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A focus for hot stars - The German STScI*

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Abstract: The German STScI is re-installing a 1m-class professional telescope for spectroscopic work on massive stars. A combination of scientific investigations and training of young scientists will be the main goal of the newly established institute. Professional equipment (telescope, instrumentation, software and accommodation) and a respective network will not only offer the opportunity for specific long-term campaigns but also for a joint effort to bring together professionals and young scientists.

1 Introduction

The former Wendelstein Telescope operated by the University of Munich has a new home after being replaced by a bigger instrument. The telescope will be installed in a new service building close to the city of Waldbröl, some 50km east of Cologne. The main scientific application will be spectroscopy of massive stars including the visible and near infrared wavelength range. The telescope focus can be used for scientific campaigns and instrumental engineering runs of astronomical institutes. In addition, young scientists (scholars and students) will be trained in the use of astronomical instrumentation.

2 The observatory

The telescope has a 0.8m Ritchey-Chretien primary mirror with an equivalent f-ratio of f/12.5, manufactured by DFM Engineering Inc. / USA (fig. 1). The primary mirror is pneumatically supported and the system focus is thermally stabilized by invar elements. A GUIDE ACQUIRE MODULE offers three different focus positions of the same telescope focal length which allows the use of different instruments without mechanical adjustment (fig. 2). Equipped with a standard spectrograph of spectral resolution of about 10.000, a typical S/N of 100 can be achieved within 30 minutes for a star of about 10mag. We intend to use an infrared focal plane array for imaging and/or spectroscopy between 1 and 2.5 microns (fig. 3). Finally, we will install an Echelle spectrograph with a spectral resolution of at least 20.000 for the complete visual spectra range (fig. 4). For reliability and acceptance in the scientific community, the observatory will operate with professional data processing packages. Figure 5 shows the complete observatory complex. The telescope tower is covered by a dome which houses

*The Schnörringen Telescope Science Institute has no relation with the Space Telescope Science Institute in Baltimore.

the telescope, plus an instrument room in the basement. For optimized seeing conditions the dome itself will be equipped with ventilation flaps and will be actively water cooled according to modern investigations on dome seeing (Zago 1995). A heat exchanger will transfer the heat to the service building for heating and hot water. The service building consists of a control room which houses a series of computers. These computers control all system units (tracking, positioning, data acquisition). An office, seminar room, sanitary, kitchenette and sleeping rooms complete the building, so that proper and independent working conditions are provided (fig. 6). Electrical power will be delivered by photovoltaic cells which will cover the roof of the service building.

Figure 1: The 0.8m DFM telescope with focal ratio f/12.5.

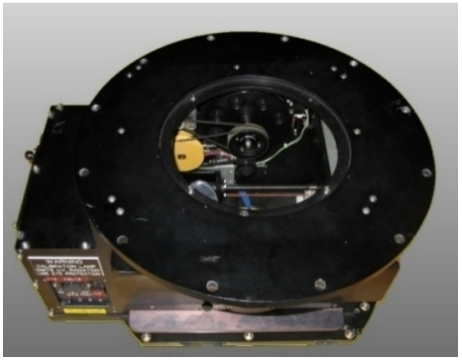

Figure 2: The DFM GUIDE ACQUIRE MODULE (GAM).

3 Site conditions and practical work

The observatory will be erected at 300m altitude, and hence, atmospheric conditions can not compete with professional sites. We expect an average humidity of about 60% during 80 clear nights per year. Average seeing is of the order of 3-4 arcsec. This is an average value, estimated at various sites in western Germany. For professional sites that would be very bad. Our efforts for a better dome and telescope seeing (see above) are nevertheless justified. According to Zago (1995) a cooled and ventilated dome will improve seeing conditions in any case. Note that a warm primary mirror introduces about 0.4 arcsec per degree Celsius above environment temperature. Quick access to a relatively dark and remote site, compensates for these penalties. Regional astronomical institutes can quickly install their instrumentation, which are later used at professional sites.

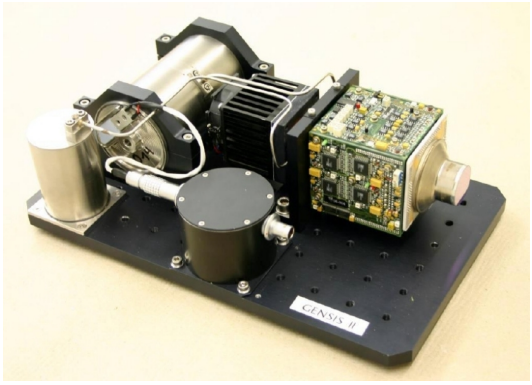

Figure 3: The AIM infrared focal plane array (FPA) with a 256 x 1024 MCT array. The sensor is pulse-tube cooled to 150 K. The quantum efficiency of the chip is about 60% between 1 and 2.5 microns (www.aim-ir.com).

