EP 7: The Sun and Heliosphere I

Zeit: Dienstag 14:00–16:15 Raum: KGI-Aula

Hauptvortrag EP 7.1 Di 14:00 KGI-Aula

Das neue 1.5m Sonnenteleskop GREGOR — •Reiner Volkmer — Kiepenheuer-Institut für Sonnenphysik, Schöneckst. 6, 79104 Freiburg

Das neue 1.5 m Sonnenteleskop GREGOR wird gegenwärtig am Teide Observatorium auf Teneriffa, Spanien durch ein deutsches Konsortium aus Kiepenheuer-Institut für Sonnenphysik, dem Astrophysikalischen Institut Potsdam, dem Institut für Astrophysik Göttingen und anderen nationalen und internationalen Partnern errichtet.

Es ist für hoch genaue Messungen des magnetischen Feldes und von Gasströmungen in der solaren Photosphäre und Chromosphäre mit einer räumlichen Auflösung von besser als 70 km auf der Sonne und für hoch aufgelöste stellare Spektroskopie konstruiert.

Das neue Teleskop mit offener Struktur, komplett herunter fahrbarer Kuppel, alt-azimutaler Montierung, adaptiver Optik und einer Auswahl von neu entwickelten wie auch bewährten wissenschaftlichen Postfokusinstrumenten ersetzt das 45 cm Gregory Coudé Teleskop, welches nach insgesamt 40 Jahren außer Betrieb gegangen ist.

Nach seiner Inbetriebnahme wird es eines der leistungsfähigsten Sonnenteleskope der Welt sein und mit dem Start der Beobachtungen werden viele neue wissenschaftliche Erkenntnisse erwartet.

Hauptvortrag EP 7.2 Di 14:30 KGI-Aula

The magnetic field of the quiet Sun — •Oskar Steiner — Kiepenheuer-Institut für Sonnenphysik, Freiburg

In the past year the Sun's surface appeared often featureless and smooth since we are now in a minimum phase of the solar cycle. Over periods of months, no sign of magnetic activity was visible. And yet, even the most quiescent surface area harbors ample amounts of magnetic field as is now clearly revealed by long exposure magnetograms with the new Japanese space observatory Hinode. What is the physical nature of this magnetic field and where does it stem from? This presentation highlights some aspects of the quiet Sun magnetic field. It is shown how three-dimensional magnetohydrodynamic simulations can help us in answering these questions, but not without validation by close comparison with observations. In order not to go astray with too abstract model concepts, we must take care keeping the simulations realistic enough for enabling the computation of synthetic spectro-polarimetric quantities that can be directly compared with true observations. It is demonstrated how this interaction between simulation, the production of synthetic observation, and subsequent comparison with true observations works, and how it can help us in understanding the Sun's magnetic character.

EP 7.3 Di 15:00 KGI-Aula

Single-lobe Stokes-V profiles in the solar atmosphere — •Reza Rezaei, Wolfgang Schmidt, and Rolf Schlichenmaier — Kiepenheuer-Institut für Sonnenphysik, Freiburg, Germany

Stokes polarimetry provides information about the magnetic field and its interaction with the plasma in the solar photosphere and chromosphere. While most of the observed Stokes-V profiles in active regions and the network are nearly antisymmetric, strongly asymmetric and *abnormal* V profiles are common in the inter-network. We observed a small quiet Sun region close the center of the solar disk with the German Vacuum Tower Telescope in Tenerife on July 07, 2006. Stokes profiles of the neutral iron lines at 630.15 and 630.25 nm and the intensity profile of the Ca II H line at 396.8 nm were recorded strictly simultaneously with the two channels of POlarimetric Littrow Spectrograph. We find that half of all profiles with an amplitude above the 3σ noise level are one-lobe profiles. Among them, about 78 % have a blue lobe only and 22 % have only a red lobe. There are several examples, where the amplitude of the blue-lobe-only profile exceeds 1 % of the continuum while there is no such case for the red-lobe-only profiles. The mean amplitude of the blue-lobe-only profiles ($0.30\,\%I_\mathrm{c}$) is also larger than the mean amplitude of the red-lobe-only profiles ($0.26\,\%I_c$). In addition to the above mentioned case, we find new categories of *abnormal* Stokes-V profiles in which there are significant differences between the Fe I 630.15 and 630.25 nm lines. There are indications that the degree of asymmetry and the fraction of abnormal V profiles increase with decreasing magnetic flux and increasing spatial resolution.

EP 7.4 Di 15:15 KGI-Aula

Doppler shifts on the full solar disk in the chromosphere: The chromospheric network and coronal holes — •Christian Bethge[1], Hardi Peter[1], and Christian Beck[2] — [1]Kiepenheuer-Institut für Sonnenphysik, Schöneckstr. 6, D-79104 Freiburg, Germany — [2]Instituto de Astrofisica de Canarias (CSIC), Via Lactea, E-38320 La Laguna, Tenerife, Spain

The Chromospheric Telescope (ChroTel) on Tenerife observes the full solar disk on a 2048 x 2048 detector in the three most prominent chromospheric lines, Ca II K (393 nm), H alpha (656 nm) and He I (1083 nm). Due to a tunable Lyot filter in the Helium channel it is possible create full-disk Doppler maps. As those spotlight chromospheric dynamics within a velocity range of 2-80 km/s and down to a length scale of about 3", they will serve as a useful tool not only to understand the onset and dissolution of eruptive events, but also the influence of the chromosphere on contiguous solar layers and phenomenons therein, e.g. the origin of the fast solar wind in coronal holes.

