Cosmic Rays and Neutron Monitors – a training course in science and applications

September 14-19, 2009
Athens, Greece

NMDB Training Course
Students Presentations

Student's presentations Program	
Monday, September 14, 2009	
18:00 – 18:30	**'**Solar energetic particle observations and propagation in the 3-D Heliosphere in December 2006' **Olga E. Malandraki** Institute for Astronomy and Astrophysics, National Observatory of Athens, Greece
18:30 – 18:45	'The last GLE event of solar cycle 23' **Chuan Li** Mullard Space Science Laboratory Uni. College London
18:45 – 19:00	**'**Properties of the extreme solar particle events during the solar cycle 22 and 23' **A. Andriopoulou[1], C. Plainaki[1], H. Mavromichalaki[1], A. Belov[2], E. Eroshenko[2]** [1] National & Kapodistrian University of Athens [2] IZMIRAN, Russian Academy of Sciences
19:00 – 19:30	**Posters**
Tuesday, September 15, 2009	
18:00-18:20	'Cosmic Ray Intensity Variation and Its Connection with the Total and Spectral Solar Irradiance' **Gigolashvili M.Sh., Kapanadze N.G.** *Georgian E. Kharadze National Astrophysical Observatory at Ilia Chavchavadze State University*
18:20– 18:40	'Recurrent modulation of galactic cosmic rays: A comparative study between IMP, SOHO, STEREO, and Ulysses' **Jan Gieseler** *University of Kiel*
18:40 – 19:00	'Cosmic Ray and Solar Energetic Particle Effects on Electronic Device of the spacecraft' **Shrinivasrao R. Kulkarni** *Christian-Albrechts-University, 24118, Kiel, Germany*
19:00 – 19:30	**Posters**

Poster Presentations	
P1	Hafelekar, a cosmic rays observatory **Martin Leitner, Jussel Patrick, Yury Balabin** *Institue of Astro- and Particle Physics, University Innsbruck, Austria*
P2	Solar modulation during the Holocene **F. Steinhilber[1], J. Abreu[1], J. Beer[1], B. Heber[2], K. Herbst[2]** *[1]Eawag, Dübendorf, Switzerland; [2]University of Kiel, Germany*
P3	Modeling the Martian neutral particle radiation predictions for ExoMars/IRAS and implications for Martian habitability during the Noachian **Bent Ehresmann** *Arbeitsgruppe Extraterrestrik, Institut für Experimentelle und Angewandte Physik, Christian-Albrechts-Universität Kiel, Germany*
P4	Using the real-time Neutron Monitor Database to establish an Alert signal **Mavromichalaki H. [(1)], Souvatzoglou [(1)], Sarlanis C.([1)], Mariatos G. [(1)], Papaioannou, A.[(1)], Belov [(2)], Eroshenko E.[(2)], Yanke V. [(2)] for the NMDB team** [(1)] Physics Department, University of Athens, Athens GR (emavromi@phys.uoa.gr) [(2)] IZMIRAN after Pushkov, Moscow, Russia
P5	A proposal of an embedded data acquisition system for a neutron monitor **Óscar García Población** *Departamento de Automática, Escuela Politécnica Superior, Universidad de Alcalá, Spain*

Solar energetic particle observations and propagation in the 3-D Heliosphere in December 2006

Olga E. Malandraki

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Abstract

We report observations of solar energetic particles obtained by the HI-SCALE and COSPIN/LET instruments onboard Ulysses during the period of isolated but intense solar activity in December 2006, in the declining phase of the solar activity cycle. We present measurements of particle intensities and also discuss observations of particle anisotropies and composition in selected energy ranges. Active Region 10930 produced a series of major solar flares with the strongest one (X9.0) recorded on December 5 after it rotated into view on the solar east limb. Located over the south pole of the Sun, at >72ºS heliographic latitude and 2.8 AU radial distance, Ulysses provided unique measurements for assessing the nature of particle propagation to high latitudes under near-minimum solar activity conditions, in a relatively undisturbed heliosphere. The observations seem to exclude the possibility that magnetic field lines originating at low latitudes reached Ulysses, suggesting either that the energetic particles observed as large Solar Energetic Particle (SEP) events over the south pole of the Sun in December 2006 were released when propagating coronal waves reached high latitude field lines connected to Ulysses, or underwent perpendicular diffusion. We also discuss comparisons with energetic particle data acquired by the STEREO and ACE in the ecliptic plane near 1 AU during this period

