COMMISSION 10. SOLAR ACTIVITY (ACTIVITÉ SOLAIRE)

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In preparing the present report, which covers the period July 1, 1981, to June 30, 1984, close collaboration has taken place between Commissions 10 and 12, the two solar commissions, in order to avoid duplications and to insure that pertinent subjects are treated. The reader is referred to the report of Commission 12 for further solar topics. It is a pleasure to acknowledge the excellent work of the reviewers who wrote the different sections of this report, and all the members of the commission who provided information on research to be included.

I. Ground-Based Optical Solar Instrumentation
(P. Mein)

A. NEW TELESCOPES AND CORONAGRAPHS

A new 50-cm horizontal telescope, built by C. Zeiss Jena and similar to the Ondrejov instruments, has been installed by the Slovak Academy of Sciences at Stara Lesna Observatory. The solar tower telescope of Nanjing University, China, is now in operation, and the telescope of Purple Mountain and its control system were renewed. In the framework of the Joint Organization for Solar Observations (JOSO), several telescopes are set up in the Canary Island Observatory. The Swedish instrument is operating at the Roque de Los Muchachos, and a 45-cm open telescope from the Utrecht Institute should be erected also at La Palma. The 45-cm Gregory-Coudé from the Göttingen University and the 60-cm Vacuum Tower Telescope from the Kiepenheuer Institute will be ready at Izana in 1985 (JOSO report 1983). On the same site, the 90-cm French polarization-free telescope THEMIS is planned before 1990. As a final goal of JOSO, a Large European Solar Telescope (LEST) is presently promoted by the LEST Foundation. The aperture should be 240 cm. Active and adaptive optics should be included in this new generation instrument. Attempts for defining a Large Multipurpose Solar Telescope were also made at Pulkovo Observatory; seeing conditions are analyzed in this context at the Kislovodsk Station. A one-dimensional aperture telescope is presently under construction in Nice. It is especially suited for brightness and velocity speckle-interferometry measurements (Aime et al. 1983). The stability of telescope drives has been investigated by Hammerschlag with a special view to wind effects on open telescopes (Adv. Tech. Opt. Tel., SPIE 1982). Improvements were undertaken at the tower of the Sacramento Peak Observatory (SPO). Tests have been made to use helium instead of vacuum inside the telescope. The window could be replaced by a thinner one. In order to compensate image motions due to seeing effects, a correlation tracker was realized with a 32 x 32 pixel Reticon array; the rate of FFT calculations is around 1 kHz (von der Luke 1983). Electronic detectors are used more and more in solar astronomy. The multiple diode array of SPO includes eight units; a flat field source calibrates the interference fringes. Two new coronagraphs are operated by the High Altitude Observatory (HAO) at Mauna Loa, Hawaii. One of them (23 cm) allows inner corona observations with linear diode array detectors; the other (12.5 cm) is devoted to Hα limb activity (Fisher et al. 1981). A new 20-cm emission-line coronagraph is also in use at SAO; the level of scattered light is remarkably small (SPIE 1984). Electron density in coronal active regions can be measured at the Pic-du-Midi by the K-coronameter (Noens & Leroy 1981). The Huancayo Observatory (Peru) is setting up a 12-cm coronagraph at the

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Cosmos Station; because of financial difficulties, Fabry-Perot observations of λ5303 will be carried out in 1985 during only 2 months.

B. SPECTROMETERS AND FILTERS

Most of the new telescopes are equipped with spectrographs. A long Cerny-Turner Spectrograph (10 m) is associated with the Slovak instrument. A multiple spectrograph is fed by the Nanjing telescope, and a wide wavelength range can be covered at the Purple Mountain Observatory (Acta Ast. Sinica 16, 1975; 24, 1983). The spectrograph installed on the 50-cm refractor of the turrett dome at the Pic-du-Midi can be used in the mode of a multichannel subtractive double pass, which allows high spatial resolution in two-dimensional spectroscopy. The Meudon spectroheliograph is presently renewed. At the Canary Island Observatory, the Gregory-Coudé and the VTT will have 9.3 and 15 m spectrographs respectively. The latter will be equipped with a MSDP device built in Meudon (JOSO 1983). The SPO universal birefringent filter (UBF) has been improved. Absolute calibration is provided by laser source, and the filter can be tuned to a selected wavelength in less than 1 s. The Arcetri Observatory is developing a UBF in view to the German VTT set up in the Canary Islands (JOSO 1982). The filter is tried now at the Pic-du-Midi, and the wavelength control should be digitized in the near future. The universal birefringent filter FPSS of Meudon is designed for velocity and magnetic field observations (Huntsville workshop 1984). A high resolution (2 to 5 cm) computer-controlled universal filter is in progress at Culgoora. It will be mounted on a 30-cm telescope.

