EP 16: Sun II

Zeit: Freitag 8:30–10:30 Raum: AKM

Hauptvortrag EP 16.1 Fr 8:30 AKM

Solar Dynamics Observatory (SDO) — •Markus Roth — Kiepenheuer-Institut für Sonnenphysik, Schöneckstr. 6, 79140 Freiburg, Germany

The Solar Dynamics Observatory (SDO) is the first mission to be launched for NASA's Living With a Star (LWS) Program. SDO is designed to help understanding the Sun's influence on Earth and Near-Earth space by studying the solar atmosphere on small spatial and temporal scales in many wavelengths simultaneously. The mission is planned to be launched in early 2010, and carries three primary instruments on board: the Helioseismic and Magnetic Imager (HMI), the Atmospheric Imaging Assembly (AIA), and the Extreme Ultraviolet Variability Experiment (EVE). The recorded data of 1-2 TB per day will be predominantly used for studying the origins of solar activity and how Space Weather is related to that activity. Measurements of the interior of the Sun, the Sun's magnetic field, the hot plasma of the solar corona, and the irradiance that creates the ionospheres of the planets will contribute to achieve the goals of the mission. In my presentation I will describe the science objectives of SDO, the instruments on board, expected results and their potential impact on future solar research.

EP 16.2 Fr 9:00 AKM

Kinetic Simulations of Type II Radio Burst Emission Processes — •Urs Ganse[1], Rami Vainio[2], and Felix Spanier[1] — [1]Lehrstuhl für Astronomie, Universität Würzburg — [2]Department of Physics, University of Helsinki

While the phenomenology of type II radio bursts is rather well studied, the detailed mechanism of the emission is not fully understood. Rather than trying to find the correct evolution of the CME using methods of fluid dynamics or combined fluid/kinetic methods, we are using a fully kinetic approach to model the movement of particles in a shock environment, therefore neglecting the large scale evolution of the shock, while correctly modelling the kinetic microphysics. The kinetic simulation itself is based on fully-relativistic Particle-in-Cell methods. This technique allows for observation of plasma wave excitation in the shock region and gives a deep insight into the mechanisms of emission and transformation of different wave modes. We were using Fourier- and Laplace-transform based analysis to identify wave modes and electromagnetic emission, especially focused on their evolution in time. Our simulations were able to produce phenomenological features similar to type II radio bursts, with a focus on production of waves through three-wave interaction. We present results of these simulations and compare them to previous models of radio burst modeling.

EP 16.3 Fr 9:15 AKM

Semi-Kinetic model for coronal loop — •Sofiane Bourouaine[1], Eckart Marsch[1], and Christian Vocks[2] — [1]Max-Planck-Institut für Sonnensystemforschung, 37191 Katlenburg-Lindau, Germany — [2]Astrophysikalisches Institut Potsdam, 14482 Potsdam, Germany

A multi-ion kinetic model for a coronal loop is presented, whereby ion heating in the magnetically confined plasma is achieved by absorption of ion-cyclotron waves. We assume that linear Alfvén/cyclotron waves penetrate the loop from its footpoint and directly heat the ions. Then due to electron-ion collisions the electrons can also be heated. Depending on the spatial variation of the mean magnetic field, the model is able to produce warm and hot model loops having features similar to the ones observed in extreme-ultraviolet and soft X-ray emissions in real coronal loops. Furthermore, it is found that a loop with high expansion factor is far from local thermal equilibrium (LTE) and shows remarkable temperature differences between electrons and ions. Also in such a case, the heavy ions (minor ions) are via resonant wave absorption heated more than the protons and helium ions (major background ions), whereby the cyclotron-resonance effect leads to a temperature anisotropy. However, if the flux tube cross section is nearly homogeneous, temperature isotropy of the ions is maintained in most parts of the loop, and the plasma is nearly in LTE.