The last GLE event of solar cycle 23

Chuan Li

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Abstract

Solar energetic particles (SEPs) are one manifestation of violent releases of magnetic energy on the Sun. All geo-effective or major SEP events are associated with coronal mass ejections (CMEs) and/or flares. The main controversy focuses on which process is dominant during particle injection. We present studies of SEP dynamics, flare magnetic reconnection rate, and the coronal magnetic configuration during the 2006 December 13 event. Our analysis suggests that flare acceleration dominates as the cause of the initial SEP injection and produces a highly anisotropic particle distribution with a hard energy spectrum. Subsequently, the acceleration source appears to switch to a wide-spread interplanetary CME-driven shock, which produces a nearly isotropic particle distribution with a softer energy spectrum.

Properties of the extreme solar particle events during the solar cycles 22 and 23

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Abstract

Despite the uniqueness of ground level enhancement events, an effort to connect their major characteristics has been made, through a statistical analysis. The most intense events of solar cycles 22 and 23 were chosen and analysed thoroughly. The analysis includes the calculation of the onset time of the events, the lag between the time of the maximum flux and the onset time, the determination of longitudinal and latitudinal distributions, as well as the asymptotic cones for each event. In the analysis, one-minute and 5-minute cosmic ray data provided by polar and middle-latitude stations from the worldwide network of neutron monitors was used. Data from the NMDB database were also used (http://www/nmdb.eu). The characteristics of the events are then studied together and careful comparisons are made. In this paper the preliminary results and the conclusions of this analysis are presented. Finally, an evaluation of the statistical results and their possible to other space weather applications is considered through a discussion.

Cosmic Ray Intensity Variation and Its Connection with the Total and Spectral Solar Irradiance

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Abstract

Variations of the Solar Spectral Irradiance (SSI) and the Cosmic Ray variations using last space observations during 2003-2008 by satellite precise devices and ground-based observations of the Cosmic rays in Tbilisi, Oulu and Magadan with standard neutron monitors are investigated.

By spectral analyses of the time series of the SSI (spectral ranges □□ 1-7, 30.4, 121.5, 312.360, 405.990 nm) and the cosmic rays variations we have found that the negative correlation exists between the cosmic rays intensity and solar 0.1-7, 30.4, 121.5, 312.4 nm X-ray flux. Only 405.99 nm X-ray fluxes are positively correlated with the cosmic rays observed in Tbilisi, Oulu and Magadan.

Keywords: cosmic rays, solar spectral irradiance: observations-correlations

Recurrent modulation of galactic cosmic rays: A comparative study between IMP, SOHO, STEREO, and Ulysses

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ABSTRACT

It is well known that the galactic cosmic ray (GCR) ux is modulated by Corotating Interaction Regions (CIR) in the vicinity of Earth. When Ulysses first explored high latitude regions in 1996, it was found that the ux of GCRs was still modulated on the time scale of one solar rotation, although neither the solar wind nor the interplanetary magnetic field at these latitudes showed the characteristics of CIRs. This process led to the modification of our understanding of either the heliospheric magnetic _field (HMF, Fisk _eld) or the transport of particles perpendicular to the HMF. 12 years later, Ulysses explored these high latitude regions again. From September 2007 to September 2008, the GCR ux at Earth showed a clear 27 day solar-rotation modulation. However, the GCR ux at Ulysses from 2.6 AU to 3.7 AU and 73_ to 47_, respectively, did not show the same behavior as in the 1990's as discussed before. Unlike the _rst time period, the two STEREO spacecraft launched in 2006 allow for additional near-Earth orbit measurements at multiple heliographic longitudes in 2008, thus allowing not only to { 2 {investigate the latitudinal structure with Ulysses and SOHO but also the longitudinal distribution using STEREO, SOHO, and Ulysses.

