

Performance of the Digital Science Partnership Remotely-Operated 0.5-Meter Corrected Dall-Kirkham Telescopes

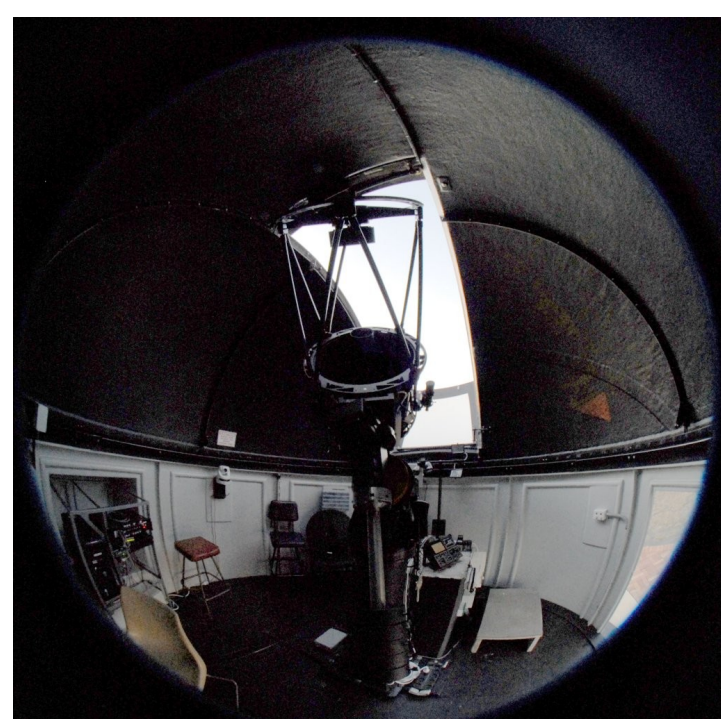
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OVERVIEW

The Digital Science Partnership is a collaboration between the University of Louisville and the University of Southern Queensland to develop remote and robotic astronomical instrumentation and software, primarily for education, student research, and teacher training. Users include students at USQ and UofL, K-12 teachers seeking professional development, and students and teachers visiting planetaria at the University of Louisville and Northern Kentucky University. Two instruments are now in operation – identical 20-inch (0.5-meter) corrected Dall-Kirkham telescopes on substantial German equatorials.

