A New Camera for WYFFOS

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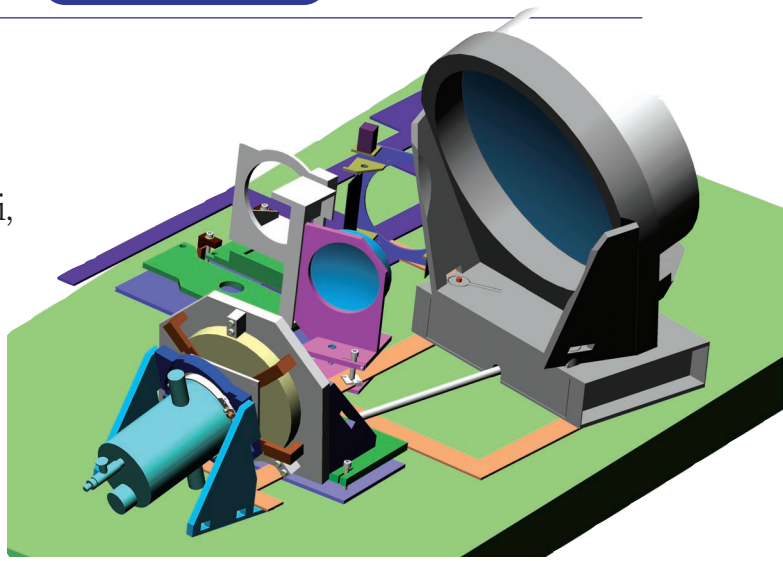

AutoFib2, the prime focus, multi-object spectrograph of the WHT, was recently upgraded with the installation of the Small Fibre Module. This allows to reach a fainter limiting magnitude and to observe a larger number of objects than with the previous large fibres.

With the new module, the image of each fibre (1.6 arcsec diameter in the sky) projected onto the CCD is presently undersampled with the present camera of WYFFOS, the Nasmyth spectrograph fed by AutoFib2. The projected full-width at half maximum of each fibre is in fact ~1.4 pixels both in the spectral and spatial direction.

As part of the upgrade of the instrument, a new camera for WYFFOS with a longer focal length (293 mm instead of 132 mm of the present camera) has therefore been designed. The new WYFFOS Long Camera will provide an adequate sampling of the fibres of AutoFib2, increasing the spectral resolving power up to 9500 with the Echelle grating presently available with WYFFOS.

The Long Camera, in combination with a large format CCD, will also allow further developments, such as introducing a larger number of fibres, or significantly increasing the spectral resolution by adopting smaller fibres in multi-object or integral-field spectrographs.

Beginning in the early nineties proposals for a new camera for WYFFOS were made by the RGO. The camera continued to be developed there until its closure in 1998. ING then took over project leadership and continued developing the concept culminating in 2001 in a definitive design.
In 2001 the optical design and construction of the WYFFOS Long Camera was contracted to ASTRON, based at Dwingeloo, The Netherlands. Just before last Christmas the design passed the Preliminary Design Review (PDR) held at ASTRON.

Some of the ASTRON team come originally from the Kapteyn Institute of Roden and some are relative young designers who together have recently worked on the instruments VISIR and MIDI for the VLT and VLTI. Those from Roden have a long relationship with ING, which is renewed with this project.

The preliminary design was made from ZEMAX optical data and tolerance calculations, to 3 dimensional file of optical lines generated by ZEMAX, copied into the drawing package pro-Engineer, into 3D dimensional principal sketches of the structure in pro-E. Also 3D strength and mostly stiffness calculations where done to prove the quality.

The accompanying illustration shows the camera (with the WYFFOS covers removed) looking from the cryostat end. The existing Hartmann shutter from the original camera will be reused in a new position. Light passes through a meniscus lens and is reflected from a folding flat onto a spherical mirror before passing to the detector through a cut-out in the flat. A field flattener lens is positioned just before the cryostat window.

The meniscus lens will be made out of N-BK7 material, the diametre will be 200 mm and the original optical design has been changed to use spherical surfaces, rather than the aspherical earlier design. The folding flat is made of Zerodur about 230 mm wide with a square hole in the middle.

What catches the eye is the large spherical mirror, again Zerodur, with a diameter of about 670 mm and a weight including structure of about 200 kg. This heavy mirror is the optical element that is the most sensitive for tolerances of the whole camera and is also very sensitive for temperature changes in position in respect to the flat mirror and detector. So the heaviest part will be adjustable in all its directions and will move in respect to the table to compensate for temperature expansion (see the thin, long, low-expansion rod) while the rest of the camera will be mostly non-adjustable optics.

Hereafter the light goes through the square hole in the middle of the flat and via a field flattener lens it will be projected into a standard ING cryostat.

The camera is optimised to use as a detector two MIT Lincoln Labs low-fringing, high-QE CCDs butted together as a two chip mosaic of 4K by 4K 15 micron pixels. These are being purchased by ING as part of a consortium of observatories and will be mounted in a standard cryostat and integrated with ING's Data Acquisition System (UltraDAS) using an SDSU-2 controller. This work will be carried out by ING on La Palma.

The final opto-mechanical design started early in January and is in full progress with commissioning planned for semester 2003A. ¤

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