EP 4: Sonne und Heliosphäre I

Zeit: Dienstag 14:00–16:00 Raum: GW2 B2880

Hauptvortrag EP 4.1 Di 14:00 GW2 B2880

A new view of the solar atmosphere through IRIS — •Hardi Peter — Max Planck Institute for Solar System Research, Göttingen, Germany, peter@mps.mpg.de

The magnetic and dynamic connection through the different regimes of the solar atmosphere provides one of the major challenges in solar physics. Covering temperatures from below ten thousand to above ten million degrees, NASA's Interface Region Imaging Spectrograph (IRIS) is optimized to follow the fast processes in the solar atmosphere at unprecedented resolution in the near and far ultraviolet. IRIS provided new insights over a range of topics, ranging from small-scale transient energetic events in the chromosphere, magnetic and helical structures in the upper solar atmosphere, non-thermal particle acceleration in active regions to the dynamics in flares. Spectroscopic observations highlight the role of reconnection and its nature in the chromosphere and transition region. In particular, the important role of plasmoids in reconnection events has been emphasized and very strong heating of chromospheric plasma was found that provides new evidence on an atmospheric structure that is more complex than thought before. In combination with numerical modeling it became clear that many of the observed spectra can only be understood if the energetic particles are produced in small-scale reconnection events, which then excite the observed transition region lines. In this and other areas, IRIS has been very successful in providing new insight into a range of open issues in solar atmospheric physics, and poses new questions that motivate new theoretical and observational work.

EP 4.2 Di 14:30 GW2 B2880

SCIAMACHY Solar Reference Spectrum — •Tina Hilbig[1], Klaus Bramstedt[1], Mark Weber[1], Matthijs Krijger[2], Ralph Snel[2], and John P. Burrows[1] — [1]Institute of Environmental Physics, University of Bremen, Germany — [2]SRON Netherlands Institute for Space Research, Utrecht, the Netherlands

SCIAMACHY (Scanning Imaging Absorption spectroMeter for Atmospheric CHartographY) aboard ESA*s environmental satellite ENVISAT is a double monochromator designed to measure the radiance backscattered from the Earth to study atmospheric trace gas species. It was operating from 2002 until 2012.

Furthermore, SCIAMACHY performed daily sun observations via a diffuser. Solar spectra in the wavelength range from 212 nm to 1760 nm and two narrow bands from 1930 to 2040 nm and 2260 to 2380 nm are measured with a spectral resolution of 0,2 to 1,5 nm in 8 spectral channels.

Recent developments in the SCIAMACHY calibration (e.g. a physical model of the scanner unit including degradation effects, and an on-ground to in-flight correction using the on-board white light source (WLS)) are used for the generation of a new SCIAMACHY solar reference spectrum as a first step towards a 10-year time series of solar spectral irradiance (SSI) data. For validation comparisons with other solar reference spectra are performed.

EP 4.3 Di 14:45 GW2 B2880

Nonlinear force-free coronal magnetic stereoscopy — •Iulia Chifu[1,2], Thomas Wiegelmann[1], and Bernd Inhester[1] — [1]MPI für Sonnensystemforschung, Justus-von-Liebig-weg 3, 37077, Goettingen,Germany — [2]Astronomical Institute of Romanian Academy, Cutitul de Argint 5, Bucharest, Romania

Getting insights into the 3D structure of the solar coronal magnetic field have been done in the past by two completely different approaches: (1.) Nonlinear force-free field (NLFFF) extrapolations, which use photospheric vector magnetograms as boundary condition. (2.) Stereoscopy of coronal magnetic loops observed in EUV coronal images from different vantage points. Both approaches have their strength and weaknesses. Within this work we present an extension of a NLFFF method which includes the 3D stereoscopic reconstructions of the coronal loops. We apply the newly developed code to a combined data-set from SDO/HMI, SDO/AIA and the two STEREO spacecraft. We find that prescribing the 3D stereoscopically reconstructed coronal loops the S-NLFFF method leads to an agreement between the modelled field and the stereoscopically reconstructed one. It leads also to a decrease in the angle between the current and the magnetic field which indicates an improvement in the force-free solution by a factor of two.

