EP 3: Sun and Heliosphere I - Structure (MHD, Corona, TR, SW-acc.-Region)

Zeit: Dienstag 16:30–18:30 Raum: BSZ - Pabel HS

Hauptvortrag EP 3.1 Di 16:30 BSZ - Pabel HS

Helicity in the solar atmosphere — •Gherardo Valori[1] and Etienne Pariat[2] — [1]University College London - Mullard Space Science Laboratory - Holmbury St. Mary - Dorking - Surrey - RH5 6NT — [2]Observatoire de Paris-Meudon LESIA Batiment 14 5 Place J. Jansen 92195 Meudon France

Magnetic helicity is a geometrical measure of the entanglement of magnetic field lines that is approximately conserved by the magnetohydrodynamical equations even in the presence of reconnection. It has therefore been proposed as the conceptual tool to understand highly nonlinear dynamical processes in plasmas, like the re-arrangement of post-disruption magnetic fields in tokamaks or the occurrence of coronal mass ejections. However, given its global character and stringent mathematical formulation, magnetic helicity is of difficult application to natural systems as they occur, for instance, in the solar atmosphere. This talk will report on a series of tests on the reliability of magnetic helicity computations, and address the conservations properties of helicity and its link to the stability of coronal structures that are important in modeling coronal mass ejections.

EP 3.2 Di 17:00 BSZ - Pabel HS

Global non-potential coronal magnetic field models — Anthony Yeates[1], Tahar Amari[2], Ioannis Contopoulos[3,4], Xueshang Feng[5], Duncan Mackay[6], Zoran Mikic[7], •Thomas Wiegelmann[8], Joseph Hutton[9], Christopher Lowder[1], Huw Morgan[9], Gordon Petrie[10], Laurel Rachmeler[11], Lisa Upton[12], Aurelien Canou[2], Pierre Chopin[2], Cooper Downs[7], Miloslav Druckmueller[13], John Linker[7], Daniel Seaton[14], and Tibor Toeroek[7] — [1]Durham University — [2]CNRS, Paris — [3]Research Center for Astronomy, Athens — [4]MEPhl, Moscow — [5]National Space Science Center, Beijing — [6]University of St. Andrews — [7]Predictive Science, San Diego — [8]MPI for Solar-Sytem-Research, Goettingen — [9]Institute of Mathematics and Physics, Aberystwyth — [10]NSO, Boulder — [11]NASA Marshal Space Flight Center, Huntsville — [12]High Altitude Observatory, Boulder — [13]Brno University of Technology — [14]Royal Observatory of Belgium

Within an international collaboration we compared several static and evolutionary global corona models: non-linear force-free, magnetostatic, evolutionary magneto-frictional, full MHD and zero-beta MHD. The models agree on the amount of open flux, streamer location and broad magnetic topology. They disagree on the shape of helmet streamers and electric currents. Static models are better in active regions, evolutionary models better to model filaments. Our advise is to combine static extrapolations with energysation from evolutionary models.

EP 3.3 Di 17:15 BSZ - Pabel HS

Coronal magnetic field evolution over the cycle 24 — •Iulia Chifu[1,2], Thomas Wiegelmann[1], and Bernd Inhester[1] — [1]Max Planck Institute for Solar System Research,Goettingen,Germany — [2]Astronomical Institute of Romanian Academy, Bucharest,Romania

Many explosive phenomena, like flares and coronal mass ejections are caused by instabilities in the solar corona. Most of the time there is a strong correlation between the eruptive events and the evolution of the magnetic field. The low density and magnetic field intensity in the solar corona makes it difficult to obtain direct measurements of the magnetic field. We therefore extrapolate photospheric synoptic vector magnetograms from SDO/HMI into the corona. We use the nonlinear optimization method to reconstructed the magnetic field over the cycle 24, assuming that a force-free coronal magnetic field. We analyse this 10-year data set regarding the evolution of the free magnetic energy, correlation with the global flaring activity. We investigate also the location and structure of open field regions (coronal holes) and their separatrices to closed helmet streamer like regions.

EP 3.4 Di 17:30 BSZ - Pabel HS

An optimization principle with positive-definite pressure and density for reconstructing magnetohydrostatic equilibria in the lower solar atmosphere — •Xiaoshuai Zhu and Thomas Wiegelmann — Max Planck Institute for Solar System Research, Göttingen, Germany

We developed an optimization principle for computing magnetohydrostatic equilibria with gravity from photospheric measurements. A transformation, which ensures a positive pressure and density, is introduced to optimize the timestep of pressure, density and magnetic field. The code is tested by application to linear MHS solution. The results show our code is able to reconstruct the original solution with high accuracy. There are obstacles still to be overcome before the code can be applied to real data.

