EP 8: Sonne und Heliosphäre (II)

Time: Friday 10:30–13:00 Location: DO24 1.103

Invited Talk EP 8.1 Fri 10:30 DO24 1.103

Solar magnetic fields and their heliospheric response — •Julia K. Thalmann — Institute of Physics/IGAM, University of Graz, 8010 Graz, Austria

Permanently (re-)generated by a dynamo action deep inside the Sun, a large-scale magnetic field is extending far out into interplanetary space and in the form of the solar wind causing the so-called space weather. Global as well as local features of the Sun's magnetic field reappear more or less regularly with alternating periods of low and high activity. The temporal evolution of the global magnetic field and superposed, smaller-scale centers of activity (active regions) determine the dynamics in the inner heliosphere. Most impressive, localized solar phenomena like flares and coronal mass ejection originate from the magnetically closed solar active regions and expel considerable amounts of charged particles and radiation. In addition large-scale, magnetically open regions like coronal holes that interact with neighboring magnetically closed regions contribute to the ongoing acceleration of solar wind particles and cause a corresponding heliospheric response. A concise summary of our current understanding of the physical contributors dominating the dynamics in the inner heliosphere is necessary and important in order to possibly realize real-time space weather prediction and formulate remaining open questions for future missions.

Invited Talk EP 8.2 Fri 11:00 DO24 1.103

An Introduction to the International Space Weather Initiative — •Michael Danielides — Danielides Space Science Consulting, Bentzin, Germany

Presented will be an introdution to the International Space Weather Initiative (ISWI), its projects, organization and opportunities. A summary on the international activities related to ISWI follows.

ISWI supports small global instrument networks, science data bases and provides space science training through out Centres for Space Science and Technology Education.

A report and outview on German ISWI (http://www.iswi-germany.de) activities and projects will be given.

EP 8.3 Fri 11:15 DO24 1.103

Coronal active region modeling based on SDO data — •Stephan Barra[1,2], Wiegelmann Thomas[1], and Fichtner Horst[2] — [1]MPI für Sonnensystemforschung — [2]Ruhr-Universität Bochum

The heating of the solar corona, which has a temperature of order of 10^6 K compared to 5000K in the photosphere, is yet a puzzling problem. Several models to describe the physical parameters, e.g. temperature or density, along coronal loops with different assumptions for the relevant physical processes (like wave damping) were suggested in the past, for example the RTV78 model by Rosner, Tucker and Vaiana. With these models and the knowledge of the 3D configuration of the magnetic field above an active region it is possible to calculate the radiation emitted by the coronal loops above this region. This 3D field configuration is provided for an active region with the help of a nonlinear force free field optimization code from photospheric SDO/HMI vector magnetogramms as boundary conditions. We use this field to model the plasma along these loops with the RTV78 model and create artificial coronal images in different wavelength, which we compare with images obtained with the multispectral imager SDO/AIA. The same has been done with a potential field reconstructed from the same data set. Such comparisons allow us to evaluate the quality of our model approach.

EP 8.4 Fri 11:30 DO24 1.103

Anisotropies of wide-spread solar energetic electron events observed with STEREO and ACE — •Nina Dresing[1], Raúl Gómez-Herrero[2], Andreas Klassen[1], Olga Malandraki[3], Wolfgang Dröge[4], and Yulia Kartavykh[4,5] — [1]IEAP, University of Kiel, Germany — [2]Space Research Group, University of Alcalá, Spain — [3]National Observatory of Athens, Greece — [4]Institut für Theoretische Physik und Astrophysik, University of Würzburg, Germany — [5]Ioffe Physical-Technical Institute, St. Petersburg, Russian Federation

STEREO, in combination with near-Earth observatories as ACE or Wind provides three well separated viewpoints, which are perfectly suited to investigate SEP events and their longitudinal dependences. We collected a list of 21 near-relativistic wide-spread electron events in the period from 2009 to mid 2013, where we request a minimum longitudinal separation angle of 80 degrees between the source active region at the Sun and the magnetic footpoint of one spacecraft observing the event. Anisotropies are investigated to disentangle source and transport mechanisms leading to the wide particle spreads. One favorable mechanism is efficient perpendicular transport in the IP medium leading to vanishing anisotropies at well-separated positionis. Another scenario is a large particle spread close to the Sun either due to a coronal shock or due to coronal transport. Here, we expect significant anisotropy at 1 AU due to the wide injection range at the Sun and the afterwards focusing during the outwards propagation. For both of the above scenarios we find events in our sample, which suit the expected observations and even further events, which do not agree with these.

