# EP 5: Postersitzung I

Zeit: Dienstag 16:30–18:00 Raum: GW2 2.OG

EP 5.1 Di 16:30 GW2 2.OG

**On the optimum use of the Mg II Index as a proxy for UV solar spectral irradiance variations** — •Neda Darvishsefat[1,2], Mark Weber[1], and John P. Burrows[1] — [1]IUP Institute of Environmental Physics, University of Bremen — [2]AWI Alfred Wegner Institute, Bremerhaven

The Mg II index is a useful proxy to model solar spectral irradiances (SSI) in the UV spectral region. In order to confirm how suitable the use of this proxy is, the correlation of the Mg II index composite with available SSI satellite data from SORCE SOLSTICE (2003-present), UARS SOLSTICE (1991-2001) and UARS SUSIM (1991-2005) has been analyzed. The observation periods of each of these instruments cover solar minima and maxima of the 11-year solar cycle. The spectral range investigated is from 115 to 300 nm in the UV. The SSI sensitivity with respect to changes in the Mg II index has been obtained and its stability over the 11-year solar cycle is discussed. The results show for all three instruments in most parts, stability of the sensitivity within its uncertainty range through the observation time, particularly for the lower wavelengths in the UV region. For higher wavelengths above about 250 nm additional parameters like sunspots have to be considered in the linear regression in order to achieve better results.

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**Long-lasting solar energetic electron injection during the 26 Dec 2013 widespread SEP event** — •Nina Dresing[1], Raúl Gómez-Herrero[2], Bernd Heber[1], Andreas Klassen[1], Manuela Temmer[3], and Astrid Veronig[3] — [1]IEAP, University of Kiel, Germany — [2]SRG, Universidad de Alcalá, Spain — [3]Institute of Physics, University of Graz, Austria

The solar energetic particle (SEP) event on 26 Dec 2013 was observed all around the Sun by the two STEREO spacecraft and close to Earth. A remarkable feature of the in-situ observations is the long-lasting anisotropy observed at all three viewpoints lasting for many hours at Wind and up to more than a day at STEREO B. Also the near-relativistic electron intensities show long-lasting rises over many hours. To explain such observations a temporally extended injection scenario is required which could be realized by the associated CME-driven shock. Because energetic electron events were previously assumed to be purely flare-ralated, it is important to characterize the possible role of shocks for solar energetic electrons. Especially in the context of widespread SEP events the role of efficient perpendicular transport vs. an extended source region is discussed controversially. We analyze remote-sensing and in-situ observations and discuss the role of the shock for the energetic electron event as well as its limitations.

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**GEANT 4 Simulation of the Solar Electron Proton Telescope aboard the STEREO mission** — Stefan Wraase, •Bernd Heber, Stephan Böttcher, Nina Dresing, Andreas Klassen, and Patrick Kühl — Christian-Albrechts-Universität, 24118 Kiel, Germany

The Solar Electron and Proton Telescope (SEPT), one of four instruments of the Solar Energetic Particle (SEP) suite for the IMPACT investigation, is designed to provide the three-dimensional distribution of energetic electrons and protons with good energy and time resolution. It consists of two dual double-ended magnet/foil particle telescopes which cleanly separate and measure electrons in the energy range from 30-400 keV and protons from 60 - 7000 keV. Anisotropy information on a non spinning spacecraft is provided by the two separate telescopes: SEPT-E looking in the ecliptic plane along the Parker spiral magnetic field both towards and away from the Sun, and SEPT-NS looking vertical to the ecliptic plane towards North and South. The dual set-up refers to two adjacent sensor apertures for each of the four view directions: one for protons, one for electrons. In this contribution a simulation of SEPT utilizing GEANT 4 has been set up with an extended instrument model in order to calculate improved response functions of the four different telescopes. This will help to understand and correct instrumental effects in the measurements.

