

the better part of 1990. Fabrication of the components commenced in November of that year by Idehara Machining in Hilo, Hawaii. With all the fabricated and vendor supplied components in place by April of 1991, final assembly began with the assistance of T. Gregory.

Initial electronic testing of the Z (focus) motion conducted by P. Papasian was a complete success. This test was critical because two servo controlled motors, electronically synchronized (slaved), lift the Tilt and Rotation stage assemblies verti-

cally through separate recirculating ball screws. Maximum mechanical wobble as measured by digital readout gauges across about a half a meter was never more than 20 microns!

We now have a mechanically complete detector environment designed in house and built on the island just eighteen months after it was only an idea. The next phase is to thoroughly test all the motions with the Galil motor controls, which will be actuated by software developed in house.

*W. Knight*

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## RECENT TECHNICAL ACTIVITIES

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### The Observation of a Total Solar Eclipse with a 3.6 m Telescope

The Hawaii Total Solar Eclipse of July 11, 1991, the most publicized astronomical event of its time, is a somewhat cloudy memory, 3 months later. Locals, as well as visiting myriads, here especially for the eclipse, all can relate their "Eclipse Experience," some humorous, some not. Most frequently, they missed it because an uncharacteristic cloud cover obscured the sun over most of the Big Island, except, luckily, Mauna Kea summit.

A steady parade of requests from magazine writers, TV stations, newspapers, photographers, for ring-side seats, summit tours, special considerations, last-minute urgencies, etc., made for an unending public relations chessgame. The major effort on Mauna Kea was undertaken by a NOVA film crew, directed by Tom Levinson, of WGBH-Boston. They used some 30 cine-cameras, varying from video, 8-mm, 16-mm and 35-mm were located around the summit, with about a quarter of them in or around the CFHT building. The final TV production is expected to be shown in the USA in February, 1992. Levinson assures us that the quality is spectacular.

Nonetheless, CFHT Corporation enjoyed, some would say, endured, a memorable Solar Eclipse 91. This note summarizes the varieties of preparations, activities, and especially the finale of observing with the largest "solar telescope in the world."

#### Initial Program Selection

The Call for Scientific Proposals to use CFHT for solar eclipse experiments went out in early '89, and the evaluation by an outside group of astrophysicists arrived at recommended priority ratings. Our internal operational and compatibility appraisals led to the final choices, in February, 1990, for the main 5th floor telescope program as well as one secondary experiment from the ground floor adjacent to the building. These were:

- Prime Focus: Dr. Serge Koutchmy et. al., Institut d'Astrophysique, Paris: "Prominence and Coronal fine structure," using a special wide-field aerial surveillance camera, to be loaned from the French Air Force; yielding one 228 x 228 mm<sup>2</sup> photograph every 1.6 seconds, 50% of each frame occupied by the complete solar-lunar disk image. At the same time, part of the wide-field-corrected prime focus field of view was to be directed to a video

CCD camera, for speckle measurements of prominences.

- Ground Floor: Dr. Philippe Lamy, Laboratoire d'Astronomie Spatiale, Marseille: "Wide-field Infrared Intensity and Polarization Observations of the solar corona," using CIRCUS camera, between 1.25 and 4.8 microns.

#### February 1991 "Dry Run" with Final Instrument Arrangements

Instrument designs during 1990 evolved to final configurations considerably different in both cases. The PF solar camera that arrived in late January 1991, now included not one wide-field cine-camera, but instead, 4 different narrow-field cameras, each positioned around or near the solar limb. This arrangement was tested during a two-night Engineering Run, February 4-5, 1991, using for light sources, a waning moon, Saturn and stars. Focussing methods, pointing accuracy, and expected image spatial resolution were confirmed, and real and potential problems were identified with telescope logistics, equipment, experimenters, and operating staff. The following six months were used to solve or circumvent most such areas.

#### Telescope, Instrument & Operations

At the ground level, one last-minute change was made to the infrared experiment, using J. Kuhn's new IR detector and camera, instead of CIRCUS. In addition, a 3-m celeostat, with radially graded filter and a film plate camera, were installed in the Hatchway, with a smaller 1-m focal length system providing the feed to a polarization experiment run by L. November. Finally, at ground level, near the edge of the cinder cone, Jean Moet operated Super-VHS Sony video camera, lined up on the sun, obtained the images used by the telescope control room for eclipse event timing. In addition, the video recordings have since been copied to give us spectacular sequences before, during and after totality, especially of the moon's shadow racing eastwards towards the mainland.

CFHT operated a small experiment, adjunct to the 3.6 meter, mounting an 11-inch Celestron telescope on the Caisson Centrale, together with a CCD camera, to try to obtain simultaneous eclipse and star fields during totality. Although not fully successful, the images obtained were very helpful in diagnosing some of the Koutchmy camera results.

