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High-tech Telescope on Top of Mount Wendelstein

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A prominent feature of the silhouette of the Alps, the Wendelstein Mountain, can be seen from Garching on clear days. Extremely transparent skies sometimes even allow one to recognize on top of that mountain the domes of the Observatory of the University of Munich (USM). Only 75 km away, after one hour's ride, this site can easily be reached via cable car or by means of a famous 75-year-old cog railroad. Final access to the very top is achieved by an elevator climbing up 114 m within the mountain.

This Observatory had already a long tradition in solar research. First observations were started in 1940 (however, near the end of World War II they merely served the military to forecast radio disturbance caused by solar activity). Later, observations of solar prominences and of the solar corona began. After integration of the Observatory into the world-wide activities during the "International Geophysical Year" a 20-cm Zeiss Coudé Coronograph was installed; it was used since 1963 to provide data for international solar research.

About 20 years later, when corona observations were reduced to only a few days a year due to increased air pollution, these activities had to be stopped: it was high time to think about the future of the Wendelstein Observatory. On the other hand, a statistical evaluation of weather data obtained over 7 years clearly indicated favourable conditions, at least for stellar observations, on about 145 days a year and fairly good seeing quality as well.

Thus in 1983 a new concept was elaborated to adapt the facilities to night-time observations and to move the solar instruments to a site on the Canary Islands. After many struggles for the required financial support, finally the green light was given to the telescope builder DFM Engineering in Colorado to provide an 90-cm fork-mounted Ritchey-Crétien telescope and auxiliary equipment, including a grating spectrograph and a CCD camera with an image data analysis system.

Construction work for the new dome building (Fig. 1) started in autumn 1987. The telescope itself was delivered in November 1988, packed into a huge container that arrived at the bottom of Wendelstein after a journey of about 9,000 km. Helicopter flights scheduled for transportation to the mountain top had to be cancelled due to heavy snows and wind velocities up to 200 km/h. Therefore all of the equipment had to be brought up to the top using the cog railroad and two elevators.

The mechanical and optical setup was achieved within the scheduled time, although some problems were encountered in getting the telescope drive system to work because of strong signals from the nearby radio station. Extensive shielding measures finally solved this problem. "First light" through the telescope could be announced on January 18, 1989 when radiation reflected from Jupiter first passed through the new instrument.

However, long before this date our request to ESO concerning support of optical tests on the planned telescope had been answered positively – another example of the fruitful cooperation and of the mutual exchange of experience we had enjoyed with ESO in the past. For test purposes the ESO-Shack-Hartmann camera "ANTARES" could be made available just before this instrument had to be shipped to Chile for application as wavefront sensor at the NTT. The Hartmann exposures will serve to perform the final optical alignments and to determine the overall optical quality. Prior to the completion of these tasks visual observations have already yielded a surprising result: The atmospheric conditions on Wendelstein during several test nights yielded seeing disks well below 1" (Craters on the Moon about one arcsec of diameter still showed shadow structures in their centres!).

The probability of having such favourable atmospheric conditions as well as the number of useful nights promised by weather statistics seem to justify the installation of such a high-tech telescope. Its performance differs in several respects from those of conventional instruments of comparable size: The thin primary mirror of accordingly low heat capacity is supported by an airbag. Its pressure is adjusted according to the mirror's weight on three hard points. This device guarantees preservation of the mirror's shape and therefore optimal image quality regardless of the telescope position. Furthermore the lightweight mirror allows a very stiff mount-

Figure 1: *Ready for observation: the new telescope on Mount Wendelstein.*

Figure 2: *The Multichannel Photometer mounted at the 0.8-m DFM telescope.*

ing of low inertia to be used, which makes possible a slew speed of 4 degrees/sec. Computer control provides corrections for precession, aberration, nutation, refraction, azimuth and elevation misalignment, mechanical and optical non-perpendicularities and flexure. These corrections typically allow a pointing accuracy of better than 10 arcsec RMS to be achieved. Back-up instrumentation weighing up to 100 kg can be mounted at the instrument rotator. (Highly sensitive detectors which may be influenced by radio noise can be protected by means of a shielding box for RF radiation.) The telescope is operated from a separate control room. Two terminals respectively allow one to command the telescope motion via a menu and to display all relevant status parameters. An automatic dome drive and an autoguider that follows stars brighter than 15 mag provide an almost automatic observation mode.

