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LATEST NEWS ON INSTRUMENTATION

New RedEye Grism Mode Slated for Spring 1994 Tests

One of the new Redeye modes that we hope to offer for general use to the CFHT Community during 1994 is a low resolution spectroscopy mode. The Redeye-grism project is in a fairly advanced state at the time of this report, as all critical components are either on order from various manufacturers or in a mature design state. The optical design was frozen last summer and was ultimately constrained by (1) Redeye's existing wide field optics, (2) the space available in Redeye's filter cells (6 mm thickness) to hold grisms, and (3) Milton Roy's stock resins and grating masters. Given these constraints, two designs were reached, which are described in Table 1. Both designs are based on a ZnSe prism and transmit the H-band in third order and K-band in second order. The main performance difference between the grisms is that the 60 gr/mm design yields higher efficiency (as expressed by its blaze function) in the H-band, yet lower overall dispersion. Figure 6 shows the blaze functions for the two possible designs. *Note that these functions represent only one factor in the total system throughput and should therefore only be used for comparing relative system efficiencies.* Note that the new design changes the wide field camera's plate scale to 0.35 arcsec/pixel and a resolution element has been defined in Table 1 to be two pixels for a projected slit width of 0.7".

As part of the performance evaluation of this design, Milton Roy was kind enough to replicate at no charge a smooth ~30 µm thick resin sample onto a piece of glass, which we scanned with the IRTF's infrared lab spectrometer at room temperature and 77 K. Figure 7 shows the results of those resin scans. Several weak absorption lines are evident, with a mean transmission of ~92% across the H and K-bands. No significant temperature dependence was found with these C-X absorption lines.

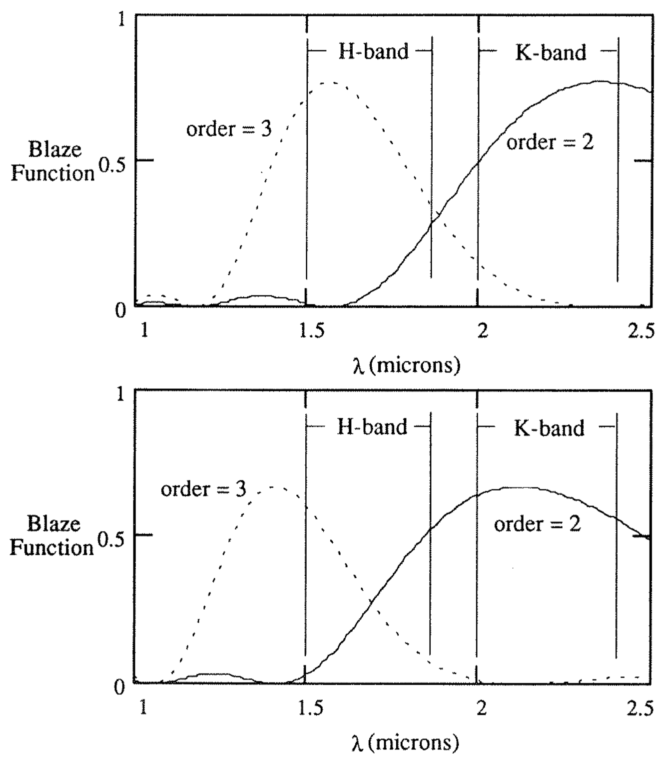

Figure 6: Above is the blaze function for the 60 gr/mm option, which offers better overall throughput, particularly across the H-band. Shown below is the 79.35 gr/mm option, which has significantly better spectral resolution, but at the price of H-band throughput.

Table 1

Grating (gr/mm)	Primary Angle	Blaze Angle	Order	Central Wavelength (λ_c in µm)	Wavelength of Peak Blaze (µm)	Blaze at λ_c	Resolving Power ($\lambda_c/\Delta\lambda$)
60	11.2°	28.7°	2	2.20 (K)	2.34	73%	132
			3	1.65 (H)	1.56	70%	146
79.35	14.8°	35°	2	2.20 (K)	2.12	65%	177
			3	1.65 (H)	1.41	36%	295

Table 1: Summary of the differences in the design and performance of the two grism options.

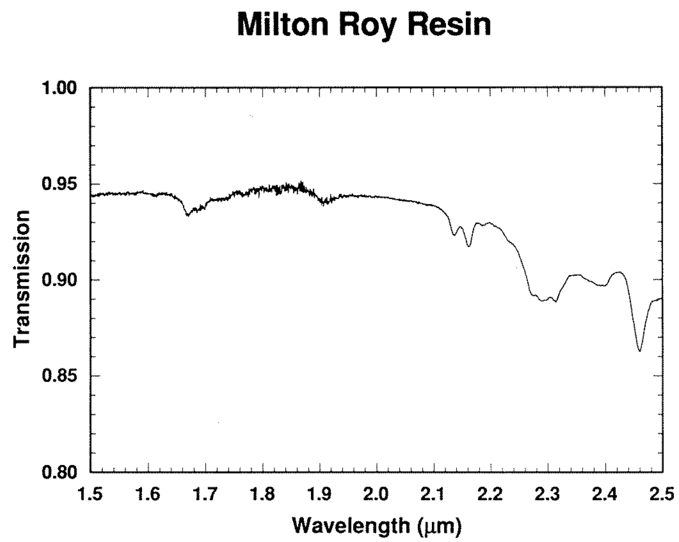

Figure 7: The transmission curve for the resin that will be used in the Redeye grisms is shown. The most significant absorption will be in the K-band.