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**The not so standard Neutron Monitor: An initiative for standardization** — •Christian Steigies[1] and Christos Sarlanis[2] — [1]Christian-Albrechts-Universität zu Kiel — [2]ISNet Co, Athens, Greece

Neutron Monitors (NM) are standardized ground-based cosmic ray detectors. The IGY type has been in use since the International Geophysical Year 1957. In 1964 it has been succeeded by the NM64, which provides better count-rate statistics. Although most stations of the worldwide Neutron Monitor network are of the NM64 type, some IGY NMs are still in use today. Since the beginning NMs deliver hourly count-rates to the World Data Center for Cosmic Rays (WDC-C) in a standardized format. With the creation of NMDB.eu also a standard data format for high-resolution measurements is in place. However, the data processing of NMs, that is determination of count-rates of the whole monitor (which consists of typically 18 individual counter tubes), is not standardized. Single tubes may produce errors (spikes, dropouts, drifts, snow or wind effect) which deteriorate the high-precision measurement if this data is not properly corrected. Different NM stations experience different kinds of problems, so each station has developed their own algorithms to correct data, ie a simple sum algorithm, different median editors, or the so called super editor. In a world where we are trying to standardize NM data from the detection system all the way to the database, data correction should be standardized as well. Thus we are working on a software package which will be used to study and compare the different algorithms using actual data provided by different NM stations.

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**Neutron monitor measurements on the German research vessel Polarstern** — •Bernd Heber[1], Dennis Galsdorf[1], Konstantin Herbst[1], Helena Krüger[2], Hendrik Krüger[2], and Michael Walter[3] — [1]Christian-Albrechts-Universität, 24118 Kiel, Germany — [2]Center for Space Research, North-West University, Potchefstroom 2520, South Africa — [3]Deutsches Elektronen-Synchrotron DESY, D-15738 Zeuthen

Neutron monitors and muon telescopes are ground-based devices to measure the variation of galactic cosmic ray intensities. Since their measurements are influenced by the variable Earth magnetic field and the atmospheric conditions close to its position a detailed knowledge of the instrument sensitivity with geomagnetic latitude (rigidity) and atmospheric pressure is essential. The rigidity dependence is determined experimentally by utilizing several so called latitude scans. The Polarstern is currently one of the most sophisticated polar research vessels in the world that spends almost 310 days a year at sea. Between November and March it usually sails to and around the waters of the Antarctic, while the northern summer months are spent in Arctic waters. In other words the vessel scans twice a year the rigidity range below the atmospheric threshold and above 10 GV. One mini neutron monitor, constructed by the North West University campus Potchefstroom, and muon telescope, constructed by DESY Zeuthen, are measuring the variation of galactic cosmic rays with respect to the position of the vessel. In this presentation the measurements of the neutron moinitor over the last years are presented.

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**The search for Europa plume signatures in Galileo in-situ data** — •Hans Huybrighs[1,2,3], Elias Roussos[1], Norbert Krupp[1], Markus Fränz[1], Yoshifumi Futaana[2], Stas Barabash[2], and Karl-Heinz Glassmeier[1,3] — [1]Max Planck Institute for Solar System Research, Göttingen, Germany — [2]Swedish Institute of Space Physics, Kiruna, Sweden — [3]Institut für Geophysik und extraterrestrische Physik, Technische Universität Braunschweig, Braunschweig, Germany

Hubble observations obtained in recent years indicate the existence of water vapour plumes originating from the surface of Jupiter's moon Europa. The first opportunity to study these plumes in-situ will arise when ESA's JUICE mission or NASA's Europa Mission will arrive there. However, it has been suggested that the past Galileo mission could have encountered these plumes already. In particular it has been suggested that high plasma densities and anomalous magnetic fields measured during the E12 flyby could be linked to plume activity. Here we present an overview of Galileo in-situ data obtained during the Europa flybys and compare the data in the context of the search from

Europa plumes. Focus is in particular on the data obtained with the plasma instrument PLS.

