90prime: A Prime Focus Imager for the Steward Observatory 90-inch Telescope

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90prime
Steward Observatory

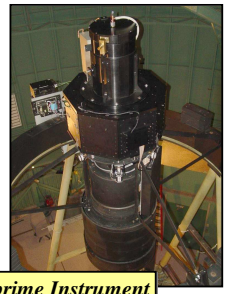
Abstract

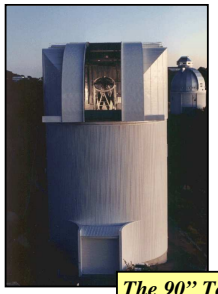
Steward Observatory is currently commissioning a prime focus wide-field imager for the 90-inch telescope located at Kitt Peak. The camera's focal plane array is populated with a mosaic of four thinned Lockheed 4096 x 4096 pixel CCDs. The f/2.98 system provides a plate scale of 0.45"/pixel and a total field-of-view of 1.16˚ x 1.16˚. The optical design includes a four element corrector and six position filter wheel. The first science run was conducted in November 2003. We will describe the design of "90prime" instrument and results from the commissioning runs.

Instrument Characteristics

Focal Ratio: f/2.98 (f/2.67 uncorrected)
Focal Plane Array: 8192 x 8192 pixels
Pixel Size: 15 µm
Total FPA Area: (138.16 mm)^2
Inter-CCD Gap: 15.76 mm (~1050 pixels)
Active Focal Plane Area: (122.40 mm)^2

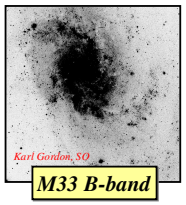
Plate Scale: 30.2"/mm
Full Field-of-View: 1.16˚ x 1.16˚
Pixel Scale: 0.45"/pixel
Active Field-of-View: 1.03˚ x 1.03˚


The 90prime Instrument

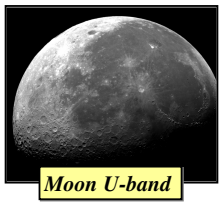

The 90" Telescope

Motivation

Recent advances in CCD technology, computing power, and lens polishing techniques now permit the construction of high efficiency wide-field imagers. The experience of the U of A Imaging Technology Lab and Steward Observatory's Mirror Lab allow Steward to take full advantage of these technological advances. The 90prime instrument utilizes an 8k x 8k pixel array with a plate scale of 0.45"/pixel (1.2" typical seeing) which will provide a total field-of-view of 1.16˚ x 1.16˚ or an area 150 times larger than the current facility imager. The prime focus imager will substantially increase the capability of this 2-m class telescope.



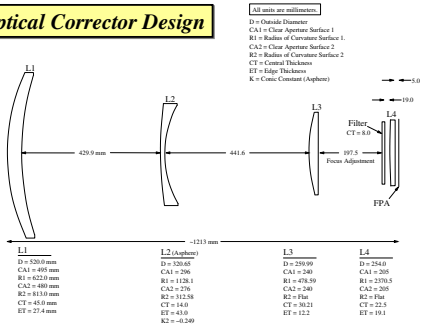
M33 B-band


Moon U-band

Current Use

Shared-risk observing with the 90prime instrument began in November 2003. Observers from Steward, UA Planetary Sciences, ASU, and NAU have been awarded time. The instrument was scheduled for 49 nights between January and July 2004. The images to the left were obtained during some of the engineering and shared-risk time.

Optical Corrector Design



Instrument Components

Dewar
Infrared Labs Cryogenic Dewar
23 Liter LN2 Capacity
48 Hour Hold Time

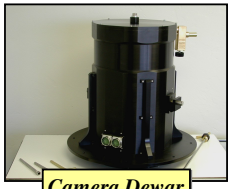
CCD Mosaic Camera
8k x 8k Pixel Array
Four Thinned 4k x 4k Arrays
Lockheed CCD4185 Chips
4 amps/chip (2 currently used)

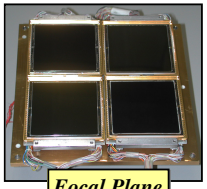
CCD Electronics
8 Channel Generation III SDSU Controller
50 s Readout
~12 e$^-$ Readnoise

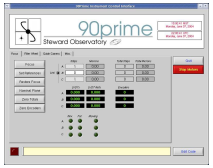
Top Box
200 mm x 200 mm Slit Type Shutter
1% Homogeneous Exposures > 0.1s
Six Position Filter Wheel
SO Guide Camera 4' x 4' FOV and Filters

Optics and FIlters
4 Element Corrector
Bessell UBVRI
SDSS u', g', r', i', z'
Washington C, M, DDO51

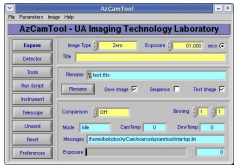
Software Interface
Galil Motion Controller
Low Level Motion Routines
National Instruments LabVIEW
AzCAM Tool


Camera Dewar


Focal Plane

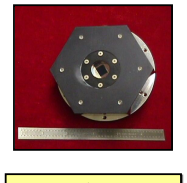


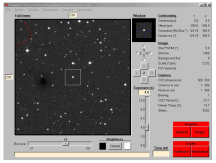
90prime Main GUI

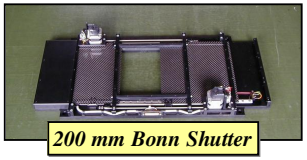


AzCam Tool Main GUI

Six Position Filter Wheel


SO Guide Camera


SO Guider GUI


200 mm Bonn Shutter

http://compton.as.arizona.edu/90prime/index.html