SCIENTIFIC NEWS

DISCOVERY OF CARBON STARS IN THE BAADE WINDOWS

In the course of their July observations dedicated to research on carbon stars in dwarf spheroidal galaxies and globular clusters, M. Azzopardi and J. Lequeux were able to obtain grens exposures of three of the transparent Baade windows (1965, Evolution of Stars and Galaxies, p. 277). They used the grens (2000 Å/mm) at the CFHT prime focus, with hypersensitized IIIa-J plates, and a GG435 Schott filter which cuts off the short-wavelength part of the spectrum. The spectral domain thus selected (4350-5300 Å) allows detection primarily of the strong molecular C2 band with its head situated at 5165 Å.

After a careful and systematic examination of the plates under a microscope by E. Rebirot, 15 candidate carbon stars were discovered, of which 9 are in the most transparent Baade window centered on the globular cluster NGC 6522; 4 and 2, respectively, of the candidates are in the windows named Sgr I and Sgr II.

The detector, consisting of a three-stage image intensifier coupled to a television camera tube, was operated remotely using an HP-1000 mini-computer which controls all of the instrument functions including the format selection, exposure control and data archiving. Details of the detector and the operational environment are given by Di Serego Alighieri, Perryman and Macchetto (Astron. & Astrophys., submitted), the ESA scientific staff responsible for the detector development and its operation.

During an exposure, the video signal from the television camera is continuously monitored, and the digitized image is accumulated in a dedicated memory which may be read non-destructively at any time. This allows for great operational flexibility: the field acquisition and focussing are optimized at the start of an exposure, and the exposure time is reviewed continuously as the image accumulates in the memory.

During the October run, the detector was operated exclusively in an imaging mode, using a pixel size of 25 μm corresponding to a scale of 0.18 arcsec per pixel. Some of the scientific programs undertaken exploited the instrument's unique high-time-resolution imaging mode. In this mode the digitized photon event addresses are written to magnetic tape every TV frame period (every 30 msec in the 512 x 512 format) for subsequent analysis offline.

The observing program was drawn up to make the best use of both the photon-counting nature of the detector, in particular, its low system noise and its good ultraviolet sensitivity, and the excellent seeing characteristics of the CFHT site. In the normal imaging mode, the program covered observations of the optical counterparts of radio jets, and of the line emission surrounding quasars, Seyferts and dominant cluster galaxies.
Two other types of observation were undertaken using the high-time-resolution imaging mode. The first of these related to observations of the fields of three radio pulsars, with periods in the range 1.1-1.5 seconds. In the off-line analysis, images will be extracted and stacked according to their phase within the radio pulse period. The principal advantage of the time-resolved imaging data over data acquired using, for example, photomultipliers, is that the optimum aperture can be defined on the basis of the integrated image, with a knowledge of the field geometry and of the image profile. In addition, arbitrary areas of the sky surrounding the radio pulsar can be monitored for variations in the atmospheric transmission. It is hoped that useful limits may be placed on the optical emission from these radio pulsars in this exploratory program.

The high-time-resolution imaging mode was also used for narrow-band ultraviolet imaging of nearby galactic nuclei, and of the gravitational lens 2345+007. In these cases the aim was to acquire a long series of high-time-resolution images, which will be corrected off-line for erratic image motion, and from which the very best resolution images may be extracted. In this way it is hoped that the spatial resolution of the data, already in the range 0.4-0.7 arcsec, may be further improved, allowing a better understanding of these different objects.

During the run, throughout which the detector functioned according to expectation, quantitative estimates of the seeing could be made using an iterative least-squares algorithm to fit Gaussian profiles to the digitized stellar images. The seeing never exceeded 1 arcsec (FWHM) throughout the run, reached 0.7 arcsec or better at some times during each night, was between 0.6-0.7 arcsec for four of the nights, and reached 0.45 arcsec on two of the nights. These quantitative measurements are all the more encouraging since they were made on exposures often exceeding 30 minutes. Only one night was lost due to clouds.

Some results of the observations are shown in the accompanying figure. This shows an image of the radio galaxy 3C 66B in which the optical jet is clearly visible. Papers describing the detailed results of these observations are already in preparation.

This observing run at CFHT has provided an excellent opportunity to acquire scientific data with characteristics closely resembling those of images expected from the Point Object Camera on the Space Telescope. Preliminary examination of the data indicates that they should be scientifically valuable in their own right.

HIGH ANGULAR RESOLUTION OF PG1115+080A

The triple quasar PG1115+080A is very probably an example of a gravitational lens. In fact, 4 components are known: A1 (m = 16.9, observed in March 1983 at CFHT with the CE Grand Champ by Vanderriest et al.). A2 (separation 0.5", $\Delta m = 9.1981-83$). B (separation 1.6", $\Delta m = 2.5$), and C (separation 2.3", $\Delta m = 2$). If the gravitational lens model applies to this object, a fifth component should exist.

In May 1984, D. Bonneau and R. Foy observed PG1115+080A (A1 + A2) at the CFHT prime focus with their speckle interferometer in the visible. Seeing conditions were remarkable - 0.3" FWHM. This was measured using an image of the reference star obtained by recentering instantaneous images of 20 ms. On the other hand, the transparency was only average on account of dust emitted during the recent eruption of Mauna Loa.

From a comparison of the correlated images, the result was a difference in magnitude of 1.8 (m(A2) - m(A1)). This is significantly larger than previously published measurements. Could PG1115+080 be a QSO in the class of Optically Violent Variables? Does one parameter of the lens vary rapidly? Is A2 really an image of PG1115+080A?

Other questions come to mind with this second result: the component A2 shows an elongation (extension of 45 milliarcsec with the cross-correlation), while A1 is
point-like as seen with a 3.6-m telescope. A model with a complex mass distribution in the lens could probably produce an elongated configuration. Could this extension be an enlargement of the quasar? Could this elongation be due to a separation of A2 into two components A21 and A22? Could A22 be then the 5th component of the image PG1115+080? Could A2 be a remote field galaxy?

To learn more, it is necessary to keep observing PG1115+080A regularly.

**IMAGE PROCESSING WITH CIGALE OF NGC 6946**

In April 1983, J. Boulesteix and collaborators used the CFHT/Marseille's scanning Fabry-Perot and focal reducer with the Observatoire de Marseille's TV photon-counting detector to study the dynamics of spiral galaxies. The data from this observing run have been processed in France using the Marseille Fabry-Perot processing package CIGALE, and some results for the galaxy NGC 6946 are shown here. The observation itself was relatively short, corresponding to 320 seconds in each of 16 channels (or wavelengths). A full sweep of all 16 channels was limited to several minutes in order to avoid random variations in atmospheric transmission. Reduction with the Harris 500 computer of the Observatoire de Marseille required more than 6 hours of CPU time. This gives an order of magnitude estimate of the time required for processing with CIGALE, i.e., four or five times that needed to make the observations. The figures below show images of the galaxy which have been corrected for instrumental transmission. In the three-dimensional continuum map (figure 1), one can pick out the nucleus and two peaks on opposite sides of the galaxy that are probably clusters of subgiant and giant stars. The Hα isophotal image (figure 2) shows emission from large HII regions as well as diffuse emission in the spiral arms and in the galactic disk. There are large differences in intensity between the HII regions and the disk. Also shown here (figure 3) is a map of the velocity obtained using steps of 10 km/sec. With the use of this powerful Fabry-Perot processing package, Boulesteix and collaborators hope to construct a catalog of galactic HII regions and galactic rotation curves.