EP 3.5 Di 17:45 BSZ - Pabel HS

On the Magnetic Topology and Extreme Ultraviolet in Solar Flares with Late Phase — •Jun Chen[1,2], Rui Liu[1], Kai Liu[1], and Yuming Wang[1] — [1]University of Science and Technology of China, Hefei, China — [2]University of Potsdam, Potsdam, Germany

It was recently discovered that some solar flares exhibit a late-phase peak in EUV emission with 'warm' temperatures (e.g., Fe XVI 33.5 nm), which is referred to as EUV late phase. In this paper, we carried out a statistical study of 51 M- and X-class flares with EUV late phase (ELP) during 2010–2015. These flares are categorized as circular-ribbon, two-ribbon, and intricate-ribbon flares, based on the flare morphology observed in the chromosphere. It is found that the circular-ribbon flares with ELP often possess a coronal null and the associated fan and spine, which are typically embedded in a dome-shaped quasi-separatrix layer (DQSL) intersecting with a curved plate-shaped QSL (PQSL). The footprints of the PQSL correspond to an extended ribbon enclosed by the circular-shaped ribbon and a remote ribbon. The coronal loops responsible for ELP are found to be closely associated with not only the spine but more generally the PQSL. The majority of two-ribbon flares with ELP are confined, and the two ribbons are not associated with any preexisting QSLs. It is still an open question whether the ELP is primarily due to plasma cooling or additional heating.

EP 3.6 Di 18:00 BSZ - Pabel HS

Magnetohydrodynamic calculation of the temperature and wind velocity profile of the solar transition region — Todor Mishonov and •Albert Varonov — Department of Theoretical Physics, Faculty of Physics,
St. Clement of Ohrid University at Sofia, 5 James Bourchier Blvd., BG-1164 Sofia, Bulgaria

The mechanism of the solar corona heating still remains unexplained, almost 80 years after the discovery of the million degree hot solar corona. Observations show that the temperature increases two orders of magnitude in the transition region (TR), the boundary between the solar chromosphere and the solar corona. We are giving a detailed magnetohydrodynamic (MHD) calculation of the height dependence of the temperature and solar wind velocity. The temperature and solar wind velocity profiles are calculated for static frequency dependent spectral density of incoming MHD waves, no time dependent computer simulations have been performed. Heated by the MHD waves, the background plasma temperature increases leading to strong plasma viscosity increase, which results in more efficient MHD wave absorption. Within this calculation, the width of the TR is also evaluated by maximal value of the logarithmic derivative of the temperature. In such a way after 70 years we have returned to the original Alfvén idea [H. Alfvén, *Granulation, Magneto-hydrodynamic waves, and the heating of the solar corona*, MNRAS **107**, Issue 2, pp. 211-219, (1947)] that corona is heated by AW.

EP 3.7 Di 18:15 BSZ - Pabel HS

Doppler Spectroscopy for the Determination of Speeds and Temperatures in Solar Eruptions — •Adalbert Ding[1,2] and Shadia Rifai Habbal[3] — [1]Institut für Technische Physik, Berlin — [2]Institut für Optik und Atomare Physik, Technische Universität Berlin — [3]Institute for Astronomy, University of Hawaii, USA

Eruptions from the Solar surface (CMEs, prominences, flares) are events which provide valuable information about the dynamics of the plasma processes at the Sun's surface and in the Solar corona. Using high resolution dual and triple channel partially multiplexed imaging spectrometers (PAMIS) the composition of the particles involved, their speed and their temperature could be determined with outstanding accuracy. We present spectroscopic observations acquired during the 20. March 2015 and the 21. August 2017 total solar eclipses which captured Fe XIV emission from very hot (appr. 2 x $10^6 K$) plasmoids in some cases enshrouding a core of relatively cold (< 2 x $10^5 K$) neutral and singly ionized atoms as well as H and He emission from prominences detaching from the Solar surface. Speeds between 100 and 1500 km/s and temperatures as high as 2 x $10^6 K$ of the particles have been obtained in both instances by measuring the Doppler shift and the Doppler broadening of the relevant emission lines. The present observations explore the most critical region of the Solar corona, namely the acceleration region of the Solar wind which is currently untenable from any other platform or instruments.