Operation of the grism mode should be straightforward. A cold field mask that leaves two quadrants clear for target acquisition in the imaging mode (and has a slit dividing the remaining two quadrants) will be installed prior to grism runs. Targets are acquired with the grism rotated out of the beam then offset onto the slit. Telescope guiding is started, the grism is rotated into the beam, and a spectrum is recorded. Since the reimaged focal plane is coplanar with the slit for both the imaging and spectroscopy modes, focusing can be done in the imaging mode through conventional means. Order sorting is accomplished with stock H and K filters. The optical model of this design reveals rms monochromatic spot sizes of ~1 pixel across most of the field. Since the projected slit size is 2 pixels (0.7"), this level of aberration should be acceptable.

Engineering tests for this mode are tentatively scheduled for the spring of 1994. The planned infrared version of SIS should represent a long term solution to the need for low/moderate resolution spectroscopy at J and H, but since this instrument will not include a cold slit, the Redeye grism mode will be the only low resolution high sensitivity K-band spectrometer we have to offer the Community at the facility level for the near future. Interested prospective users should contact Doug Simons at the CFHT main office for additional details.

D. Simons

PUEO: The CFHT Adaptive Optics Bonnette

I. Progress Report

The CFHT Adaptive Optics Bonnette project has entered a very dynamic phase during the last six months. Actual fabrication of many parts have started and some optical components have been received at the time of this writing.

The project progressively reached full speed after last June official contract signing by CFHT, DAO (NRC) and Laserdot.

The aluminum main body of the bonnette has been cast and machined in Vancouver (Canada) and is now being anodized (Figure 10). Most of the mechanical components inside the casting have been completed. Most of this work is about 2 months behind schedule. This is due to many concurrent activities at DAO (SIS upgrade, SIS to OSIS transformation, MOCAM). Some problems have been encountered with the pupil and f/100 field viewing system on the WFS stage. Another design was developed with the help of H. Richardson using transfer optics instead of the optical fiber. Although this design is slightly more complicated mechanically, it will offer better throughput and an easier installation/removal of the ISIT camera.

The acceptance tests for the opto-mechanical assembly are being written in Waimea and will be submitted to DAO for approval in the near future. A test rig is being designed at DAO to accommodate PUEO plus the maximum instrumental load (300 kg plus PUEO weight).

Optical components have started to arrive; Applied Physics Specialties delivered the computer designs for the multi-coating of the toroid Beam Splitters.

The tip-tilt mirror mount is completed. Last June some of us had a demonstration of its functioning after a first assembly. Even at this very rough stage it worked almost up to specifications without any fine-tuning. P. Gigan has since sent the aluminum parts for anodizing. A more careful assembly, fine tuning and characterization are taking place as we write this.

There has been some tribulations concerning the final geometry of the bimorph deformable mirror. A geometry had been arrived at during the Control Algorithm Meeting of last April. By making numerous simulations at CFHT it was later realized that this geometry was flawed by cross-talk between non-corresponding rings of the bimorph mirror and WFS lenslet array. This implied a slightly worse Strehl ratio of the final image, and degraded the bandwidth of the system. Since this was discovered late, days (!) before the bimorph mirror fabrication was supposed to start, the fabrication was put on hold and M. Northcott of IfA was asked to confirm that the new geometry arrived at by CFHT (F. Rigaut) had indeed eliminated this problem. Subsequently, François and Malcolm also investigated the consequences of having the bimorph mirror at an incidence angle of 25 degrees in the beam. At this stage of the simulations and verifications, a good agreement has been found independently by the 2 groups, showing that no major problems should be expected with this design.

Many pieces of the "software puzzle" are coming together. The DUCK kernel for the AOB controller has been completed by W. Rambold. The bench control command set of the AOB controller has also been defined by B. Leckie from DAO. After a very thorough Preliminary Software Design Review last August, Laserdot and CFHT signed-off on the Software Definition Document defining the collaborative efforts between CFHT, Laserdot, and DAO. In it are the software architectural design, user interfaces, machine interfaces, and communications protocols. This document serves as the road map for each team to proceed with completing their respective software. During this meeting, J. Kerr also installed a loaner HP9000/730 workstation at Laserdot for the development of their software which is required to run on the user interface computer. At CFHT a first draft of the Pegasus user's interface has been developed.

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