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**Long Term Stability of a 1 GHz Laser Frequency Comb** — •Michael Debus and Philipp Huke — Institut für Astrophysik, Universität Göttingen, Deutschland

One part of the instrumentation plan of the E-ELT is a high resolution spectrograph (HIRES). For the calibration unit of HIRES a laser frequency comb (LFC) may be used. We are investigating the stability of a 1 GHz LFC. The whole setup is referenced to the GPS-frequency attaining a stability of $8 \cdot 10^{-12}$. One frequency generator is used to stabilize the repetition rate of the LFC, a second one is used to stabilize the offset frequency. Both are GPS-referenced. The stability of the frequency generators and the corresponding electronics is crucial to the overall performance of the LFC. The behavior of the frequency generators was characterized both on and off the GPS-reference as well as the stability of the electronic circuits. It is also important to know the inherent drift of the offset frequency in order to stabilize it over an extended period of time.

We have reached a relative stability of $1.2 \cdot 10^{-11}$ over 6 hours. Currently we are aiming to keep the LFC in lock for at least 12 hours. Additionally we are investigating other parameters like spectral amplitude stability, polarization and the behavior in a fibre coupling.

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**Modeling particle induced atmospheric ionization after 2010** — •Jan Maik Wissing[1], Alexander Mizuk[1], and Olesya Yakovchuk[1,2] — [1]Institute of Environmental Systems Research, University of Osnabrück — [2]Skobeltsyn Institute of Nuclear Physics, Moscow State University, Moscow, Russia

The Atmospheric Ionization Module OSnabrück (AIMOS) calculates a global 3D ionization profile based on data from the NOAA GOES and POES satellites that can be used e.g. in climate models. Due to a discontinuation of both input data sets the model was restricted to the years 2001 to 2010. In this work we will describe how the model has been extended to 2016.

During the extension a couple of problems in the satellite data became obvious that may also impact other studies based on GOES or POES data, e.g. the new GOES satellites have different energy ranges even though the instument is identical to the older ones (e.g. P7 old 165.–500.MeV, P7 new 110.–900.MeV). Finally it turned out that the energy ranges are simply not known or at least subject of severe uncertainties, which is good to know as this satellite data is widely used for 20 years now. We will present our attempt to overcome this limitation by recalculating the energy thresholds based on the shifted center energy with variing steepness of the flux spectrum.

In case that newer satellite data shows significant flux differences as e.g. in the magnetospheric energies, the impact on atmospheric ionization will be discussed.

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**Effects of Key GCR and SEP Shower Parameters in Earth-like Atmospheres** — •Markus Scheucher[1], John Lee Grenfell[2], and Heike Rauer[1,2] — [1]Department of Astronomy and Astrophysics (ZAA), Berlin Institute of Technology (TUB), Hardenbergstr. 35, 10623 Berlin, Germany — [2]Department of Extrasolar Planets and Atmospheres (EPA), German Aerospace Center (DLR), Rutherfordstr. 2, 12489 Berlin, Germany

To investigate the habitability of planets having Earth-like (N2-O2 dominated) atmospheres orbiting in the Habitable Zone of quiet and active M-dwarf stars, it is necessary to determine the effect of stellar radiation and the incoming energetic particle fluxes upon atmospheric composition and temperature. Planetary atmospheres are constantly bombarded by Galactic Cosmic Rays (GCRs) and Stellar Energetic Particles (SEPs), which can create showers of secondary particles down to the surface. We perform a study investigating the influence of key particle shower parameters, by varying secondary particles production profiles, NOx and HOx production efficiencies, and model their effects upon atmospheric composition and temperature in a cloud-free 1D climate-chemistry model.

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**The role of energetic particles in an exoplanetary atmosphere - a GEANT 4 based simulation tool** — •Sasa Banjac, Konstantin Herbst, and Bernd Heber — Christian-Albrechts-Universität, 24118 Kiel, Germany

In the near future it can be expected to detect more rocky exoplanets in the habitable zone of M- and K-dwarf stars The harsh stellar radiation environment and a possible tidal locking of these planets could outweigh the observational advantages by destroying biosignatures such as ozone (O3) ("false negative") or by producing biosignatures abiotically ("false positiv") and by affecting the habitability, e.g. in the form of an enhanced UV exposure, but also an enhanced flux of energetic particles (measured in the form of the dose rate) on the (exo-)planetary surface. In order to determine the radiation environment in a exoplanetary atmosphere we developed a tool based on the GEANT 4 library package that allows to calculate not only the ion-pair production but also the radiation dose on the surface of an exoplanet. The development aims for high flexibility in the specification of not only atmospheric and soil composition, but also of the radiation environment. Therefore, it will be applicable to the Solar system. In this contribution the setup and first results are presented.