The first astronomical instrument mounted (Fig. 2) was the High Speed Multichannel Photometer MCCP (cf. *The Messenger* No. 48, p. 29) developed at the USM which allows simultaneous UBVRI measurements of object, comparison and sky, thus compensating for changing atmospheric transparency. (This instrument has already been successfully operated at the ESO 1-m, 2.2-m and 3.6-m telescopes.) High-speed light curves of the dwarf nova U Gem were the first astronomical data recorded on Wendelstein. Application of the remotely controlled spectrograph with a Reticon detector and the CCD camera for narrow band imaging are planned in the near future.

In principle the new telescope should serve the following specific purposes:
- Thorough training of students and observers as preparation for observing runs at large telescopes.
- Performance of test runs in the course of instrument and detector developments.
- Execution of observing programmes which are so time-consuming that observing time at other sites will not be given to visiting astronomers – or programmes which concern singular events like nova and supernova eruptions or the appearance of comets. All of these tasks are favoured by the easy access to our observatory, as well as by the existence of a proper infrastructure.

In addition, astronomical observations simultaneous with those on satellite-borne telescopes, and cooperations with international observing campaigns are planned. Finally, a certain amount of telescope time will be granted to visiting astronomers to allow them to take a look through the blue Bavarian sky.

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Spatial Resolution Imaging of the Radio Source 3C 255

The optical identifications of the 3CR sources are now nearly complete (Spinrad et al. 1988), and only 7 are lacking redshifts.

The radio source 3C 255 is one of these remaining sources, and the deep image presented here was taken to search for a possible underlying distant cluster. Three CCD exposures in V and R were taken with the 2.2-m ESO-MPI telescope on La Silla under moderately good seeing conditions (1.2 to 1.5 arcsec). Adding these images gives a total exposure time of 2 h. The visible counterpart of the radio source is the central object of the frame. There are three other objects, W, E, and S, located at about 7 arcsec from it.

Spinrad et al. noticed that the central object is elongated, as most distant 3CR sources are. On this CCD frame we resolve the elongated region of the source into at least three components (possibly five), the average distance between the components being about 2 arcsec.

The source itself may have four unresolved components (on 1 arcsec scale) or extensions, namely the central object, two extensions in the northern direction and one towards the south.

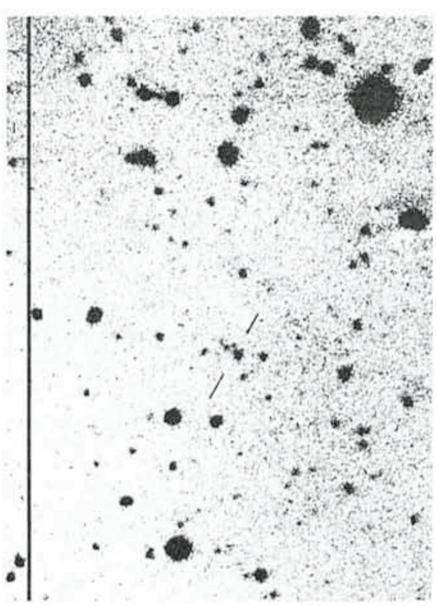

Figure 1: *A 90-minute CCD frame (V) obtained with the 2.2-m telescope at La Silla, showing the distant cluster of galaxies around the radio source 3C 255. The magnitude of the optical image of the source is ~23. The foreground cluster in the upper part of the frame is at redshift z ~ 0.2. North is up and East is to the right.*

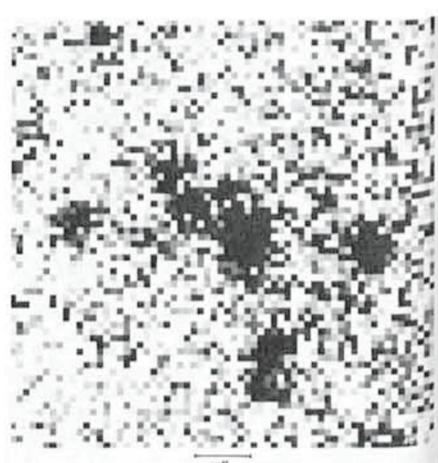

Figure 2: *A spatially resolved image of the elongated radio source 3C 255 obtained with the 2.2-m telescope on La Silla. Exposure time: 3600 s + 1800 s in V (seeing 1.2 arcsec) + 1800 s in R (seeing 1.5 arcsec). The optically identified source is resolved into a bright object and at least 3 fainter components. North is up and East is to the right.*