EP 17 Sonne: Atmosphäre

Zeit: Donnerstag 09:00–10:45 Raum: B

Hauptvortrag EP 17.1 Do 09:00 B

Special Results from the RHESSI-Mission — •Gottfried Mann — Astrophysikalisches Institut Potsdam, An der Sternwarte 16, D-14482 Potsdam

RHESSI (Ramaty High Energy Solar Spectroscopic Imager) was launched in the framework of the Small Explorer program by NASA on February 5, 2002. The spectrometer covering the range 3 keV - 17 MeV consists of 9 cooled Germanium crystals. Thus, RHESSI is providing hard X-ray images of the Sun with an unprecedented spectral and spatial resolution for three years.

The main aim of this mission is to get more information on electron acceleration during solar flares. Since energetic electrons are responsible for both the nonthermal radio and X-ray radiation, the Astrophysical Institute Potsdam participates in the RHESSI mission by a common radio and RHESSI data analysis using its own radio data, which are provided by the radiospectralpolarimeter (40-800 MHz).

A special mechanism for generation of highly energetic electrons will be presented. Magnetic reconnection is thought to be the basic process during flares. According to this scenario high speed jets are pushed away from the reconnection site. If the velocity of such jets is super-Alfvenic, then a shock wave can be established in the outflow region of reconnection. This shock is able to generate highly energetic electrons, which can be the source of hard X-ray radiation. This mechanism will be discussed in a quantitative manner and compared with radio and RHESSI data.

Fachvortrag EP 17.2 Do 09:30 B

Generation of electrostatic instability due to propagation of plasma jets in the solar corona — •Rossitsa Miteva and Gottfried Mann — Astrophysikalisches Institut Potsdam, An der Sternwarte 16, D-14482 Potsdam

When a jet of hot and dense plasma shooting out from a reconnection site propagates further on through the solar corona, different disturbances in the background medium are naturally expected to occur. We perform a multifluid analysis on a moving flaring plasma stream (solar jet) through some background plasma (solar corona). We look for a set of favourable conditions under which the generated disturbances may grow in time indicating the presence of instability. All theoretical inputs lay in the typically observed range of values for the characteristic coronal parameters. The goal of this study is to show whether such configuration could account also for the observed heating and acceleration of electrons in the solar corona. Beams of mildly relativistic electrons propagating through the corona give rise to the so-called type III and U bursts in the metric radio data. Generally a good spatial and temporal correspondence between the type III/U bursts and the solar (soft X-ray) jets has been already reported. A complete theoretical approach on this issue however is not known. We propose a model for jet associated electrostatic instability and a possible subsequent acceleration of electrons in the solar corona. The numerical results from this study are compared with the outcomes from a data analysis on solar jets and metric radio bursts.

Fachvortrag EP 17.3 Do 09:45 B

Investigating stellar coronae using models of solar structures — •Pia Zacharias and Hardi Peter — Kiepenheuer-Institut für Sonnenphysik, 79104 Freiburg

In order to investigate the density and temperature structure of stellar coronae we describe them as being composed of a large number of coronal loops, i.e. as multi-loop coronae. Each of these loops is modeled by an analytical approximation to a static loop model or, even more simple, by well known scaling laws relating loop length, heating rate, temperature and pressure. We construct the stellar corona by assuming a distribution of loop lengths and heating rates, for which the loop densities and temperatures are calculated. From these the emission in various EUV and X-ray spectral lines is derived using the atomic data package CHIANTI. We now treat the spectrum integrated from all these loops as the spectrum from a hypothetic star, i.e. we analyze this spectrum with standard techniques used in stellar EUV and X-ray spectroscopy.

We find that the classical inversions of stellar spectra can give results for the average temperature or density of a star which are up to an order of magnitude off the peak of the respective distribution used as input for the multi-loop model. Nevertheless, the typical scale height of the corona derived from the synthesized spectrum matches the loop length quite well. This study shows the limitations of classical EUV and X-ray diagnostics to infer temperatures and densities from stellar spectra, but it also shows new ways how to derive such quantities in a more reliable way.

Fachvortrag EP 17.4 Do 10:00 B

3D MHD coronal models of active regions and quiet Sun — •Sven Bingert und Hardi Peter — Kiepenheuer-Institut fuer Sonnenphysik, 79104 Freiburg

The lower corona and transition region of the Sun are highly structured through the magnetic field, and are very dynamic. To account for both the structure and the dynamics, a 3D MHD model of the corona is employed, with the heating due to braiding of magnetic field lines. Based hereupon EUV emission line profiles formed in the transition region and corona are derived. This forward model approach allows us to directly compare our model results to observations.

We will present results from the 3D MHD model for a small active region and the quiet Sun. In a previous analysis we showed that the emission measure and the Doppler shifts as well as temporal fluctuations, as derived from the 3D coronal active region model, match the observations strikingly well. The next step is to concentrate on the quiet Sun, and investigate the role of the magnetic field concentrations along the boundaries of the super-granular cells outlining the chromospheric network.

Fachvortrag EP 17.5 Do 10:15 B

Current concentrations in the solar corona — •Jörg Büchner — Max-Planck-Institut für Sonnensystemforschung

The heating of the solar corona and solar eruptions are due to energy flows from the photosphere. here magnetic coupling plays a crucial role. One of the possible mediators of this energy are currents. Since coronal currents are invisible one has to derive their location, structure and strength from the most reliable information available - the photospheric magnetic fields and plasma flows. We demonstrate the results of such approach and compare them with observation of the consequences of current concentrations like localized heating events and eruptions in the solar atmosphere.

Fachvortrag EP 17.6 Do 10:30 B

First VUV Sun-as-a-star spectrum compared to other cool stars — •Hardi Peter — Kiepenheuer-Institut für Sonnenphysik. 79104 Freiburg

This paper reports the first full-Sun vacuum ultraviolet (VUV) emission line profile originating from the transition region from the chromosphere to the corona. It is based on a raster scan of the whole solar disk using SUMER/SOHO. The full-Sun spectrum has a spectral resolution which allows an investigation of details in the line profile as well as a thorough comparison to stellar spectra as obtained, e.g. with FUSE or STIS/HST.

The full-Sun spectrum shows enhanced emission in the wings, and is well described by a double Gaussian fit with a narrow and a broad component. It is shown that the broad component is due to structures on the solar surface. Thus it is proposed that the broad components of other solar-like stars are also a consequence of the mixture of surface structures, and not necessarily a signature of small-scale heating processes like explosive events, as it is commonly argued.

A comparison to spectra of luminous cool stars shows that the line asymmetries of these stars might also be a surface structure effect and not or only partly due to opacity effects in their cool dense winds.

These comparisons show the potential of high quality full-Sun VUV spectra and their value for the study of solar-stellar connections. As an example, this study proposes that α Cen A has a considerably higher amount of magnetic flux concentrated in the chromospheric magnetic network than the Sun.