EP 5.11 Di 16:30 GW2 2.OG

**Photochemical Responses induced by Stellar Energetic Particles for Earth-like Planets in the Habitable Zone of M-dwarf Stars** — •John Lee Grenfell[1], Markus Scheucher[2], and Heike Rauer[1,2] — [1]Dept. Extrasolar Planets and Atmospheres (EPA), German Aerospace Centre (DLR), Berlin Adlershof, Germany — [2]Centre for Astronomy and Astrophysics (ZAA), Berlin Institute of Technology (TUB), Berlin, Germany

We apply a coupled climate-convective chemistry column model to Earth-like planets (i.e. planets assuming Earth's development, biomass emissions and an atmosphere dominated by molecular nitrogen and oxygen) orbiting in the Habitable Zone of an M-dwarf star. Using an air shower approach for incoming stellar energetic particles we analyse photochemical responses induced by the resulting secondary electrons which break up molecular nitrogen and oxygen in the atmosphere. We present an analysis of the intra-family partitioning of the resulting nitrogen-oxides (NOx) and hydrogen-oxides (HOx)(and their reservoir molecules) which are responsible for destroying the biosignature species ozone assuming different levels of stellar activity.

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**TLS participation in the MPC NEOCP program** — •Bringfried Stecklum — Thüringer Landessternwarte, 07778 Tautenburg, Deutschland

The Thueringer Landessternwarte (TLS) has a long-standing tradition for what concerns the discovery of minor planets. Recently, it joined the Near Earth Object Confirmation Program (NEOCP) of the Minor Planet Center (MPC). The contribution provides on overview on the observational capabilities and prospects. The results of the astrometric measurements will be summarized. This effort is carried out as part of the EURONEAR initiative.

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**Untersuchungen zum Einfluss von geomagnetischer Aktivität auf Zusammensetzung und Zirkulation der Thermosphäre und deren Kopplung in die mittlere und obere Atmosphäre** — •Sabine Barthlott[1], Miriam Sinnhuber[1], Thomas Reddmann[1], Stefan Versick[1], Holger Nieder[2] und Alexey Vlasov[2] — [1]Karlsruher Institut für Technologie (KIT), Karlsruhe, Deutschland — [2]ehemals KIT

Geomagnetische Aktivität beeinflusst die Zusammensetzung und Zirkulation der unteren Thermosphäre. Die wesentlichen Prozesse hierbei sind Photoionisation, Teilchenionisation und Joule-Heizen. Die hierdurch verursachten Änderungen in der Thermosphäre wirken sich auch auf andere Atmosphärenschichten aus. Durch Ionisation in der Aurora erhöhtes Stickstoffmonoxid (NO) führt durch Absinken zu Änderungen in den darunterliegenden Atmosphärenschichten (z. B. Ozonschicht). Die in der unteren Thermosphäre z. B. durch geomagnetische Stürme angeregten Schwerewellen können sich nach oben bis in die Umgebung von Satelliten mit erdnaher Umlaufbahn auswirken.

Um diese Kopplungen in Modellen korrekt wiederzugeben, ist es wichtig, die Prozesse in der unteren Thermosphäre möglichst genau zu beschreiben. Im Rahmen des SPP Projekts 'Dynamic Earth' wird das gekoppelte Chemie-Klimamodell EMAC (hier in einer erweiterten Version bis ∼170 km) weiterentwickelt und oben genannte Prozesse (z. B. Photoionisation) implementiert. Am Beispiel Winter 2008/2009 werden erste Ergebnisse der Weiterentwicklung mit Standardsimulationen und Beobachtungen verglichen.

**Teil II der Postersitzung findet am Mittwoch 16:30-18:00 statt. Die Autoren werden gebeten an beiden Postersitzungen teilzunehmen.**