EP 8.5 Fri 11:45 DO24 1.103

Influence of Ground Level Enhancements on the Terrestrial Production of ^{10}Be, ^{14}C and ^{36}Cl — •Konstantin Herbst[1], Jürg Beer[2], Bernd Heber[1], Allan J. Tylka[3], and William F. Dietrich[4] — [1]IEAP, Christian-Albrechts-Universität zu Kiel, Kiel, Germany — [2]Swiss Federal Institute of Aquatic Science and Technology, EAWAG, Switzerland — [3]Space Science Division, Naval Research Laboratory, Washington, DC, USA — [4]Praxis, Inc., Alexandria, VA, USA

Cosmogenic radionuclides are a product of the interaction of primary cosmic rays, in particular galactic cosmic rays (GCRs), with the Earth's atmosphere. But only primary particles with energies above several 100 MeV can trigger the necessary reaction chains. Because GCRs are modulated by the solar activity on their way through the interplanetary medium the GCR-induced cosmogenic radionuclide production is anti-correlated to the solar cycle. During phases of strong solar activity also solar energetic particle (SEP) events occur frequently. In particular SEP events which can be detected by ground-based instruments, so-called ground level enhancements (GLEs), may strongly contribute to the cosmogenic radionuclide production. Beside the variation due to the modulation of GCRs we will investigate the influence of 58 GLEs, which occurred within the past five solar cycles and discuss the possibility to detect such events in present ice-core and tree-ring records. In addition, an estimate for the probability to find such events over the past 10'000 years, also known as Holocene, during different modulation conditions will be given.

EP 8.6 Fri 12:00 DO24 1.103

Anisotropy measurement capability of SOHO-EPHIN — •Saša Banjac[1], Nina Dresing[1], Raul Gómez-Herrero[2], Bernd Heber[1], Andreas Klassen[1], Patrick Kühl[1], and Cristoph Terasa[1] — [1]Institut für Experimentelle und Angewandte Physik, Christian-Albrechts-Universität zu Kiel — [2]SRG, University of Alcalá, 28871, Alcalá de Henares, Spain

The Electron Proton Helium INstrument (EPHIN) is a multi-element array of solid-state detectors with anticoincidence to measure energy spectra of electrons in the range 250 keV to 8.7 MeV, and of hydrogen and helium isotopes in the range 4 MeV/n to 53 MeV/n. The instrument has a 83° full width conical field of view. It is mounted on the SOHO spacecraft pointing along the nominal Parker-Spiral, i.e. 45° west. Using a Monte Carlo based method we explore the anisotropy measurement capability of EPHIN, making use of the information provided by the segmentation of the two upper detectors of the stack (A and B). Finally, the developed methods are applied to a sample of solar events and the results are analyzed and compared in order to discuss the potential of the sensor to determine particle anisotropies.

EP 8.7 Fri 12:15 DO24 1.103

Transit-time aspects of ENAs generated by charge exchange in the outer heliosphere — •Mark Siewert and Hans-Jörg Fahr — AIFA, Universität Bonn

Energetic Neutral Atoms (ENAs) have recently emerged as a new tool for remote sampling of astrophyiscal plasmas in the border region of the heliosphere. Pushed forward by the highly successful IBEX mission, time-dependent ENA data of the entire heliospheric boundary layer is now available for a time range of nearly five years. However, the source region and interpretation of the ENAs observed by IBEX is still unclear, and criteria that may allow to differentiate between

different models are sparse. In this talk, we present recent results on transit-time aspects of our own model for ENA production, and demonstrate that a reaction in the ENA flows due to the end of the solar minimum in late 2010 should emerge in the data being taken right now.

EP 8.8 Fri 12:30 DO24 1.103

The entropy production at the multi-fluid MHD solar wind termination shock — •Hans Jörg Fahr and Mark Siewert — Argelander Institut für Astronomie, Universität Bonn, Auf dem Huegel 71, 53121 Bonn

It has become evident meanwhile that the MHD solar wind termination shock needs a multifluid theoretical approach to adequately describe the intertwisted physical complexity in the interaction between fields and particles. In this approach here we treat the passage of three separate fluids over the MHD shock, namely solar wind protons, pickup protons and electrons. Connected with the different downstream pressures of three fluids we also calculate the different fluid entropies that are produced at the shock passage. As we can show the most relevant contribution to the total particle entropy is connected with the electron pressure which actually by far dominates the downstream plasma pressure.

EP 8.9 Fri 12:45 DO24 1.103

The Dynamics of Comet ISON C/2012 S1 near Perihelion — •Adalbert Ding[1,5], Shadia Rifai Habbal[2], Miloslav Druckmüller[3], and Peter Aniol[4] — [1]Institut für Optik und Atomare Physik, Technische Universität Berlin, Berlin, Germany — [2]Institute for Astronomy, University of Hawaii, Honolulu, Hawaii, USA — [3]Faculty of Mechanical Engineering, Brno University of Technology, Brno, Czech Republic — [4]ASTELCO, Martinsried, Germany — [5]Institut für Technische Physik, Berlin, Germany

Comet ISON C/2012 S1, discovered in 2012, was predicted to have a sun grazing orbit approaching the sun as near as 0.7 solar radii above its surface on Nov 28 2013 at 18:45 UT. Direct white light images of the comet moving through the inner corona were obtained with a wide angle Lyot-type coronograph. The perfect match between the observed inner corona orbit and the trail captured by the LASCO/C2 coronograph was proven using a special correlation procedure. Furthermore emission spectra were obtained during perihelion using a high resolution ($\lambda/\Delta\lambda$=15000) imaging slit spectrometer operating simultaneously in 2 different bands. An external linear occulter was used to discriminate between the sun's and the comet's emission location. The observed line spectra display distinct features of diatomic molecular emission differing from the atomic and molecular absorption structures in the sun's spectrum. In a preliminary analysis these were assigned to the C_2 molecular emission features (Swan bands) and possibly CO^+ emission. The molecular emission processes and the dynamic behavior of the comet in a hostile environment will be discussed.