EP 16.4 Fr 9:30 AKM

Solar Flare Particle-in-Cell Simulation Results — •Gisela Baumann[1,2], Aake Nordlund[1], Klaus Galsgaard[1], Troels Haugboelle[1], and Jacob Trier Frederiksen[1] — [1]Niels Bohr Institute, Copenhagen — [2]Ruhr-Universität Bochum

Solar flares are highly energetic phenomena on the Sun, releasing huge amounts of energy, carried amongst others by particles which are accelerated up to a few hundred km/s. In this talk the first results from a flare particle-in-cell (PIC) simulation, conducted to study the particle acceleration mechanism in solar flares, are presented. Two cases are compared: with and without collisions (Coulomb scattering) and likewise for gravity.

EP 16.5 Fr 9:45 AKM

Heating and acceleration of fast solar wind ions - a simulation study — •Yana Maneva[1], Eckart Marsch[1], and Jaime Araneda[2] — [1]Max Planck Institute for Solar System Research, Katlenburg-Lindau, Germany — [2]Departamento de Fisica, Universidad de Concepcion, Chile

We performed a set of one-dimensional hybrid simulations to investigate the preferential heating and acceleration of ions via the parametric decay of a large-amplitude Alfven-cyclotron wave. The electrons are treated as a charge- and current-neutralizing massless fluid, whereas a particle-in-cell method is used to follow the dynamics of the ion distribution functions under low-plasma-beta solar wind conditions. In the course of its evolution, the initial pump wave gets parametrically unstable and generates a broad spectrum of longitudinal ion-acoustic (IAW) and transverse ion-cyclotron waves (ICW), which destroy the coherent fluid motion of the ions and drive non-thermal processes. Trapping in, and consequent Landau damping of, the daughter IAWs lead to ion beam formation and generate or amplify differential streaming between the different ion species, whereas diffusion of the initial coherent ion bulk motion and pitch-angle scattering by the ICWs heat the ions in the perpendicular direction. Due to their lower mass densities and higher gyration rates, alpha particles and heavy ions get preferentially heated and accelerated. Depending on their initial drifts the core of the protons and alpha particles change their anisotropies, so that at low drifts the particles have larger temperatures in perpendicular direction, whereas for higher drifts strong parallel heating is observed.

EP 16.6 Fr 10:00 AKM

Coronal convection and solar wind sources — •Eckart Marsch and Werner Curdt — Max-Planck-Institut für Sonnensystemforschung

New results are presented regarding the relationships between the coronal magnetic field and the intensities and Doppler shifts of ultraviolet emission lines. We introduce the term coronal convection to indicate the observation that the plasma in the solar atmosphere is not static but everywhere moves. The blueshifts and redshifts seen in transition-region and coronal lines are interpreted as corresponding to upflows and downflows of plasma on open (funnels) and closed (loops) magnetic field lines, which tightly confine the low-beta coronal plasma and guide its flow. Strong evidence for this notion exists in the ubiquitous redshifts seen at both legs of loops on all scales, and in the lasting blueshifts occurring in magnetic funnels. We investigate which of these magnetic structures may supply mass and energy to the corona, and what the possible sources of the solar wind are on the scale of supergranular motion, which is the ultimate driver of coronal mass convection and solar wind outflow.

EP 16.7 Fr 10:15 AKM

Generation of energetic protons during solar flares — •Gottfried Mann — Astrophysikalisches Institut Potsdam, An der Sternwarte 16, D-14462 Potsdam, Germany

Huge flares are associated with the emission of gamma-ray lines indicating the generation of energetic protons during flares. In the framework of the reconnection scenario of solar flares, jets of hot plasma shoot away from the reconnection region due to the relaxation of the new magnetic field configuration. If the jet velocity exceeds the local Alfvén speed, a standing shock wave, so-called termination shock TS), can be established in the flare region. Such TS is able to accelerate both electrons and protons via the shock-drift acceleration (SDA). A fully relativistic study of SDA at the TS confirms that this mechanism is able to accelerate protons up to few tens of GeV under flaring conditions in the solar corona. This model implies different locations for electron and proton acceleration at the TS. That can explain the separation of the hard X- and gamma-ray sources as really seen by RHESSI imaging observations.