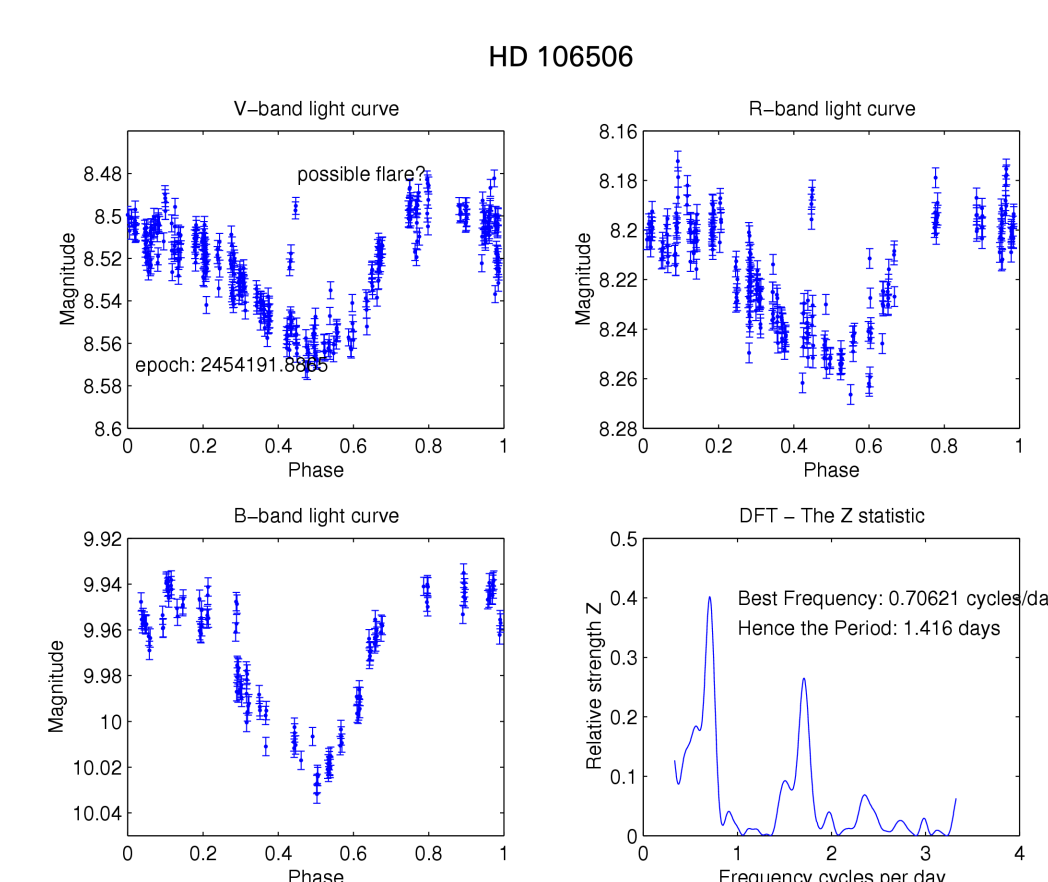


Exterior and interior views of the Louisville Telescope dome at Mt. Kent Observatory



IMAGING AND PHOTOMETRY

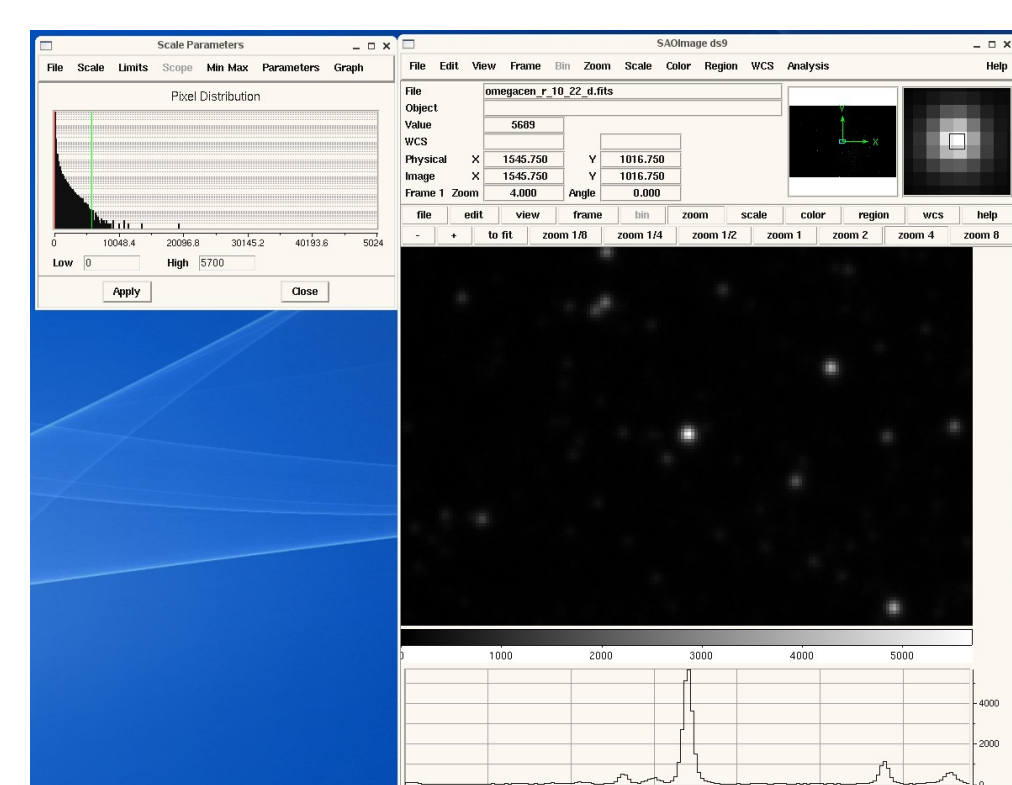