Observations of the total Solar Eclipse with the 3.6m "(extra) galactic" CFH Telescope clearly presented some challenges. To begin with, even a 99% eclipsed Sun was still able

to fry the wide-field-corrector and the instruments. Moreover, the Sun elevation of  $21^{\circ}.4$  was very low and precluded a reliable use of the primary mirror cover, which already had rather slow 15-second opening or closing time. We thus developed a quick-acting manually-operated "Solar Shutter," with the help of Hood Sailmakers furling gear, to prevent unexpected sunlight on the primary mirror and to ensure safety to the PF cage instruments. In addition, we decided to use a blind offsetting technique: fortunately, a bright ( $m_v = 3.7$ ) star,  $\delta$  Geminorum, happened to lay very close to the Sun and was indeed to be used as a reference star for speckle work, by the Hamamatsu video camera. To begin, therefore, we decided to guide on another bright star, at a similar elevation and an azimuthal difference  $\sim 90^{\circ}$ , until  $\sim T_2 - 5$  minutes, and then offset to  $\delta$  Gem. This gave some hope of achieving the final centering just at the beginning of the observations, and even of tweaking the focus if needed. As the real timing of a Solar Eclipse is always some seconds off from the official one, we got a permanent monitoring of the Sun with a video camera, courtesy M. Jean Moet, which would be used for the GO and STOP marching orders.

### **Final & Only Performance: 06:30-08:30 AM, July 11, 1991**

The actual sequence, with a few surprises in store, went approximately as follows:

**$T_2 - 109$  minutes.** Sunrise, gorgeous aesthetically, disgusting on the astronomical point of view (Pinatubo haze + high altitude cirrus + close-by rolling fog). Elevator and phones disabled to avoid interferences.

**$T_2 - 90$  minutes.**  $\beta$ Orionis ( $m_v = 0.14$ ) star acquired at the center of the Hamamatsu. Telescope guiding, with rather large corrections (low elevation!).

**$T_2 - 65$  minutes.**  $\beta$  Orionis disappears. Due to the increased brightness of the day sky, related to the Pinatubo cloud, compounded by the absence of gain control on the Hamamatsu.

**$T_2 - 50$  minutes.** After some minutes of intense thinking, offsetting of  $\beta$  Orio from the Hamamatsu to the Sony video camera, which has gain control. Just succeeded, as the star appears at the corner of the 1 arcmin field!

**$T_2 - 16$  minutes.** Re-offsetting of  $\beta$  Orio to the Hamamatsu, with the hope that it would be in the field and that the sky is dark enough to avoid target saturation. Fully successful!

**$T_2 - 12$  minutes.** Fog begins to roll inside the dome.  $\beta$  Orio momentarily lost. This eventuality had been discussed previously, and we took the agreed upon action: None.

**$T_2 - 6$  minutes.** Solar Shutter in place. Telescope, then dome, offsetted to the position of  $\delta$  Gem.

**$T_2 - 1$  second.** Final GO. Solar Shutter opened in 3.5 (estimated) seconds!  $\delta$  Gem (barely) visible near the center of the field of the Hamamatsu. Any idea of adjusting the focus quickly forgotten. All instruments working.

**$T_2 + 120$  seconds.** Rotation of the Bonnette  $\sim 25^{\circ}$ . The Sony video camera crosses the solar chromosphere.

**$T_2 + 242$  seconds.** Final STOP. Solar Shutter closed in place in less than 2 seconds! Telescope and dome sent on runaway.

**PAU for over 250 years.**

## Summary

On the 5th Floor, the team members had visual contact, so to speak, with the eclipse process. The buildup, during partial phase, was unexciting, except when foggy cloud banks rolled up from the south to cover the summit, drifting into our dome at  $T_2 - 5$  minutes. But, at the instant of totality, everything changed. A truly all-encompassing feeling of other-worldliness, never before experienced; this totally black spot in the sky, surrounded by intense white-pink-green pulsating light: these were definitely not our well-know friends: the sun and moon! They were new, strangely different apparitions, not even disguises. For four minutes, vocabularies compressed to one quiet, drawn-out, breathless phrase..... "wo..ow!" The spectacular finale, the sparkling diamond-like Bailey's beads, came much too soon, as we averted our eyes, our telescope and the dome.

*G. Monnet & J. Sovka*

## On-Line Pre-Processing

The on-line pre-processing scheme developed at CFHT by the software group (with the help of the French cooperant E. Vallauri) has been first inaugurated during the last November '91 FOCAM run. The observers and CFHT staff were very pleased with the performance of the scheme. A complete description has been published in the CFH Bulletin No.25 (I 1991).

*The Editor*

## User's Coordinate Lists Via E-Mail

We have received many requests from observers who want to transmit their lists of objects to CFHT in advance of a run, and have them available on line during the run. We have been accommodating a few observers who had enormous coordinate lists, but this took a lot of manual work. A complete, automatic system of handling mailed observer coordinate lists will be available in TCS IV, but that is still well in the future.

To accommodate current requests, a limited, interim system has been developed on TCS III. It still requires manual intervention, as the HP 1000 systems are not on the ethernet. However, the amount of work is very small, and quite acceptable.

The system stores coordinate lists in named files with a capacity of 500 stars. Multiple files may be used by an observer. The e-mail data must be in an exact format, and is semi-automatically converted to the internal format of the TCS III. The observer and telescope operator will be presented with a printout of the file contents and object numbers, which are needed to access the objects at the telescope. Coordinate files may be kept between runs, although this cannot be guaranteed. Once the data on the system, the files may be updated, or added to as needed. Unfortunately, this can only be done by the T.O., as the data is only available on the TCS III HP 1000 computer system. Also, there is no provision for retrieving updated, or newly created lists.

A complete description of the system is available for those observers interested in making use of the facility. The best contact is the staff astronomer assigned to support your observing run.

*W. Cruise and M.J. Link*