

# RECENT TECHNICAL ACTIVITIES

## July 1990 Telescope Shutdown

Summer 1990 at CFH Telescope has been a busy one, seeing the completion of a number of important projects, and the continuation of others. Planning and scheduling of the shutdown activities carried on for almost one year. Meanwhile, actual engineering on components and systems continued in parallel. Not to diminish their importance nor the different scales of effort required, the following lists the achievements that were brought together just prior to and during the July 1990 shutdown period:

1. The new f/8 secondary cell, designed here and machined in Los Angeles, was fitted up and behaved flawlessly.
2. Both major mirrors, the 3.6 m primary and the 1.5 m secondary, were realuminized.
3. The old grey epoxy layer of the observatory (5th floor), was stripped, resurfaced and newly painted. Also, mezzanine walls, the dome rails and bogie assemblies, and the electrical bus bar screens were all cleaned and painted.
4. The 4th floor Computer Room was renovated, reorganizing hardware, streamlining or eliminating cabling, improving AC power supply, and making the layout more efficient.
5. Cassegrain Bonnette electronics upgrades and documentation were completed.
6. The IR upper end and chopping secondary servo mechanism were disassembled, repaired, modified and tested.
7. Primary mirror support pads were removed from the cell, disassembled and all 24 neoprene diaphragms replaced. Mauna Kea's high altitude conditions are very damaging to rubber components; even though not under operating stress. Now such components are stored at Waimea, under dry, dark, controlled circumstances.
8. The primary mirror outer perimeter baffle was replaced.
9. The outer (rotating) dome and lower stationary building were cleaned and painted, now sporting a spectacularly bright, even white coat. The local painting contractors are to be commended for their ingenuity, perseverance and skill.

For Summer 1990, all in all, a very productive and successful outcome. Thanks to all for their many hours of hard work, and extra efforts to help in achieving our objectives.

*Jerry Sovka*

## Mercury Spill at CFHT

On September 21, 1990, 15:00 hrs, the CFH Telescope was declared officially "closed," thereby beginning an unexpected, emergency shutdown due to a mercury spill of about 250 ml of mercury escaping from a puncture in the f/8 secondary mirror radial support system rubber tube. The subsequent

investigations into the extent of mercury migration and catastrophically damaging reactions between mercury and aluminized mirror surfaces, the cleanup equipment and procedures, the follow up occupational health and safety issues, all have provided us with a new knowledge data-base. The impact upon our operations, in man-hour-efforts, real and hidden costs, etc., from what seemed to us, a well-contained benign source, has convinced us that we wish not to repeat such an event. Furthermore, we believe that other observatories or laboratories may benefit from our hard-won expertise: liquid mercury, even in such "small" quantities as 100 milliliters, needs to be treated with great respect and utmost vigilance.

The f/8 secondary cell replacement project, approved in late-1988, had the objective to eliminate air leaks in the vacuum boundary, to stiffen the structure and to allow quicker more predictable assembly of the unit after aluminizing. A key element in the concept remained the use of the Perkin-Elmer designed mercury-filled rubber toroid that provide the mirror radial support forces when the cell was non-horizontal. This bicycle tube was held captive in two machined grooves: one around the 1.55 meter diameter mirror and an opposite one in the outer steel cell assembly. All tests indicated that performance was better than design predictions.

### Sequence of Events

1. On the night of Sep 2/3, telescope pointing was lost briefly, but regained after re-initializing TCS. We now believe this was the initial puncture of the rubber tube. As the telescope was moved around in dec and alpha, the radial support forces on the steel inlet tube cut through the rubber, and pressured small amounts of mercury to escape. The secondary mirror was thus slightly loose.
2. Over the next two weeks, Sep 10-18, there were a variety of unexplained pointing and secondary support indicators, which were (incorrectly) diagnosed as due to vacuum leaks in the valves to the cell.
3. On Thursday morning, Sep 20, mercury drops were detected under the telescope west beam. To determine the extent of the damage, it was necessary to take the f/8 upper end off the telescope. No observing that night.
4. On Friday, Sep 21, we installed the prime focus upper end as a backup observing program, for one night. During the day, f/8 cell was disassembled, the hole in mercury tube found and other traces of mercury on the telescope were noted. The critical factor was that about 75% of the primary mirror aluminized surface was damaged, (see Figure 9). At 15:00 hours, the decision was announced that the observatory was closed until further notice.
5. A fact-finding and planning meeting held 08:00 hrs, Sat., with a summit inspection in afternoon. Full protective measures against mercury vapor or liquid exposure or contamination of personnel were implemented. Inspection of telescope and building confirmed extensive spread of fine mercury mist droplets