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**BAADER PLANETARIUM** GMBH

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Founded in 2006, **PlaneWave Instruments** is committed to providing observatory-class products for serious astronomers at an unprecedented value. Developed by PlaneWave, the CDK (Corrected Dall-Kirkham) is a revolutionary telescope, its optical system was designed to excel at imaging on large format CCD cameras while remaining an excellent instrument for visual use.

Created to meet the demands of both the serious imager and visual observer, the CDK is offered at an unprecedented price/performance ratio for a telescope of this quality and aperture. One advantage of the CDK design is its ease of collimation and achievable centering tolerance for a telescope of this class. This assures that the user will get the best possible performance out of the telescope. The end result is a telescope which is free from off-axis coma, off-axis astigmatism, and curvature of field, yielding a perfectly flat field all the way out to the edge of the largest CCD sensors available today. Today PlaneWave makes a full line of CDK and Ritchey-Chrétien (RC) telescopes as well as imaging and observatory class mounts to provide complete imaging systems for both individuals and industry.

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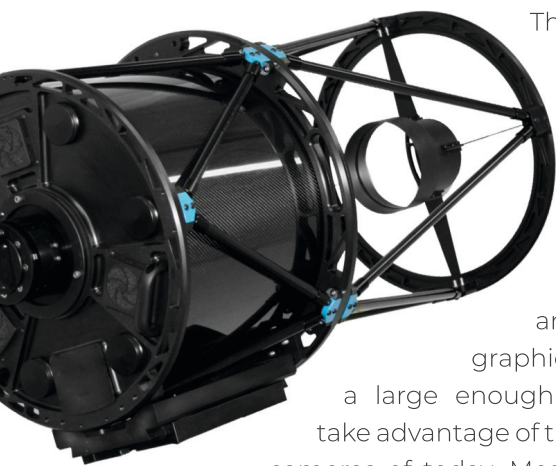
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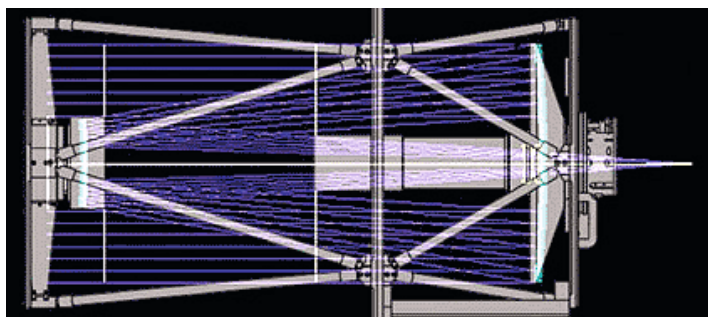


## THE OPTICAL DESIGN OF CDK ASTROGRAPHS

*Shown on the example of CDK20 Astrograph*



The CDK [Corrected Dall-Kirkham] telescope is based on an optical design developed by Dave Rowe. The goal of the design is to make an affordable astrographic telescope with a large enough imaging plane to take advantage of the large format CCD cameras of today. Most telescope images degrade as you move off-axis from either coma, off-axis astigmatism, or field curvature. The CDK design suffers from none of these problems. The end result is a telescope which is free from off-axis coma, off-axis astigmatism, and curvature of field, yielding a perfectly flat field all the way out to the edge of a 52mm (respectively 70mm on most other CDK-optics) image circle. This means pinpoint stars from the center out to the corner of the field of view.