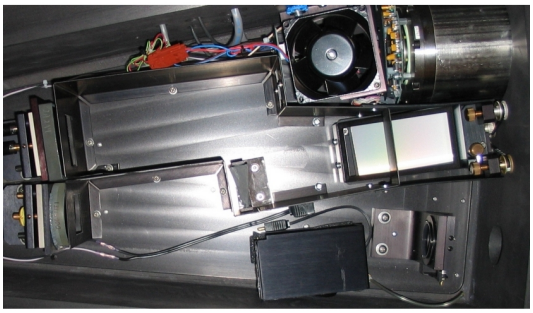

Figure 4: One of the two STScI Echelle spectrographs for the visual spectral range. Collimator and camera (left) consist of off-axis mirrors. The Echelle grating (right) has a size of 100 x 200 mm.

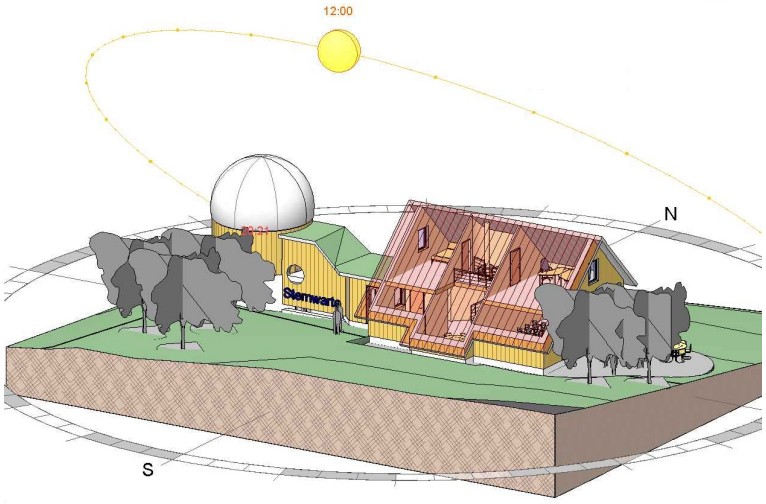

Figure 5: The STScI complex including all necessary equipment for professional work.

3.1 Research and science

Our observatory will be offered to the professional community. We are able to offer long-term campaigns together with other amateur and professional groups (e.g., the MONS campaign - Williams 2011). This is valid for the wavelength ranges covered by our spectroscopic instruments (see above). It will be also possible to perform campaigns in other fields, e.g., deep sky imaging with Johnson filters or in the IR. The telescope can carry heavy instrumentation of the order of 200 kg, as it is often needed in professional astronomy.

3.2 Training the next generation

Our observatory provides excellent training opportunities for young scientists (students), particularly if they are geographically close to their home university. This is especially valid because our training site is equipped with professional hard- and software. We believe in hands-on instrumental experience as it is widely required for modern astronomy with state-of-the-art technology. So, we do not plan

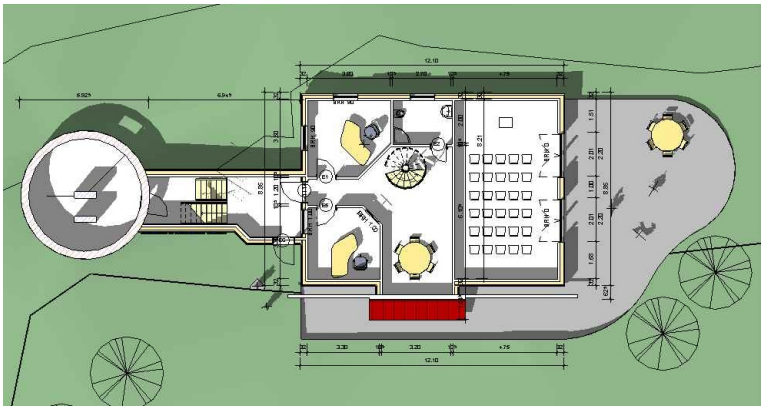

Figure 6: Basement of the service building with control room, office and seminar room.

to offer remote telescope control. A workshop with a lathe and milling machinery completes our technical site equipment.

4 Resume

By combining a professional observatory, the scientific education of the operators (astronomer and atmospheric physicist, both spectroscopists), a good location in Germany, appropriate equipment and an existing network in astrophysics, the STScI has a specific character in Germany. The observatory generally serves two purposes . That are research activities, together with the professional astronomy and training of young scientists from schools and universities.

Acknowledgements

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