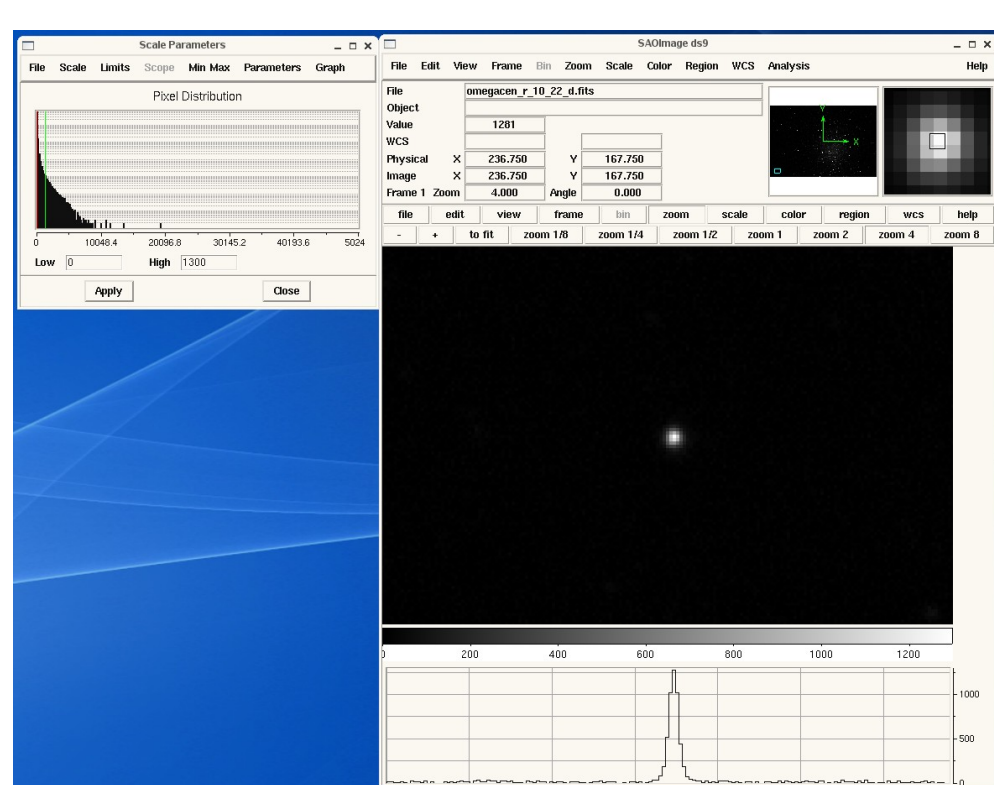
The telescope's optical stability, wide field of view, and flat distortion-free focal plane enable accurate photometry in conventional guided and drift scan or time-delay integration imaging.