EP 4.4 Di 15:00 GW2 B2880

Coronal active region modelling based on SDO data — •Stephan Barra — MPI für Sonnensystemforschung — Ruhr-Universität Bochum, TP IV

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. Many models have been introduced to describe the corona and its behavior. Especially coronal loops, individual hoses of magnetically confined plasma, have been subject to research. Multispectral imagers like NASA's SDO/AIA, in principle, allow for thermal analysis of such loops. The magnetic field in the corona can be obtained by extrapolating magnetic field measured on the solar surface. We describe an iterative method which deploys both observations from a multispectral imager and magnetic field extrapolations to model density and temperature along the field lines. This could help getting a deeper insight into the processes occurring in the solar corona since the 3D configuration of the physical parameters of the plasma could be tracked.

EP 4.5 Di 15:15 GW2 B2880

Current filamentation induced by 3D plasma flows in the solar corona — •Dieter Nickeler[1], Thomas Wiegelmann[2], Marian Karlicky[1], and Michaela Kraus[1,3] — [1]Astronomical Institute AVCR, Ondrejov, Czech Republic — [2]Max-Planck Institut fuer Sonnensystemforschung, Goettingen, Deutschland — [3]Tartu Observatory, Toravere, Estonia

Many magnetic structures in the solar atmosphere evolve rather slowly so that they can be assumed as (quasi-)static or (quasi-)steady and represented via magneto-hydrostatic (MHS) or magneto-hydrodynamic (MHD) equilibria, respectively. While exact 3D solutions would be desired, they are extremely difficult to find in steady MHD. We construct solutions with magnetic and flow vector fields that have three components depending on all three coordinates. We show that the non-canonical transformation method produces quasi-3D solutions of steady MHD by mapping 2D or 2.5D MHS equilibria to strongly related steady-MHD states. These steady-MHD states exist on magnetic flux surfaces of the original 2D MHS-states. Although the flux surfaces and therefore also the equilibria have a 2D character, these steady MHD-states depend on all three coordinates and display highly complex currents. The existence of geometrically complex 3D currents within symmetric field-line structures provide the base for efficient dissipation of the magnetic energy in the solar corona by Ohmic heating. We also discuss the possibility of achieving force-free fields, and find that they only arise under severe restrictions of the field-line geometry and of the magnetic flux density distribution.

EP 4.6 Di 15:30 GW2 B2880

Semi-Analytical Calculation of Interplanetary Magnetic Field Configurations — •Sophie Aerdker — Ruhr-Universität-Bochum, Lehrstuhl für Weltraum- und Astrophysik

A model from Giacalone et. al. (2002) is introduced, which describes disturbances in the magnetic field of the Sun. Those disturbances are caused by interaction between the slow and fast solar wind leading to compression regions in the solar wind and the magnetic field near the sun. Once the model is presented, the possibility to visualize various regions of perturbation will be analyzed by variation of parameters. Additionally a parametrisation by time allows the representation of time dependent magnetic fields, so that magnetic fields of coronal mass ejections and temporal profiles of solar wind velocities and magnetic field strenghts can be quantified, illustrated and analyzed. Finally the model will be enhanced by a second perturbation region where also temporal dependences are considered. The mainly analytical model is applicable as an easy input for numerical calculation of solution of transport equations. This, in particular, makes it possible to simulate the propagation of particles in interplanetary space especially within 2 AU where shocks are not formed yet.

EP 4.7 Di 15:45 GW2 B2880

An empirical model to describe the modulation of galactic cosmic rays close to Earth — Jan Gieseler, •Bernd Heber, Konstantin Herbst, and Patrick Kühl — IEAP, University of Kiel, Germany

On their way through the heliosphere, Galactic Cosmic Rays (GCRs) are modulated by various effects before they can be detected at Earth. This process can be described by the Parker equation, which calculates the phase space distribution of GCRs depending on the main modulation processes: convection, drifts, diffusion and adiabatic energy changes. A first order approximation of this equation is the force field approach, reducing it to a one-parameter dependency, the solar modulation potential ϕ. Utilizing this approach, it is possible to reconstruct ϕ from ground based and spacecraft measurements. However, it has been shown previously that ϕ depends not only on the Local Interstellar Spectrum (LIS) but also on the energy range of interest. We have investigated this energy dependence further, using published proton intensity spectra obtained by PAMELA and SOHO/EPHIN as well as heavier nuclei measurements from IMP-8 and ACE/CRIS. Our results show severe limitations at lower energies including a strong dependence on the solar magnetic epoch. Based on these findings, we will outline a new tool to describe GCR proton spectra in the energy range from a few hundred MeV to tens of GeV over the last solar cycles.