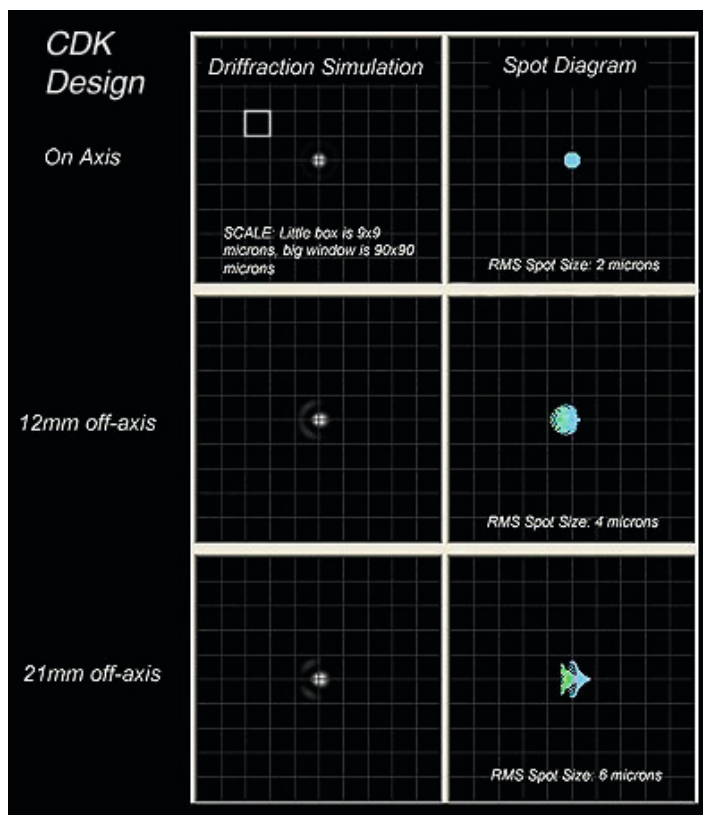
The design is a simple and elegant solution to the problems posed above. The CDK consists of three components:

- an ellipsoidal primary mirror,
- a spherical secondary mirror
- and a lens group.

All these components are optimized to work in concert in order to create superb pinpoint stars across the entire 52 to 70mm image plane.

### OPTICAL PERFORMANCE

The following graphic shows two simulations showing the CDK's stunning performance. The first is a **diffraction simulation** and the second is a spot diagram. In the diffraction simulation the star images on axis and off-axis are nearly identical. In the spot diagram 21mm off-axis the spot size is an incredible 6 microns RMS diameter. For 26mm off-axis, a 52mm image circle, the RMS spot size is 11 microns. This means the stars across the entire focal plane are going to be pinpoints as small as atmospheric seeing will allow. Both of the simulations take into consideration a flat field, which is a more accurate representation of how the optics would perform on a flat CCD camera chip.



For visual use some amount of field curvature would be allowed since the eye is able to compensate for a curved field. The diffraction simulation was calculated at 585nm. The spot diagram was calculated at the RGB wavelength, respectively at 720-, 555- und 430nm. Many companies show spot diagrams in only one wavelength, however to evaluate chromatic performance multiple wavelengths are required.



## COMPARISON: CDK VS. RITCHIEY CHRÉTIEN

The simulation below compares the optical performance of the CDK design to the Ritchey Chrétien (RC) design. The RC design was popularized as an astroimaging telescope due to its use in many professional observatories. Although very difficult and expensive to manufacture and align, the RC is successful in eliminating many of the problems that plague many other designs, namely off-axis coma. However the RC does nothing to eliminate the damaging effects of off-axis astigmatism and field curvature.

The CDK design tackles the off-axis coma problem by integrating a pair of correcting lenses into a two mirror design. The beauty is that this design also corrects for astigmatism and field curvature. Because the lenses are relatively close to the focal plane, and because these lenses work together as a doublet, there is no chromatic aberration. The CDK offers a wide aberration-free, flat field of view that allows the user to take full advantage of the very large imaging chip cameras in the market place today.

