Dravins (to Angel): Are tapered fibers commercially available (or otherwise how do you make them)?

Angel: Not as far as I am aware. The taper for f/3-f/1.5 is not too shallow and could be made by stretching a fiber in a flame.

Wlérick (to Courtès): How many fibres did you use in practice and what are the dimensions of the lenses?

Boulesteix (for Courtès): For a 20" x 20" field one uses 400 fibres. The dimension of the lenses, made in plexiglass, is 400μm. A factor of 3 enlargement is needed for the image at the Cassegrain focus of the 193cm telescope at Haute Provence Observatory.

Dodonov: I would like to mention here that in 1982 we will begin using a Multi-Slit Field Spectrograph (MSFS) with the 6m telescope. Incidentally, the idea for this was first published by Dimitrov and Baker before the Second World War. At the focal plane we have a mask with slits for each object in the chosen field and after collimating, we use a prism or a grating or a grism followed by a fast (f/1) camera mirror. The development of this instrument has been carried out by I.D. Karachentsev, V.L. Afanas'yev and myself. Three main problems had to be solved: (1) preparing the mask with the slits for each research field, (2) locating the mask accurately in the field so that each object falls on its own slit, (3) high quality guiding during the exposure. The spectral dispersion is ≃1500 A/mm with the prism (≃600Å/mm with the grating) giving coverage in the range of 4000-8000 Å. The field diameter is 18 arcmin and 400-500 objects can be examined at the same time. The limiting magnitude is expected to be near 23 mag. in B. The scientific programmes that the MSFS will be used for include deep spectral surveys at low dispersion, investigations of the luminosity functions of faint extragalactic objects and studies of the kinematics of clusters of galaxies. We wish to thank Professor Courtès for the use of his focal reducer.

Latham (to Richardson): Image slicers gain signal-to-noise at best by the square root of the number of slices. There is one interesting exception, when a CCD is used and the noise is heavily dominated by readout noise. For many CCD's the extra pixels illuminated by the sliced image can be binned together during readout with essentially no increase in readout noise. In this case the signal-to-noise can improve linearly with the number of slices.

Richardson: I agree. However, the decrease in exposure time to reach a given signal-to-noise is directly proportional to the gain of the image slicer whether the detector is photon noise limited or readout noise limited.

The image slicer that Angel mentioned in use on the MMT spectro-

C. M. Humphries (ed.), Instrumentation for Astronomy with Large Optical Telescopes, 185–187.

graph, has been referred to in the literature as a "telescope slicer" and is, in effect, an aperture slicer. Such a slicer could of course be produced in a monolithic telescope (single mirror of area equal to the combined area of the array of smaller mirrors) by means of an auxiliary, small mosaic mirror, lens or thick window, which would form a stack of stellar images along the slit followed by a stack of prisms to superimpose the aperture segments on the collimator. However, this type of aperture slicer requires N times as many slices as an image slicer of N elements to obtain the same throughput. This is because the telescope is proportional to the square root of the number of segments into which the aperture is divided, or to the square root of the number of telescopes. The telescope slicer requires more optical elements to achieve the same gain. For example, a 4 slice image slicer has the same potential gain as the slicing effect of a multiple mirror telescope with 16 telescopes or an equivalent monolithic mirror divided into 16 sub-apertures.

Brown (to Harmer, C.F.W.): Did the experimental intensity profiles allow you to assess the relative importance of surface defects, scatter in the material and surface reflections in producing the outer parts of the image?

Harmer, C.F.W.: The test did not permit the separation of the various contributions to the profile. Scattered light in the material, lack of coatings, small manufacturing defects etc., obviously contribute to the scattered light in the profile wings.

Harmer, D.L.: To add to the previous speaker's answer to Dr. Brown, it is evident that scattered light from the body of the material contributes significantly to the profile wings. The f/1.4 camera, with a long light path in fused silica, shows more scattering than the f/1.6 camera with its shorter light path within the material.

Tokovinin: (to Fossat): How do you correct for stellar radial velocity?

Fossat: The rotation of the Earth around the Sun displaces the line profile of the star far from the required position so that for each star there is a very narrow season in the year (about 1 month) when it can be observed.

Tokovinin: Do your experimental results confirm the reality of the solar pulsation with period 2^h40^m?

Fossat: We have substantial atmospheric noise and the oscillation peak in the power spectrum is buried in the noise. Taken alone it is insignificant but the phase and amplitude of this peak corresponds with those found by the Crimean and Stanford groups. I think therefore that it really does belong to the Sun.

Maillard: Is a high resolution Lyot filter not suitable for your experiments? It would have the advantage of being tunable and therefore highly suitable for stellar applications.

Fossat: Our requirement is a spectral stability of at least 1 m/s or about 3.10^{-9}. So far this has not been possible with a Lyot filter or a Perot-Fabry interferometer or any other kind of tunable monochromator.

Beckers: By using only one wing of the sodium D line for stellar observations do you introduce additional noise sources due, for example, to atmospheric scintillation?

Fossat: Using only one wing does not make the measurement more sensitive to atmospheric scintillation. It just requires the use of a continuum reference to reject transparency fluctuations of the atmosphere.

Barnes: What is the long term stability of your instrument? If this stability is near 1 m/s, could you use it to search for planetary perturbations on the center-of-mass radial velocity of the star?

Fossat: I cannot yet answer this question because the very long term stability will depend on the long term behaviour of each component-sodium cell, photomultiplier, pre-filter, polarizers etc. If the equipment does allow such measurements then be assured that we shall do so.

Wlérick (to Beskin et al.): Je n'ai pas bien compris si les variations observées dans les émissions du pulsar du Crabe sont réelles ou dûes à la statistique des photon.

Shvartsman: All variations of the Crab pulsar light curve for time-scales 10^{-6}-10^{-3}s that you saw on the picture we showed are statistical. So far we have not discovered any aperiodic variability of the Crab in the whole range under investigation (3.10^{-7}s to 1 year). We are planning to continue the search for aperiodic alterations of the Crab luminosity with our MANIA equipment.

Dravins: Do you have measurements of atmospheric intensity scintillations at high frequency?

Shvartsman: Yes we do. Generally, we find that for the 6m telescope, the intensity of atmospheric scintillations is as follows:

τ (sec)	$\Delta I/I$
1-10	$\simeq$1-5%
0.1-1	$\simeq$1-2%
10^{-4}-10^{-1}	<1%
5.10^{-6}-10^{-4}	<5%
5.10^{-7}-10^{-5}	<20%

For the shorter periods our accuracy is not high. However, I should emphasise that the aim of the MANIA programme is not to measure atmospheric scintillations but to suppress them (special software exists for this purpose).