Since ChroTel is a filtergraph instrument and not a spectrograph, one has to think of rather unconventional methods to obtain reliable Doppler maps with an accuracy in velocity of some 2 km/s. For this purpose, we use a genetic algorithm to solve an optimization problem employing high-resolution solar spectra obtained with a spectrograph at the 70 cm VTT at the same site.

The method itself and first results will be presented. The emphasis here is on the relation of the Doppler shifts with the chromospheric cell-network structure and with the outflow in (polar) coronal holes.

EP 7.5 Di 15:30 KGI-Aula

On the nature of coronal loops — •Sven Bingert, Pia Zacharias, and Hardi Peter — Kiepenheuer-Institut für Sonnenphysik, Freiburg

The structure and dynamics of a box in a stellar corona can be modeled employing a 3D MHD model for different levels of magnetic activity. Depending on the magnetic flux through the surface the nature of the resulting coronal structures can be quite different. We will compare two different models of an active region, one for two basically isolated sunspots, and another one for two sunspots surrounded by magnetic field patches comparable in magnetic flux to the sunspots.

Both models result in emission from the model corona being concentrated in loop structures. In the first case the loops seen in EUV and X-ray emission are following the magnetic field, following the general paradigm. However, in the second case, where the magnetic field is far from a force-free state, the loops seen in X-ray emission do not follow the magnetic field, but are more related to the current sheets formed in response to the footpoint motions of the magnetic field.

This result has serious implications for the interpretation of more complex magnetic structures, e.g. in the corona of active stars, where the majority of the emission might not come from loops following the magnetic field, indicating that loop-models might not be appropriate for more active coronae.

EP 7.6 Di 15:45 KGI-Aula

Solar wind outflow from the base of the corona: Comparison of modeled EUV spectra and observations — •Pia Zacharias[1], Hardi Peter[1], and Jörg Büchner[2] — [1]Kiepenheuer-Institut für Sonnenphysik, Freiburg, Germany — [2]Max-Planck-Institut für Sonnensystemforschung, Katlenburg-Lindau, Germany

It is generally agreed upon that the fast solar wind originates from (polar) coronal holes. It is still under discussion, however, from which structures within the hole the wind is coming and how the mass is supplied to the wind. In the past, it was mostly assumed that there is a continuous outflow from the chromosphere through the transition region and corona into the wind. In contrast to this, observations of Tu et al (2005; Sci 308, 519) showed first indications that the mass to the wind is supplied into coronal funnels at a height in the corona corresponding to the transition region at a couple of 100.000 K. In this presentation we will examine 3D MHD models of a part of a coronal hole in terms of the EUV emission line spectra. We compare these results to actual observations in order to test the new suggestion of mass supply to the wind above the transition region.

EP 7.7 Di 16:00 KGI-Aula

Radiosondierung der Sonnenkorona mit Rosetta, Mars Express und Venus Express in 2004 und 2006 — •Matthias

Hahn[1], Martin Pätzold[1], Silvia Tellmann[1], Bernd Häusler[2] und Mike Bird[3] — [1]Rheinisches Institut für Umweltforschung (RIU), Abteilung Planetenforschung; Köln — [2]Institut für Raumfahrttechnik, Universität der Bundeswehr München; München — [3]Argelander Institut für Aeronomie, Universität Bonn; Bonn

Während der oberen Sonnenkonjunktion von Mars Express im Jahr 2004 und 2006, sowie von Rosetta und Venus Express im Jahr 2006, konnten mit den Radioscience-Experimenten auf diesen Sonden Beobachtungen der Sonnenkorona durchgeführt werden. Dabei durchlaufen die gesendeten Radiosignale (8,4 GHz X-Band und 2,3 GHz S-Band) das dichte Plasma der Sonnenkorona. Aus Frequenzverschiebungen und Laufzeitverzögerungen des Signals lassen sich Rückschlüsse auf großskalige koronale Strukturen, den Elektroneninhalt sowie die Dichte und Turbulenz im Plasma ziehen. Das Radioscience-Experiment MaRS auf Mars Express konnte beide Konjunktionen in 2004 und 2006 abdecken. 2004 konnte hierbei ein CME beobachtet werden. Hier soll ein Vergleich mit SOHO/LASCO Bildern gezeigt werden. Im Jahre 2006 gingen Venus und Mars zur gleichen Zeit in Konjunktion. So konnten simultan an zwei verschiedenen Orten in der Korona Sondierungen durchgeführt werden. Das Radioscience-Experiment RSI auf Rosetta konnte während der oberen Sonnenkonjunktion 2006 Sondierungen innerhalb von 40 Sonnenradien zur Sonnenscheibe durchführen.