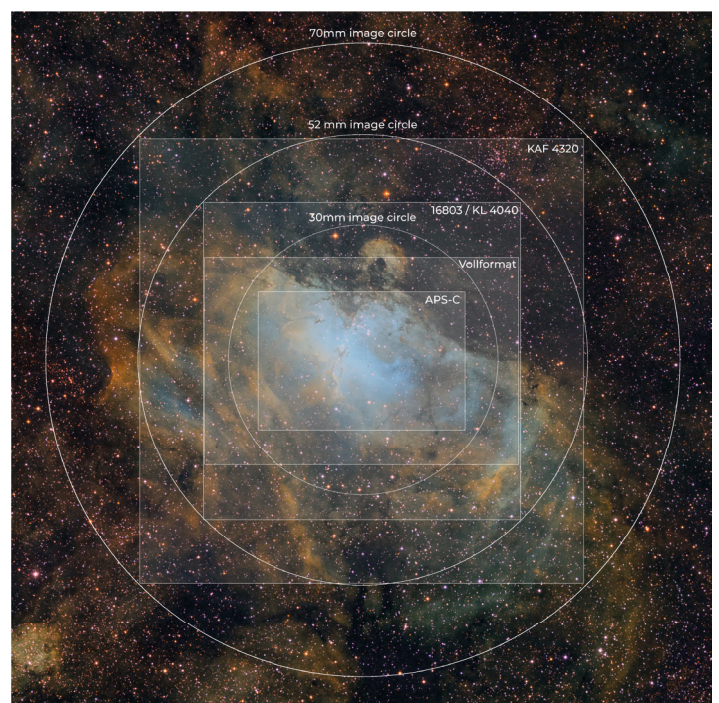
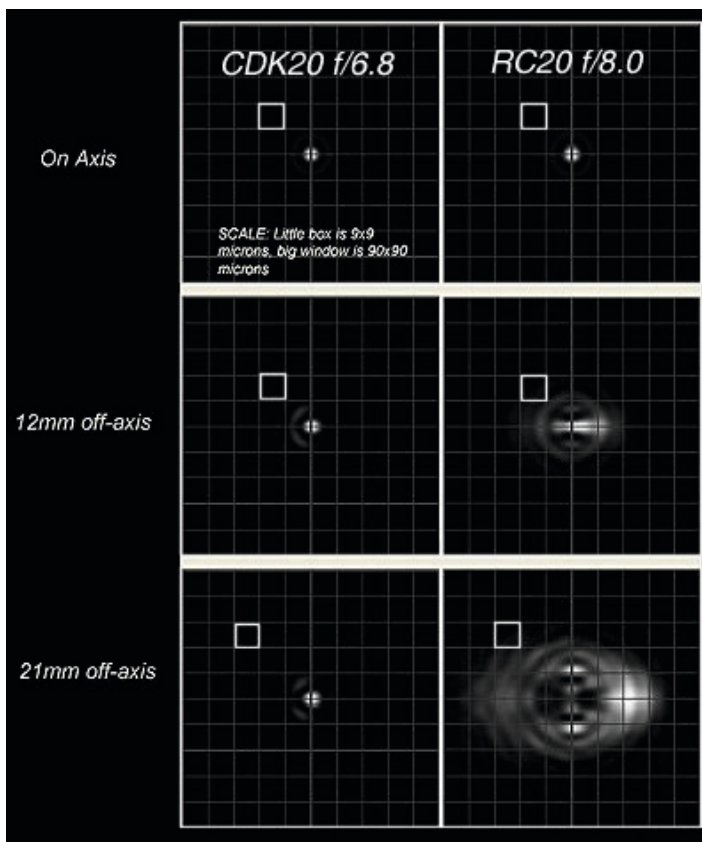
Having an aberration free telescope design means nothing if the optics cannot be aligned properly. Many RC owners never get to take full advantage of their instrument's performance because the RC is very difficult to

collimate. Aligning the hyperbolic secondary mirror's optical axis to the optical axis of the primary mirror is critical in the RC design, and the tolerances are unforgiving. The secondary mirror of the CDK design is spherical. It has no optical axis and so the centering tolerance of the CDK secondary mirror is comparatively huge. With the help of some very simple tools, the CDK user will be able to set the secondary spacing, collimate the optics and begin enjoying the full performance potential the instrument has to offer within a few minutes.

**The drastic difference in performance between the CDK and the RC is apparent.** The biggest component that degrades the off-axis performance of the RC is the defocus due to field curvature. In many diagrams shown by RC manufacturers, the diagrams look better than this because they are showing a curved field. This is fine for visual use because the eye can compensate for some amount of curvature of field. But CCD arrays are flat and so in order to evaluate the performance a spot diagrams and/or diffraction simulations requires a flat field as shown.

The small squares are 9x9 microns wide, the individual comparative images are 90 micrometers wide. The spot diagrams were calculated for a wavelength of 585 nanometers.

**Furthermore, please note:** the CDK design is f/6.8, the RC design is f/8. This is not important for stars, but it can easily reduce the exposure time when photographing extended objects like nebulae.

