# EP 1: Sun and Heliosphere I

Zeit: Montag 16:30–18:45 Raum: HS 19

**Hauptvortrag** EP 1.1 Mo 16:30 HS 19

**The Sun in high resolution** — •Lucia Kleint — Leibniz-Institut für Sonnenphysik (KIS), Freiburg, Germany

GREGOR is Europe's largest solar telescope and allows us to study the solar atmosphere at scales as small as 50 km. Some of the important open questions in solar physics only become accessible by studying the Sun at such scales: What is the fine structure of sunspots? How does the quiet Sun magnetic field evolve? How is energy dissipated during solar flares? Because dynamic events on the Sun can take place within seconds and because polarimetric observations are essential to derive the magnetic field, even solar observations often reach a photon-starved regime, which can only be tackled with larger and larger telescopes. I will review recent advances in high-resolution observations and take flare physics as an example to address open questions in solar physics.

EP 1.2 Mo 17:00 HS 19

**Nonlinear magnetohydrostatic modeling of an active region based on SUNRISE/IMaX vector magnetogram** — •Xiaoshuai Zhu and Thomas Wiegelmann — Max Planck Institute for Solar System Research, Goettingen, Germany

Nonlinear magnetohydrostatic (NLMHS) model is the better approximation of the physical state in the lower solar atmosphere than nonlinear force-free (NLFF) model. It is not just in magnetic field, it is also in terms of plasma distribution. In the test case, the NLMHS model has been able to meaningfully recover the plasma density and pressure. Here we present a first application of our new code to an active region (AR 11768) that was observed by IMaX polarimeter during the second flight of the balloon-borne SUNRISE solar observatory in 2013. Using the high spatial resolution IMaX vector magnetogram which is embedded in the HMI data to cover the total active region, we are able to model the non-force-free layer in the lower atmosphere. The strongly localized plasma distribution, electric current and Lorentz force in the result show that the NLMHS model has the important advantage of extrapolating the solar lower atmosphere than linear MHS and NLFF models.

EP 1.3 Mo 17:15 HS 19

**Constraining energy release and transport processes in solar flares with X-ray and bolometric observations** — •Alexander Warmuth and Gottfried Mann — Leibniz-Institut für Astrophysik Potsdam (AIP), An der Sternwarte 16, 14482 Potsdam

Energy release and transport processes in solar flares are constrained by means of a comprehensive characterization of the physical parameters of both the thermal plasma and the accelerated nonthermal electrons, using X-ray observations from RHESSI and GOES. This is complemented by bolometric radiated energies as measured by SORCE and SOHO/VIRGO. We find evidence for two plasma components: a cooler component (10-20 MK) evaporated from the chromosphere, and an additional hotter component (>20 MK) which is more consistent with direct in-situ heating of coronal plasma. The potentially very significant role of conductive energy losses is investigated. Finally, the relative contribution of electron acceleration versus direct heating (i.e., the acceleration efficiency) is studied as a function of flare importance.

EP 1.4 Mo 17:30 HS 19

**Kelvin–Helmholtz instability in rotating solar jets observed by *Hinode* and AIA/*SDO*** — •Ivan Zhelyazkov — Faculty of Physics, Sofia University, 1164 Sofia, Bulgaria

Over the past two decades, several space missions have enabled our understanding of Kelvin–Helmholtz instability in the Sun's atmosphere. Key results obtained by *Hinode* and Atmospheric Imaging Assembly on board the *Solar Dynamics Observatory* allowed us to get useful data concerning the physical parameters of various solar jets. The rotating solar jets are among the most spectacular events in our Sun. They support the propagation of a number of magnetohydrodynamic (MHD) modes which, under some conditions, can become unstable and the developing instability is of the KH kind. The modeling of tornado-like phenomena in solar chromosphere and corona as moving weakly twisted and spinning cylindrical flux tubes shows that the KHI rises at the excitation of high-mode MHD waves within a wavenumber range/window whose width depends on the MHD mode number $m$, the plasma density contrast between the rotating jet and its environment, as well as on the twists of the internal magnetic field and jet's velocity. We have studied KHI instability in a twisted solar polar coronal hole jet, in a twisted rotating jet from a filament eruption, and in a rotating macrospicule. It has been established that good agreement between the theoretically calculated KHI developing times of a few minutes at wavelengths comparable to the half-widths of the jets, and those growth times detected from observations can be achieved at the excitation of high ($9 < m < 52$) MHD modes only.

