EP 6: Sonne und Heliosphäre I

Time: Wednesday 14:00–16:00 Location: V55.21

EP 6.1 Wed 14:00 V55.21

Spectral properties of ENA fluxes from the inner heliospheric source — •Mark Siewert and Hans Fahr — Argelander-Institut f. Astronomie, Universität Bonn

Fluxes of energetic neutral atoms (ENAs) that have been recently observed by the IBEX mission exhibit several unexpected properties, including a previously unmodeled region of increased intensities in the approximate shape of a ribbon, dominating energy regions above 1 keV. We present latest results from a model that produces a very similar feature, based on shock-processed ions in the PUI energy range. We also discuss spectral properties of the ENA fluxes derived from this model and compare them with IBEX observations.

EP 6.2 Wed 14:15 V55.21

Ion velocity-space diffusion triggered by bulk velocity fluctuations in supersonic winds — •Hans Jörg Fahr and Mark Siewert — Argelander Institut für Astronomie, Universität Bonn, Auf dem Huegel 71, 53121 Bonn

We first study the kinetic reaction of ions when getting shuffled from one to the other side of consecutive bulk velocity jumps in a supersonic wind. The jumps are described by Rankine-Hugoniot MHD jump conditions. Using two kinetic invariants at the ion passage over such jumps gives us the ion velocity transformations from one to the other side of the jump structure. It is shown that each single jump passage can be described by a specific ion velocity space diffusion coefficient. As we can show this type of velocity space diffusion at larger solar distances is the dominant process energizing ions and will lead to observed ion energy spectra.

EP 6.3 Wed 14:30 V55.21

Damping of Alfvén waves in solar partially ionized plasmas: effect of neutral helium in multi-fluid approach — •Teimuraz Zaqarashvili, Maxim Khodachenko, and Helmut Rucker — Space Research Institute, Austria

Chromospheric and prominence plasmas contain neutral atoms, which may change the plasma dynamics through collision with ions. Most of the atoms are neutral hydrogen, but a significant amount of neutral helium may also be present in the plasma with a particular temperature. We aim to study the effect of neutral helium in the damping of Alfven waves in solar partially ionized plasmas. We consider three-fluid magnetohydrodynamic approximation, where one component is electron-proton-singly ionized helium and other two components are the neutral hydrogen and neutral helium atoms. We derive the dispersion relation of linear Alfven waves in isothermal and homogeneous plasma. Then we solve the dispersion relation and derive the damping rates of Alfven waves for different plasma parameters. The presence of neutral helium significantly enhances the damping of Alfven waves compared to the damping due to neutral hydrogen at certain values of plasma temperature (10000-40000 K) and ionization. Damping rates have a peak near the ion-neutral collision frequency, but decrease for the higher part of wave spectrum. Collision of ions with neutral helium atoms can be of importance for the damping of Alfven waves in chromospheric spicules and in prominence-corona transition regions.

EP 6.4 Wed 14:45 V55.21

Spatial Gradients of Galactic Cosmic Ray Protons in the Inner Heliosphere - PAMELA and Ulysses Observations — •Jan Gieseler[1], Mirko Boezio[2], Marco Casolino[3], Nicola De Simone[3], Valeria Di Felice[3], Bernd Heber[2], and Matteo Martucci[3] — [1]IEAP, CAU Kiel, Kiel, Germany — [2]INFN, University of Trieste, Italy — [3]INFN, University of Rome "Tor Vergata", Italy

The PAMELA (Payload for Antimatter Matter Exploration and Light-nuclei Astrophysics) space borne experiment was launched on the 15th of June 2006 and is continuously collecting data since then. The apparatus measures electrons, positrons, protons, antiprotons and heavier nuclei from about 100 MeV to several hundreds of GeV. Ulysses, launched on the 6th of October 1990, was placed in an elliptical, high inclined (80.2 degrees) orbit around the Sun, and was switched off in June 2009. It has been the only spacecraft exploring high-latitude regions of the inner heliosphere. The Kiel Electron Telescope (KET) aboard Ulysses measures electrons from 3 MeV to a few GeV and protons and helium in the energy range from 6 MeV/nucleon to above 2 GeV/nucleon. Due to the spacecraft's trajectory, the measurements reflect not only the temporal variations but also the spatial distribution. In this contribution we combine Ulysses/KET and PAMELA measurements to determine the spatial gradients of galactic cosmic ray protons in the very low GeV-range in the inner heliosphere during the extended minimum of solar cycle 23.