Cosmic Ray and Solar Energetic Particle Effects on Electronic Device of the spacecraft

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When electronics of the spacecraft operating in the high energy radiation environments like Galactic Cosmic Rays (GCR) or Solar Energitic Particles (SEP) environment, may undergo dramatic changes in their properties. These changes affect the performance of the devices. The effects of GCR/SEP on the semiconductor electronic device is depends on the several factors. The nature of impinging high energy particle and the technology of electronic device are two important factors. In this presentation the basic phenomena of high energy particle effects on the electronic device with respect to above mentioned two factors will discuss.

Hafelekar, a cosmic rays observatory

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Abstract

The Hafelekar station is situated upon the city of Innsbruck at an altitude of 2300m. It was founded by Viktor Franz Hess in 1931 and there he discovered the daily variations of the the cosmic rays. At the moment the neutron monitor and myon telescope are not operating. We present the current situation of the Hafelekar station, and our future plans to activate the station with a new registration system for the NM, and additional equipment. Since everything is in planing phase, discussion and suggestions how to set up the equipment at the station are very welcome

Solar modulation during the Holocene

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Abstract

This poster compares several models of the local interstellar spectrum (LIS). It is shown that the force-field parameter (also known as solar modulation potential □ which parametrizes the modulation of the LIS in the heliosphere, strongly depends on the LIS itself. First, we derived simple equations to convert □between the different LIS. Higher polynomials only hardly improve the conversion, and thus it is concluded that the conversion with linear equations can be done with good results. Second, the conversions are applied to a 9300-yr long record of □, which shows (unphysical) negative values during some periods. Besides non-heliospheric effects such as the uncertainty in atmospheric mixing and in paleo-geomagnetic field intensity, these negative values could also be due to the usage of a too less intensive LIS. The next step will be to remove the non-heliospheric effects from the □record, which then would allow to identify the “true” LIS.

Modeling the Martian neutral particle radiation - predictions for ExoMars/IRAS and implications for Martian habitability during the Noachian

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Abstract

The exciting results of recent Mars exploration missions indicate that water existed on the Martian surface, which provides a possibility for life on Mars. Thus, there is an enhanced interest in analyzing the conditions for habitability on Mars, especially in the Noachian epoch.

An important aspect of habitability is the radiation level of charged and neutral particles in possible habitats. Using Planetocosmics, we calculate particle radiation in the Martian atmosphere and at ground level for present-day conditions. These calculations allow us to make predictions for the measurements of the Ionizing Radiation Sensor (IRAS) on ExoMars. By changing atmosphere conditions and varying the water-content of the Martian soil, we can derive radiation levels expected during the Noachian period. We will discuss the implications of these model results in terms of Noachian habitability.

Using the real-time Neutron Monitor Database to establish an Alert signal

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Abstract

The European Commission is supporting the Neutron Monitor database (NMDB) as an e-Infrastructures project in the Seventh Framework Programme in the Capacities section. The realization of the NMDB will provide the opportunity for several applications most of which will be implemented in real-time. An important application will be the establishment of an Alert signal when dangerous solar particle events (SEPs) are heading to the Earth, resulting into a Ground Level Enhancement (GLE) registered by NMs. The cosmic ray community has been occupied with the question of establishing such an Alert for many years and recently several groups succeed in creating a proper algorithm capable of detecting space weather threats in an off-line mode. A lot of original work has been done to this direction and every group working in this field performed routine runs for all GLE cases, resulting into statistical analyses of GLE events. The next step was to make this algorithm as accurate as possible and most importantly, working in real-time. This was achieved when in the latter GLE threat (GLE70) for the first time a real-time GLE Alert signal was produced. In this work, a discussion is being presented on the transition of the Alert algorithm to the NMDB. The steps of this procedure as well as the functionality of this algorithm for both the scientific community and users are also being discussed.

A proposal of an embedded data acquisition system for a neutron monitor

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This work presents the design of a flexible and compact data acquisition system for a neutron monitor, fully compatible with the Neutron Monitor Database standards. It presents the overall architecture of the experiment, introducing the New Hampshire University amplifier-discriminator and its new features, following with the proposed design based on embedded systems, and ending with the projected features of the system to be developed.