WIDE FIELD OPTICAL IMAGING AT CTIO

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1. Introduction

The CTIO 4-m and 0.6/0.9-m Schmidt telescopes provide a wide-field CCD imaging capability unequalled in the southern hemisphere. Characteristics of present and future CCD imaging systems for these telescopes are discussed.

2. 4-m Telescope and Prime Focus CCD Imager (PFCCD)

An on-going program of optical, thermal and electronic upgrades have substantially improved the performance of the 4-m telescope. At prime focus, images with FWHM as small as 0.65″ have been recorded, and 0.8–1.0″ is common. The PF corrector (Ingerson 1996 *in preparation*) is a 6-element design incorporating two rotating elements which provide atmospheric dispersion correction. The unvignetted field is 48′ in diameter, with d70 image quality of 0.20″ on-axis, and 0.45″ at the edges, and is useable from 3,400–11,000Å. The PFCCD Imager uses a Grade 0, thinned, quad-amp SITe 2048 CCD, covering a 15′ square field at scale 0.43″ pixel^{-1}. An Arcon CCD controller reads out the CCD in approximately 30 seconds. Two filter wheels can each hold up to five 4×4 inch filters, while a low power, fused silica concave lens compensates for the curvature of the CCD. The PFCCD imager is scheduled for approximately 20% of all 4-m nights, and is the most popular dark time instrument.

3. 4-m Telescope and Big Throughput Camera (BTC)

The BTC, built by A. Tyson (Lucent Technologies) and G. Bernstein (U. Michigan) contains four thinned SITe 2048 CCDs, plus all readout electronics and a Sparc 10 computer with fast disk and tape (DLT) drive. In

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combination with the 4-m telescope it is the highest throughput CCD imager in the world, and the only one to use thinned CCDs. Field size is four times that of the PFCCD, at the same scale. The BTC mounts at the 4-m PF, behind the ADC corrector. It contains a fast "focal plane" shutter and a filter bolt which holds four 6×6 inch filters. The CCDs live in a large dewar behind lenses which correct for their curvature. Since the CCDs are mounted in standard packages they are not butted together, and there is a "cross-shaped" band approximately 16 mm wide between CCDs. Normal operation is to take many exposures in a shift-and-stare mode, to produce a large, panoramic picture with no gaps, however this is not essential. BTC will be available to visitors as a supported-instrument from February 1997.

4. 4-m Telescope and NOAO Mosaic Imager

The NOAO MOSAIC imager is a joint project between NOAO-Tucson and CTIO. The detector array will initially consist of eight butted Loral 2K×4K's, these CCDs have not been thinned owing to the very low yield of the foundry runs. The Loral's will be replaced with thinned SITe 2K×4K's in late 1997. Both arrays give a field size of 38′ square, at a scale of 0.27 arcsec pixel^{-1}. The imager is read out by four Arcon CCD controllers, read time is 80 seconds for the Loral CCDs which each have only one operative amplifier. A Sparc 20 is used for instrument control, with a very powerful Sparc Ultra for image processing and display. It will be possible to display simultaneously, using two separate screens, a binned version of the full 8K×8K image and any 1K×1K section at full resolution. A large filter track holds 14 filters, and there is a fast "focal plane" shutter, plus two guide cameras. The instrument will be operated at KPNO in 1997 and at CTIO from late 1998.

5. 0.6/0.9-m Curtis Schmidt Telescope

Over the past four years the CCD imaging capability at the Newtonian focus of the Schmidt telescope has been steadily improved. The detector is a STIS (Tek) 2048, which gives a field 68′ square at a scale of 2.0 arcsec pixel^{-1}. This is a front-illuminated CCD, coated with Metachrome to provide some UV and blue sensitivity, and is read through all four amplifiers by an Arcon CCD controller. A five position filter bolt holds 4×4 inch filters, both this and the focus are under computer control. A planned detector upgrade (1998?) is to install a "mini-mosaic," consisting of 2 butted 2K×4K SITe CCDs. This would double the QE, increase the field size to 85′ square, and provide better sampling of 1.25 arcsec/pixel.