The Case of the Long Focus Cassegrain

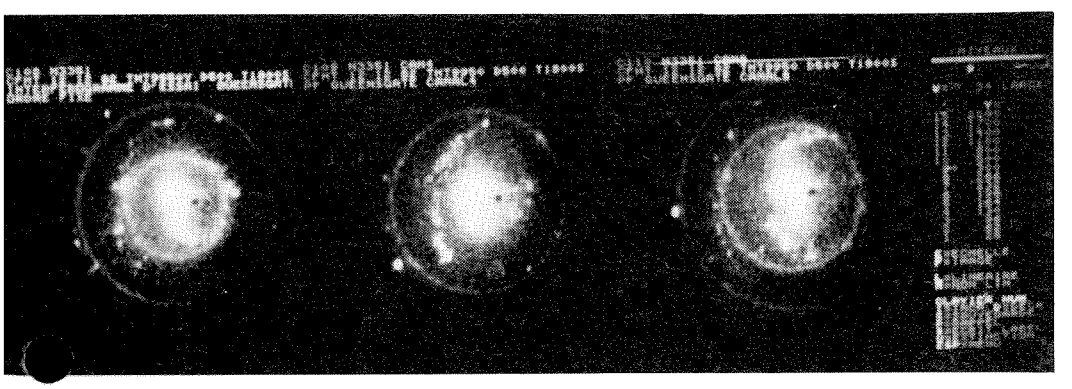
The f/8 cassegrain secondary mirror was shop-tested at the Dominion Astrophysical Observatory in the fall of 1981. Partial Hindle sphere results showed a very smooth surface but Hartmann plates analysed at E.S.O. revealed an undercorrected figure. Since the exact value of the resulting spherical aberration was difficult to ascertain, it was decided to test the mirror in the telescope.

A first series of sky-tests were made on Mauna Kea in April, 1982. A second series of tests took place in September. These Foucault and Hartmann tests confirmed the presence of spherical aberration at the nominal back focal distance of 400mm behind the cassegrain bonnette, and gave a well determined value of 0.6 arc second for the diameter of the least confusion circle. This spherical aberration disappears when the focus is pushed back by some 600mm. At that position the image quality is superb, with a FWHM less than 0.2 arc second. However, such a large back focal distance is unacceptable for many instruments and makes it impossible the use of the functions of the cassegrain bonnette.

After debating the question extensively at its May and November 1982 meetings, the Scientific Advisory Council recommended that the Corporation study all possible means of bringing the excellent images of the f/8 system to their correct position. These studies have been in progress for some time. Four basic options are considered: refiguring the present mirror; polishing a new mirror; providing a system of correcting lenses; mechanically deforming the secondary mirror. The first two options would require null-tests in the optical shop, possibly using a full Hindle sphere whose availability is in question. The correcting lenses solution entails losses and scattering of light whose importance is being evaluated. In any case, a coma corrector will be needed and provided for wide field work. Mechanical deformation of the relatively flexible 1.4m diameter secondary (aspect ratio =12) appears feasible but the full studies have to be completed. The implementation of the chosen option is expected to take between one and three years. The f/8 cassegrain will remain available in its present form for the next few semesters. Spacers are available to install light instruments at the optimum back focal distance.

Despite its shortcomings, the cassegrain focus has already been used productively by visiting astronomers. University of Hawaii's Henry, Stockton and Thompson had a successful run in September, observing clusters, galaxies and QSO's with the UH/Galileo 800 x 800 CCD. In December, the CFHT/Marseille's scanning Fabry-Perot and focal reducer underwent their initial engineering test at the cassegrain focus. Georgelin and collaborators, using the Observatoire de Marseille's TV photon counting detector, carried out the first CFHT studies of velocity fields in galaxies. This was followed by the run of Meudon's Wlérick and Dubout who used the Lallemand wide-field (82-mm) camera to investigate BL Lac objects, active galaxies and stellar populations in M33.

Demand for observing time at the cassegrain focus is increasing. During the first semester of 1983, the cassegrain is scheduled to be used on 47 nights (31% of all allocated time, up from 16% last semester) with a variety of instruments, such wide-field camera, CCDs, TV photon counting systems, scanning Fabry-Perot spectrometers and sub-millimeter photometer. Demand will further increase when spectrographs, photometer, polarimeter, high resolution cameras, etc. are commissioned. It is certain that the f/8 focus will soon replace the prime focus (40% of currently allocated time) as the most popular configuration. Thus it is important to provide the best working conditions at the cassegrain focus.



The two full rings are produced by a line of the night glow. The black spot near the center of the image is an occulting square of 2 X 2 arc second on the sky.

Sequence of three pictures of the spiral galaxy NGC 3351, taken from the TV monitor after one half hour exposure. These were obtained with the CHF Fabry-Pérot interferometer and the Marseilles photons counting camera. Each monochromatic image in Hα shows the emission regions of the galaxy in slices of velocity shifted of 90 km/s by a step of one third of interference order. The evident difference in aspect demonstrates the rotation of the galaxy itself.