EP 4: Sun and Heliosphere II - Dynamics (MHD, Particles)

Zeit: Mittwoch 11:00–12:15 Raum: BSZ - Pabel HS

EP 4.1 Mi 11:00 BSZ - Pabel HS

Properties of a Small-scale Short-duration Solar Eruption with a Driven Shock — •Beili Ying[1,2], Li Feng[1], and Lei Lu[1] — [1]Purple Mountain Observatory, CAS, Nanjing, China — [2]Max-Planck-Institut für Sonnensystemforschung, Göttingen

Large-scale solar eruptions have been extensively explored over many years. However, the properties of small-scale events with associated shocks have been rarely investigated. We present the analyses of a small-scale short-duration event. The impulsive phase of the M1.9-class flare lasted only for 4 minutes. The kinematic evolution of the CME hot channel reveals some exceptional characteristics including a very short duration of the main acceleration phase (<2 minutes), a rather high maximal acceleration rate ($50\,\mathrm{km\,s^{-2}}$) and peak velocity ($1800\,\mathrm{km\,s^{-1}}$). The fast and impulsive kinematics subsequently results in a shock related to a metric type II radio burst with a high starting frequency of 320 MHz of the fundamental band. Through the band split of the type II burst, the shock compression ratio decreases from 2.2 to 1.3, and the magnetic field strength of the shock upstream region decreases from 13 to 0.5 Gauss at heights of 1.1 to 2.3 $R_\odot$. We find that the CME ($4 * 10^{30}$ erg) and flare ($1.6 * 10^{30}$ erg) consume similar amount of magnetic energy. The same conclusions having been drawn for large-scale eruptions imply that small- and large-scale events possibly share the similar relationship between CMEs and flares. The kinematic particularities of this event are possibly related to the small footpoint-separation distance of the associated magnetic flux rope, as predicted by the Erupting Flux Rope model.

EP 4.2 Mi 11:15 BSZ - Pabel HS

The Ground Level Event on September 10, 2017 — •D. Galsdorf[1], S. Burmeister[1], N. Dresing[1], R. Goméz-Herrero[2], J. Guo[1], B. Heber[1], K. Herbst[1], A. Klassen[1], P. Kühl[1], R. Müller-Mellin[1], and R. Wimmer-Schweingruber[1] — [1]Christian-Albrechts-Universität zu Kiel, Germany — [2]Universidad de Alcalá, Madrid, Spain

Ground level events (GLEs) are the most energetic solar particle events (SEPs). On September 10, 2017 at 15:35˜UT a X8.2˜X-ray flare from the active region 2673 (S09, W91) was detected that peaked at 16:06 UT. The event was accompanied by a coronal and IP type II radio burst starting at 15:49 UT followed by IP type III radio bursts starting at 15:53 UT and a coronal mass ejection. The event onsets of near relativistic electrons have been detected at 16:06 UT and 21:38 UT at SOHO and STEREO A, respectively. In contrast to observations close to the Earth no strong SEP anisotropies have been observed at STEREO A. The neutron monitor network (NMN) recorded the second GLE for solar cycle 24 with an onset at 16:10 UT at Fort Smith. DOSIS 3d aboard the international space station showed an increase in the dose rate at low cutoff rigidities. The Electron Proton Helium INstrument on board SOHO measured protons with energies of more than 700 MeV. The analysis of the NMN indicates that the interplanetary field direction pointed to areas over South America. The biggest increase of 12% was measured by DOMC with an onset time of 17:03 UT. Data observed at Earth and the longitudinal structure in the inner heliosphere will be discussed.

EP 4.3 Mi 11:30 BSZ - Pabel HS

Decay Index Profile and Coronal Mass Ejection Speed — •Bernhard Kliem[1], Tibor Török[2], Georgios Chintzoglou[3], and Jie Zhang[4] — [1]Institute of Physics and Astronomy, University of Potsdam, Germany — [2]Predictive Science Inc., San Diego, CA, USA — [3]LMSAL, Palo Alto, CA, USA — [4]George Mason University, VA, USA

The velocity of coronal mass ejections (CMEs) is one of the primary parameters determining their potential geoeffectiveness. A great majority of very fast CMEs receive their main acceleration already in the corona. We study the magnetic source region structure for a complete sample of 15 very fast CMEs ($v > 1500\,\mathrm{km\,s^{-1}}$) during 2000–2006, originating within 30° from central meridian. We find a correlation between CME speed and the decay index profile of the coronal field estimated by a PFSS extrapolation. The correlation is considerably weaker for a comparison sample in which slower CMEs are included. We also study how the decay index profile is related to the structure of the photospheric field distribution. This is complemented by a parametric simulation study of flux-rope eruptions using the analytic Titov-Demoulin active-region model for simple bipolar and quadrupolar source regions. The simulations provide simple relationships between the photospheric field distribution and the coronal decay index profile. They also help identifying source regions which are likely to produce slow CMEs only, thus improving the correlation for the remaining CME sample. Very fast, moderate-velocity, and even confined eruptions are found and the conditions for their occurrence quantified.

EP 4.4 Mi 11:45 BSZ - Pabel HS

Classification of singular points of flow and field in ideal or slightly non-ideal MHD flows — •Dieter Nickeler[1], Marian Karlicky[1], Thomas Wiegelmann[2], and Michaela Kraus[1] — [1]Astronomical Institute AV CR, Fričova 298, 251 65 Ondrejov, Czech Republic — [2]Max Planck Institute for Solar System Research, Justus-von-Liebig-Weg 3, 37077 Göttingen, Germany

Magnetic reconnection scenarios are often connected with the existence of singular points of plasma flows and magnetic fields. In this talk we want to elucidate the relationship between different classes of magnetic null points and stagnation points and corresponding non-ideal terms. This can enlighten the nature of the "Anti-Reconnection" problem, as not every null point or stagnation point guarantees the existence of a reconnection process. We analyse possible configurations in the vicinity of these singular points, as they may occur, e.g., in solar magnetic cusp and arcade structures, concerning their geometrical and topological structure and that of the non-ideal terms in almost ideal Ohm's law.

EP 4.5 Mi 12:00 BSZ - Pabel HS

Regularized κ-distributions with non-diverging moments — •Klaus Scherer, Horst Fichtner, and Marian Lazar — Institut für Theoretische Physik, Lehrstuhl IV: Weltraum- und Astrophysik, Ruhr-Universität Bochum, D-44780 Bochum, Germany

For various plasma systems the so-called κ-distribution is widely used to describe suprathermal (non-relativistic) particle components exhibiting a power-law behaviour in velocity or energy. Despite its success the concept of the standard κ-distribution remains disputable because the latter is defined only for $\kappa > 3/2$ and possesses only a finite number of velocity moments v^l (with the integer l defining the l-th moment), some of which, i.e., $l \geqslant 2\kappa - 1$, are diverging. In order to resolve these limitations we introduce the regularized κ-distribution. After a discussion of its properties and its relation to the standard κ- as well as to the Maxwellian distribution, we provide a general analytical expression that enables to calculate all of its moments, and illustrate that only fluid results, that critically depend on these moments will change, but not those obtained within the framework of kinetic theory.