

THE OBSERVING PROGRAMS AT KANZELHÖHE SOLAR OBSERVATORY

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Abstract. Kanzelhöhe Solar Observatory is the experimental executive of the Institute of Geophysics, Astrophysics and Meteorology University of Graz, Austria. The observing program is mainly related to science objectives of the Solar physics division but additional observations are carried out in order to support satellite missions as well as international programs like Max Millenium. The program comprises full disk observations in several optical bands with a high temporal resolution for surveillance purposes. Independent projects deal with improvement of instruments, observing techniques and data archiving.

Key words: Solar instrumentation - Solar observations - image acquisition

1. Introduction

Kanzelhöhe Solar Observatory, located on a mountain at an altitude of 1500 m and about 150 km west of the main site Graz, carries out observations mainly but not exclusively for the Solar physics division of the Institute of Geophysics, Astrophysics and Meteorology University of Graz, Austria. Motivation for the work is derived from science objectives of this division and from collaborations with international partners. KSO supports several international projects and satellite missions with ground based observations. Executing observations and development of instruments as well as observing and data archiving techniques are the main subjects. The Solar physics division studies

the dynamics of the Solar atmosphere and Solar activity. Science objectives of recent projects are statistical properties of Solar activity features, pre-flare mechanisms and heating processes as well as propagation of disturbances in the Solar atmosphere (wave phenomena) and Solar drivers of space weather like CMEs. Further projects deal with large scale dynamics of the photosphere and irradiance variations.

2. Instrumentation

High quality observations need specialized instruments for the fields of scientific research. Our instrumentation is designed for a multi-spectral tomography of the Solar atmosphere in the optical spectral range. We execute full-disk observations in continuum, H α and Na-D with high temporal resolution. Observing with a Magneto-Optical Filter operated in the Na-D lines allows also to derive Doppler- and magnetograms.

3. Observations

The standard Solar surveillance program is carried out on a daily base yielding about 2000 hours of observations on 300 days per year. The so-called Patrol Instrument is a 4 telescope system on a common mounting for white-light, Na-D and H α observations. The observing program is complemented by independent projects with technical background related to the observations like event and Solar activity triggered observation control, automatic real-time flare recognition and the development of an on-line archives system.

3.1. CONTINUUM OBSERVATIONS ("WHITE-LIGHT")

A refractor $d/f = 110/1650$ with a projection lens system is used for the daily sunspot drawings which continue a long tradition of more than 50 years. Mainly intended for the derivation of the sunspot relative number they provide a quick preview about Solar activity without extra means. For precise determination of sunspot positions and areas a set of photoheliograms is taken once per day on an extra, larger

refractor ($d/f = 130/1950$) in order to support the Debrecen Photoheliographic Results (Pettauer, 1990).

3.2. H α OBSERVATIONS

H α can be quoted as *the* standard tool for all studies of chromospheric features. Full-disk observations with high temporal resolution enable to follow the evolution of rapid changing phenomena like flares and propagating waves. Kanzelhöhe Solar Observatory is one of three base stations of the Global H α Network (Steinegger, 2000). The Solar disk is imaged by a $d/f=100/2000$ lens. A filter tuning unit rotates the polarizers of the 0.7 Å Lyot filter to shift its passing band. The light is splitted by a beam-splitter cube and lenses adapt the image size and focus the Solar images to the CCD cameras. A digital image acquisition system for H α was introduced in 1997 and is operated since 2000 on a regular basis and was described in Otruba (1999). The high resolution camera for the Global H α Network was implemented in 2000. Recent improvements comprise frame selection, automatic exposure time control, increased image acquisition rate and a H α filter tuning unit to observe optional in the line wings of the H α spectral line. An upgrade from the 8-bit camera to a 10-bit camera is in progress. The high-speed 1kx1k 8-bit CCD camera delivers up to 15 frames/sec which are grabbed by the PC-based instrument controller and undergo a simple frame selection process. Maximum image acquisition rate is 1 image per 2 sec, with optional line-wing observations in a script mode it is limited to 1 image per 5 sec. Exposure time is automatically adjusted according to the sky transparency to exploit the dynamic range. The low-speed CCD camera of the Global H α Network has a very high resolution of 2kx2k and 14-bit but the disadvantage of a very slow read-out of 5 sec per frame which is the limiting parameter and inhibits a frame selection mode.

3.3. NA-D OBSERVATIONS

Since 1997 a Magneto-Optical Filter with Sodium vapor cells has been operated at Kanzelhöhe Solar Observatory and was subsequently im-

proved for stable operation on a daily base. Full-disk simultaneous spectrograms, Dopplergrams and longitudinal magnetograms are obtained with a cadence of 1 set per min and a spatial resolution of 4.3 arcsec. The instrument is described in Cacciani *et al.* (2000).

4. Data Managing and Archiving

Data obtained directly in digital form pass a local primary quality check and are transferred to the archives system via the LAN after end of observation. The archives system manages the data stream and reformatting to standard formats like FITS and JPEG and swapping of older data to archives media. Due to the huge amount of H α images per day we archive a standard time-series of 1 image per min but keep the full temporal resolution for periods of higher Solar activity. The installation of a data-base system which will provide an online catalogue of the archived data is in progress. Older data will be digitized according to the available resources and on request.

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PROGRAMI OPAŽANJA SOLARNOG
OPSERVATORIJA KANZELHOEHE

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Izlaganje sa znanstvenog skupa

Sažetak. Solarni opservatorij Kanzelhoehe je opažačka postaja Instituta za geofiziku, astrofiziku i meteorologiju Sveučilišta u Grazu, Austrija. Program opažanja je uglavnom povezan sa znanstvenim zadacima odjela za fiziku Sunca, no provode se i dodatna opažanja radi podrške opažanjima sa satelita i međunarodnim programima kao što je "Max Millenium". U okviru patrole Sunca opaža se cijeli disk Sunca u nekoliko područja vidljivog dijela spektra s visokom vremenskim razlučivanjem. Pored toga radi se na unapređenju instrumentarija, tehnika opažanja i arhiviranja podataka.

Ključne riječi: oprema za opažanje Sunca - opažanja - prikupljanje snimaka