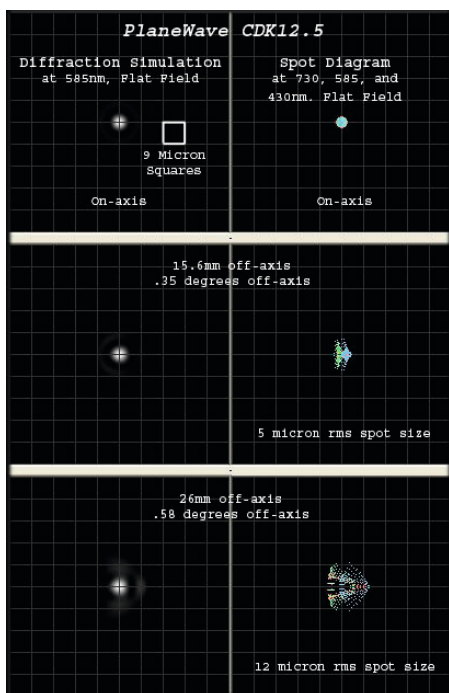






## OPTICAL SYSTEM

|                                   |  |
|-----------------------------------|--|
| Aperture                          | 12.5 inch (318 mm)   |
| Focal Length                      | 2541 mm(100.04 inch)   |
| Focal ratio                       | f/8  |
| Central Obstruction               | 17,64% by surface area;<br>42% of the Primary Mirror Diameter        |
| Back Focus from Mounting Surface  | 10.445 inch (265 mm)   |
| Back Focus from racked-in Focuser | 7.2 inch (183 mm)  |
| Weight                            | 48.5 lbs (22kg)  |
| OTA Length                        | 31 inch (787 mm)   |
| Optical Performance               | 3.8 micron RMS at 13mm off-axis;<br>12.0 micron RMS at 26mm off-axis |
| UpperCage                         | Carbon Optical Tube  |
| Lower Cage                        | Carbon Optical Tube  |
| Optimal Field of View             | 52mm Image Circle  |



## PRIMARY MIRROR

|                  |                         |
|------------------|-------------------------|
| Optical Diameter | 12.5 inch (318 mm)      |
| Outer Diameter   | 13 inch (330 mm)        |
| Shape            | Prolate Ellipsoid       |
| Material         | Fused Silica            |
| Coating          | Enhanced Aluminum - 96% |

## SECONDARY MIRROR

|          |                         |
|----------|-------------------------|
| Diameter | 4.65 inch (118 mm)      |
| Material | Fused Silica            |
| Shape    | Spherical               |
| Coating  | Enhanced Aluminum - 96% |

Prices, further images and technical information in English and German on:

[www.planewave.eu/en/cdk12](http://www.planewave.eu/en/cdk12)

PLANEWAVE **CDK 12,5** IS AVAILABLE IN THE FOLLOWING VERSIONS

WITH  
**FUSED SILICA**  
OPTICS  
#1323212Q

AS DALL-KIRKHAM  
**IRDK**  
INFRARED-OPTIMIZED  
#1323212I



OPTICAL SYSTEM

|                                   |   |
|-----------------------------------|---|
| Aperture                          | 14 inch (356 mm)  |
| Focal Length                      | 2563 mm(101 inch)   |
| Focal ratio                       | f/7.2   |
| Central Obstruction               | 23.5% by surface area;<br>48.5% by diameter                         |
| Back Focus from Mounting Surface  | 11.09 inch (282 mm)   |
| Back Focus from racked-in Focuser | 8.09 inch (206mm)   |
| Weight                            | 48 lbs (22 kg)  |
| OTA Length                        | 35 inch (889 mm)  |
| Optical Performance               | 3.1 micron RMS at 13mm off-axis;<br>6.0 micron RMS at 35mm off-axis |
| UpperCage                         | Carbon Fiber Truss  |
| Lower Cage                        | Carbon Fiber Truss with Light Shroud                                |
| Optimal Field of View             | 70mm Image Circle   |