EP 6.5 Wed 15:00 V55.21

27-Tage-Modulation der galaktischen kosmischen Strahlung — •Patrick Kühl, Nina Dresing, Phillip Dunzlaff, Raul Gomez-Herrero, Bernd Heber, Andreas Klassen und Birthe Thiel — Institut für Experimentelle und Angewandte Physik, Christian-Albrechts-Universität zu Kiel, 24118 Kiel, Germany

In diesem Beitrag wird mittels der COSTEP und CELIAS Instrumente der Raumsonde SOHO der Einfluss korotierender Wechselwirkungsregionen auf die galaktische kosmsiche Strahlung im Zeitraum von 2007 bis 2011 untersucht. Mittels Spektralanalyse wird eine 27 Tage Modulation vom Oktober 2007 bis Mai 2008 beobachtet, welche im Sommer 2009 in eine 13 Tage Modulation, also eine vier Sektor Struktur, übergeht. Zusätzlich finden wir eine Korrelation zwischen Sonnenwindgeschwindigkeit und der Amplitude der Modulation einzelner Ereignisse. Diese Korrelation hängt jedoch stark von den individuellen Ereignissen ab.

EP 6.6 Wed 15:15 V55.21

Teilchenstreuung in turbulenten MHD-Plasmen mit modifizierten Wellenmoden — •Sebastian Lange[1], Felix Spanier[1] und Rami Vainio[2] — [1]Lehrstuhl für Astronomie, Universität Würzburg, Emil-Fischer-Straße 31, D-97074 Würzburg — [2]Department of Physics, University of Helsinki, Finland

Teilchen werden im Sonnenwindplasma durch Wechselwirkung mit magnetischen Irregularitäten abgelenkt. Dadurch wird wiederum die mittlere freie Weglänge der Teilchen bestimmt. Solar Flares und coronal mass ejections (CMEs) emittieren Teilchenströme, die das Spektrum der Plasma-Feldfluktuationen verändern und einzelne Wellenmoden verstärken. Speziell Messungen von Energien bis zu 100 MeV während sogenannter "Solar Energetic Particle" events (SEP) können durch Streuung an eben solchen modifizierten Spektren erklärt werden. Im Rahmen dieses Vortrags werden Ergebnisse aus Simulationen zur Pitch-Winkel Streuung innerhalb getriebener, inkompressibler magnetohydrodynamischer (MHD) Turbulenz vorgestellt. Des Weiteren sollen Prozesse des Energietransports in solchen Plasmen, speziell im Zusammenhang diskret verstärkter Wellenmoden, präsentiert werden.

EP 6.7 Wed 15:30 V55.21

Modelling superdiffusion of energetic particles using a fractional Fokker-Planck equation — •Robin Stern, Horst Fichtner, and Frederic Effenberger — Ruhr-Universität, Bochum, Germany

In recent years in-situ measurement with various spacecraft like ACE or Ulysses have revealed that the heliospheric transport of energetic electrons and protons cannot always be characterised as normal diffusion. The observations – particularly analyses of time profiles – rather suggest a superdiffusive behaviour of these particles. After a brief presentation of anomalous transport and its theoretical treatment, first numerical solutions of a correspondingly modified transport equation and their comparison to data will be discussed.

EP 6.8 Wed 15:45 V55.21

Modeling of one-directional spike events — •Yulia Kartavykh[1], Andreas Klassen[2], Wolfgang Dröge[1], Raul Gómez-Herrero[2], Bernd Heber[2], and Karl-Ludwig Klein[3] — [1]Institut für Theoretische Physik und Astrophysik, Universität Würzburg, D-97074 Würzburg, Germany — [2]Institut für Experimentelle und Angewandte Physik, Universität Kiel, D-24118 Kiel, Germany — [3]LESIA-CNRS UMR 8109, Observatoire de Paris, F-92195 Meudon, France

Since the 1970s there were observations of solar electron events having some unusual temporal and directional characteristics. These so-called spike events exhibit very short and almost symmetric time profiles, no longer than 10-20 minutes, and one-directional pitch-angle distribu-

tions. In this work we present a model that takes into account the effects of focusing, streaming along the magnetic field lines and scattering off magnetic irregularities on the transport of solar electrons and apply it to the spike event observed on 26 February 2011. We find that our model can reproduce the observed characteristics of spike events well if the assumption is made that, compared to usual solar electron events, the scattering at pitch angles around 90 degrees is strongly suppressed.