Left: Photometry of the young solar-type star HD 106506 from autoguided images. With $v \sin(i) \sim 81$ km/s, its rotation period of 1.41 days is detected in the light curves. Right: M42 from a 3072x10240 pixel TDI image with I, R and V photometric filters. The field shown here is 0.46 degrees square with an exposure time of 73 seconds.

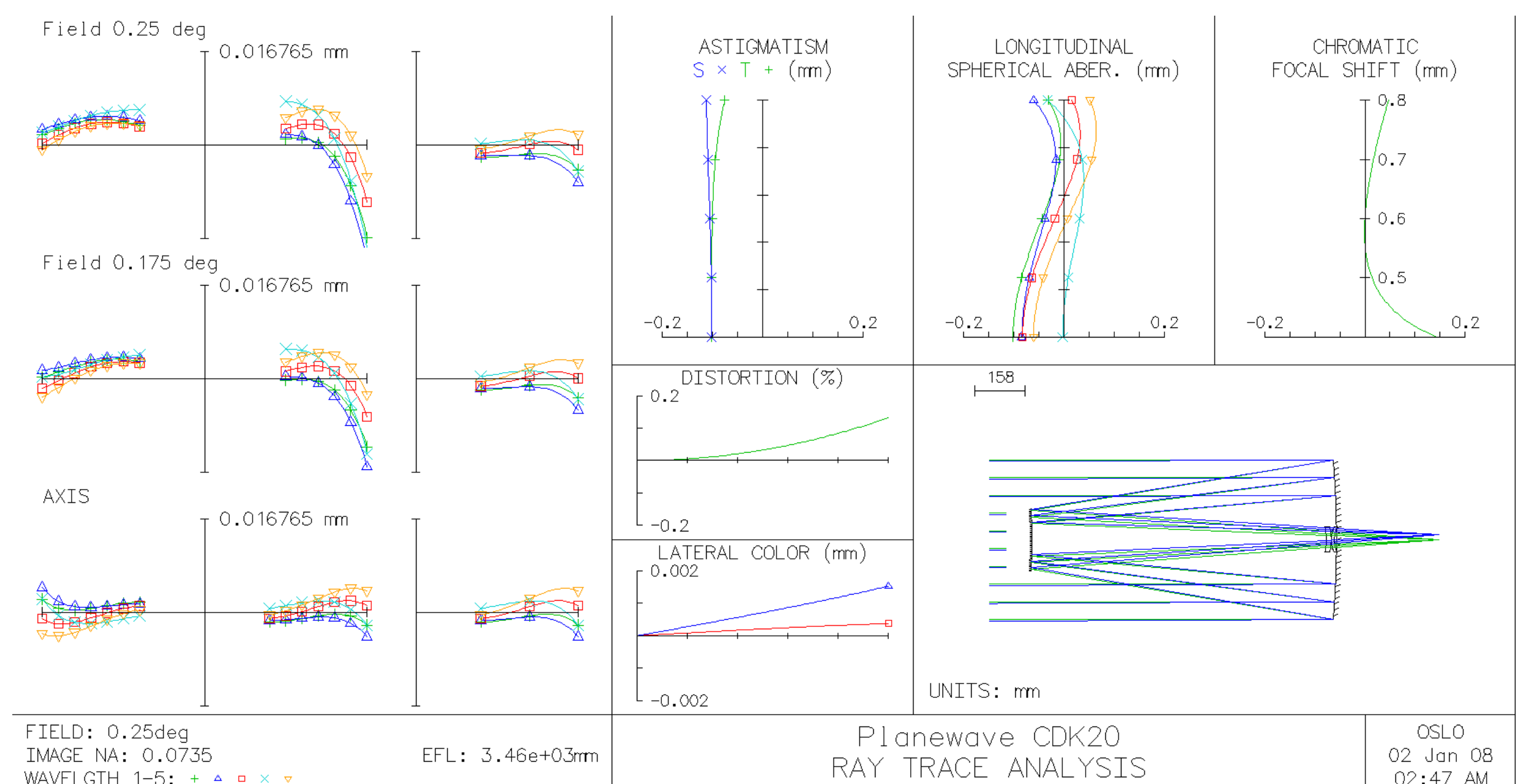
CDK20 OPTICAL SYSTEM

The telescopes were designed by Joe Haberman and Rick Hedrick and are now manufactured commercially by Planewave Instruments. They are light-weighted with a tapered Pyrex primary, a carbon composite truss, and machined aluminum frame. We have seen no significant nighttime thermal drift, and very rapid equilibration to ambient temperatures after sunset.



In this 10-s R-band exposure of Omega Centauri, stellar images off- and on-axis have identical appearance and are seeing limited at 1.5 seconds of arc full width at half maximum. The STL6303E CCD camera has 3072x2048 0.5'' pixels with a field of 27.5'x18.3'.

ANALYSIS



The corrected Dall Kirkham design uses an ellipsoidal primary, spherical secondary, and doublet corrector. Ray tracings shown here are based on "as-manufactured" parameters for our telescopes. They predict diffraction limited images with insignificant chromatic aberration from 400 to 750 nm.

LIVE REMOTE OBSERVING

The remote observing system is based on Open Source software that runs under Linux:

XmTel and XmCCD: provide telescope and camera control through through clients that connect to servers at the telescope. With an XML "INDI" communication protocol tunnelled through Secure Shell, the remote clients are responsive and effectively mask network latencies. The dome rotation is encoded with RFID tags for absolute azimuth readout.

XEphem: used with XmTel adds an interactive star chart with access to extensive databases to the user interface.

Teleconferencing: Polycom and Tandberg systems offer full H.323 teleconferencing to remote users using similar hardware or open source software such as Ekiga (Linux and Windows) and XMeeting (OSX).

Network: Internet2 provides a highspeed connection with dependable quality of service. The I2 connection extends statewide in Kentucky to the public school system, and access for students in grades 5-12 and their teachers is currently offered on a trial basis. Introductory Astronomy undergraduate students at the University of Louisville use the remote observing facility to provide hands-on experience and learning through discovery in daytime and evening classes.

FURTHER INFORMATION

Southern Skies Digital Science Partnership

Moore Observatory

<http://www.astro.louisville.edu>

Mt. Kent Observatory

<http://orion.mko.usq.edu.au>

Remote Access to Mt. Kent Observatory in Queensland Australia

<http://www.astro.louisville.edu/mtkent/remote>

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