gods of Babylonian theology, the sun, the moon and Venus. He was looking for one God who is great and who does not disappear. He disregarded those idols one by one in steps as they disappear and the lack of the solar corona deprived the sun of its glory.

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