C. POLARIMETERS AND MAGNETOGRAPHS

The vector magnetograph of the Okayama Observatory, Japan, has been in operation since 1982; the polarization of the 65-cm Coudé telescope is compensated (Huntsville Workshop, 1984). The Mount Wilson Magnetograph has been renewed (Howard 1983), and a wavelength calibration device is included (Bruning & Howard 1983). At Big Bear Observatory, the videomagnetograph was also improved by a new calibration system using solar rotation (Patterson 1983). The large coronagraph (53 cm) of the Crimean Observatory is now equipped with a linear polarization analyzer. A vector magentograph using KD*P crystals as modulators is now developed at Beijing Observatory. For special study of flares, linear polarization analysis is also available at Meudon Observatory on the refractor devoted to Hα observations.

D. CHROMOSPHERE AND SOLAR ACTIVITY OBSERVATIONS

Many instruments observe the solar activity daily throughout the world. Some of them are well known. Others must be mentioned here, even though they are not recent. At Purple Mountain Observatory, a 20-cm refractor is devoted to Hα patrol, with the possibility of local enlargement. Relative numbers of sunspots are given by the 8-cm instrument of Huancayo. The Manila Observatory (Philippines) makes daily white-light observations and Hα-K spectroheliograms. Two 6-cm refractors are used at Oelsnitz Observatory (RDA) for the study of the frequency of spots versus latitude. A double telescope (20 and 15 cm) provides white-light and Hα observations at the Stara Lesna Observatory. An eclipse-spectrograph built by Beijing and Nanjing Observatories was operating in June 1983 for chromosphere and corona observations. Some improvements in processing or acquisition of data can also be mentioned. A sunspot area meter using a TV camera is in use at Debrecen. Spectral observations of spicules are optimized at the Abastumani Observatory, Georgian SSR, by the use of automatization and special devices for line position measurements.

E. GLOBAL OSCILLATIONS, LARGE-SCALE MOTIONS, AND SOLAR DYNAMO

Helioseismology can be supported by networks of small telescopes measuring velocity oscillations without any interruption. Following the South Pole experiments, a project called IRIS and using resonance cell detectors is presently being developed by the Nice group. A similar project is planned by the

Global Oscillation Network group. Further data can be obtained with instruments observing the solar disk with various spatial resolutions. This is the case of the filter built by Cacciani et al. (1981). For high degree oscillations, we must mention the Mount Wilson system (Rhodes et al. 1983) using a CID camera. A second version of the Fourier tachometer developed by SPO and HAO is now operating; with the 100 x 100 Reticon array, the velocity noise is less than 5 ms^{-1} for each pixel (a few $cm\ s^{-1}$ for the full-disk average velocity). The spatial distribution of velocity fields can be provided by the two-dimensional solar spectrometer of Birmingham, with a view to oscillations as well as large-scale motions. The resonance-cell instrument developed in Bordeaux (Robillot et al. 1984) is also suited for differential rotation measurements. Solar diameter fluctuations complement velocities for helioseismology studies. The Pic-du-Midi heliometer is designed for high accuracy measurements. The solar diameter monitor (Brown et al. 1982) is mainly devoted to long-term effects (1 arc sec/century), as is the Astrolabe of CERGA Observatory, France (Laclare 1983). Observations of global brightness variations of the photosphere are achieved at the Crimean Observatory where a 16 x 16 detector matrix is used for center-limb measurements. For stellar comparisons, the solar cycle can be investigated by spectrometers observing the Sun as a whole. In this context, the Selective Solar Irradiance Spectrometer (Oranje 1982) realizes spectrograms of Ca II lines from the entire solar disk, as well as from smaller areas.

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II. Solar Maximum Year

(D.M. Rust)

A. ACTIVITIES

Work begun during the Solar Maximum Year (SMY) (1980-1981) was the focus of