EP 1.5 Mo 17:45 HS 19

**Multi-Spacecraft Analyse von Forbush-Decreases** — •Jan Ole Fehrs, Patrick Kühl und Bernd Heber — Christian-Albrechts-Universität zu Kiel

Die galaktische kosmische Strahlung, die ihren Ursprung außerhalb des Sonnensystems hat, wird durch die solare Aktivität auf verschiedenen Zeitskalen moduliert. Die Variation mit dem Sonnenzyklus nennt man die solare Modulation. Auf kürzeren Zeitskalen von Stunden bis zu mehreren Tagen nimmt der Teilchenfluss aufgrund interplanetarer Störungen ab. Sogenannte transiente und wiederholende Forbush-Decreases treten im Zusammenhang mit Koronalen Massenauswürfen und korotierenden Wechselwirkungsregionen auf. Durch die Messungen an mehreren Punkten in der Heliosphäre ist es möglich, die räumliche Entwicklung von Massenauswürfen zu studieren. In dieser Arbeit werden dafür Messungen des Elektron Proton Helium Instrument (EPHIN) an Bord der Raumsonden Chandra und SOHO genutzt.

EP 1.6 Mo 18:00 HS 19

**Shock accelerated electron beams in the solar corona** — •Gottfried Mann — Leibniz-Institut fuer Astrophysik Potsdam, Potsdam, Deutschland

In the solar corona shock waves can be generated either by the blast wave due to a flare or driven ahead of a coronal mass ejection (CME). Such shocks are observed as solar type II bursts in the solar radio radiation indicating the generation of energetic electrons at these shock. The radio emission at shocks are regarded to be plasma emission, i.e. the energetic electrons excite Langmuir waves due to beam-plasma interaction. These Langmuir waves convert into escaping radio waves as a result of nonlinear plasma processes This mechanism requires that the velocity of energetic electrons must necessarily exceed 4 times the thermal electron speed. Assuming shock drift acceleration as the mechanism for producing energetic electrons at shocks a beam-like electron velocity distribution function is established in the upstream region of the shock. Such electron beams are really observed in the solar radio radiation in terms of herringbones as fine structures in type II radio bursts. The observational data can be explained in the best way, if the shock propagates nearly perpendicular to the ambient magnetic field. That is the case at the flanks of shocks driven by a CME.

EP 1.7 Mo 18:15 HS 19

**Velocity Dispersion Analysis of Corrected SEPT Electron Measurements** — •Alexander Kollhoff[1], Nina Dresing[1], Andreas Klassen[1], Raúl Gómez-Herrero[2], and Bernd Heber[1] — [1]Institut für Experimentelle und Angewandte Physik, University of Kiel — [2]Dpto. de Física y Matemáticas, Universidad de Alcalá

Solar energetic particle events with an impulsive intensity time profile are dominated by electrons with energies up to a few hundred keV. The velocity dispersion of these electrons, observed at 1 AU, can provide information about how they are injected and transported through the inner heliosphere. Measurements of the Solar Electron and Proton Telescope (SEPT) aboard the Solar TErrestrial RElations Observatory (STEREO) are utilised in the solar heliospheric community to investigate electron events. Due to the instrumental setup, energetic electrons can scatter out of the solid state detector, depositing less than their total energy. Therefore, each SEPT electron channel has a response to electrons with energies above its nominal energy range. This effect of contamination becomes especially significant during the rise time of SEP events, when the energy spectrum is flattened as a result of the velocity dispersion. Computation using a GEANT4 simulation of the SEPT instrument resulted in new response functions for electrons. These response functions are used to correct the contamination of highly energetic electrons to lower electron channels. The corrected intensities are used to analyse the velocity dispersion of several SEP events. These analyses suggest a longer particle path and an earlier injection time compared to uncorrected measurements.

EP 1.8 Mo 18:30 HS 19

**Elektronenbeschleunigung an CIRs. Eine statistische Analyse der Elektronenkanäle des SEPT an Bord von STEREO** — •Henrik Dröge, Alexander Kollhoff, Bernd Heber, Patrick Kühl und Nina Dresing — Institut für Experimentelle und Angewandte Physik, Christian-Albrechts-Universität zu Kiel, Leibnizstraße 11, 24118 Kiel, Germany

Interplanetare Schocks sind bekannt dafür, energiereiche Ionen zu beschleunigen. Inwiefern Elektronen und bis zu welchen Energien sie beschleunigt werden ist Gegenstand der Forschung. Schocks können zum Beispiel im Rahmen von Coratating Interaction Regions (CIRs) entstehen. Die dabei beschleunigten Teilchen können mit Hilfe des Solar Electron and Proton Telescope (SEPT) an Bord der Raumsonden STEREO-A bzw. STEREO-B gemessen werden. Die Messmethode von SEPT beruht auf dem Prinzip der Magnet/Folien Technik, die zur Trennung von Elektronen und Ionen benutzt wird. In den Arbeiten von Wraase et al. (2018) wird anhand eines Einzelereignis gezeigt, dass Ionen in den Elektronenkanälen detektiert werden. In dieser Arbeit wird diese Methode auf eine große Anzahl von CIRs angewandt und statistisch ausgewertet. In ungefähr 76% konnte gezeigt werde, dass die gemessenen Elektronenzählraten durch eine Ionenkontamination der Elektronenkanäle erklärt werden kann.