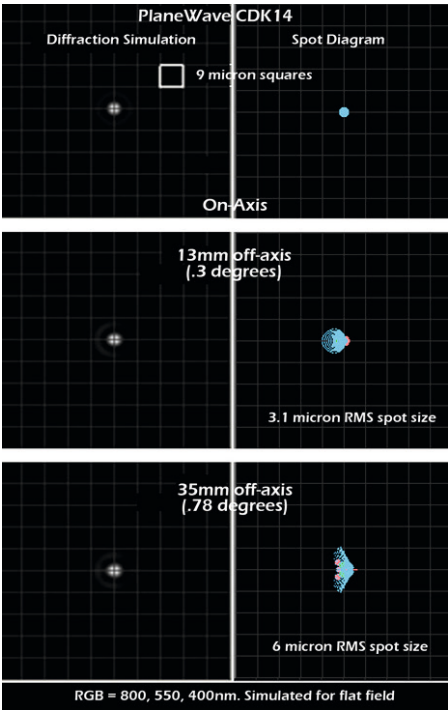
PRIMARY MIRROR

|                  |                         |
|------------------|-------------------------|
| Optical Diameter | 14 inches (355.6)       |
| Outer Diameter   | 14.5 inches (368.3mm)   |
| Shape            | Prolate Ellipsoid       |
| Material         | Fused Silica            |
| Coating          | Enhanced Aluminum - 96% |

SECONDARY MIRROR

|          |                         |
|----------|-------------------------|
| Diameter | 6.5 inch (165 mm)       |
| Material | Fused Silica            |
| Shape    | Spherical               |
| Coating  | Enhanced Aluminum - 96% |

Prices, further images and technical information in English and German on: [www.planewave.eu/en/cdk14](http://www.planewave.eu/en/cdk14)



PLANEWAVE **CDK 14** IS AVAILABLE IN THE FOLLOWING VERSION

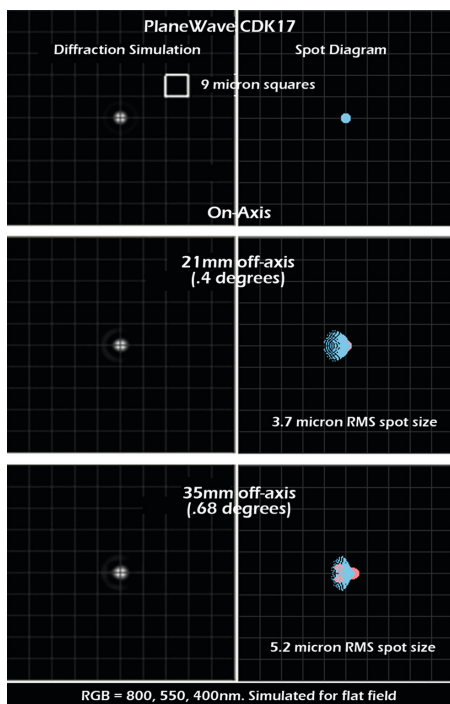
WITH  
FUSED SILICA  
OPTICS  
#1323214Q





## OPTICAL SYSTEM

|                                   |   |
|-----------------------------------|---|
| Aperture                          | 17 inch (432 mm)  |
| Focal Length                      | 2939 mm (115.71 inch)   |
| Focal ratio                       | f/6.8   |
| Central Obstruction               | 23.7% by surface area;<br>48.6% of the Primary Mirror Diameter      |
| Back Focus from Mounting Surface  | 10.24 inch (260 mm)   |
| Back Focus from racked-in Focuser | 7.24 inch (184 mm)  |
| Weight                            | 106 lbs (48 kg)   |
| OTA Length                        | 42 inch (1067 mm)   |
| Optical Performance               | 3.1 micron RMS at 13mm off-axis;<br>6.0 micron RMS at 35mm off-axis |
| UpperCage                         | Carbon Fiber Truss  |
| Lower Cage                        | Carbon Fiber Truss and Light Shroud                                 |
| Optimal Field of View             | 70mm Image Circle   |



## PRIMARY MIRROR

|                  |                         |
|------------------|-------------------------|
| Optical Diameter | 17 inch (432 mm)        |
| Outer Diameter   | 17.5 inch (445 mm)      |
| Shape            | Prolate Ellipsoid       |
| Material         | Fused Silica            |
| Coating          | Enhanced Aluminum - 96% |

## SECONDARY MIRROR

|          |                         |
|----------|-------------------------|
| Diameter | 7.48 inch (190 mm)      |
| Material | Fused Silica            |
| Shape    | Spherical               |
| Coating  | Enhanced Aluminum - 96% |

Prices, further images and technical information in English and German on:

[www.planewave.eu/en/cdk17](http://www.planewave.eu/en/cdk17)

PLANEWAVE **CDK 17** IS AVAILABLE IN THE FOLLOWING VERSIONS

WITH  
**FUSED SILICA  
OPTICS**  
#1323217Q

WITH  
**FUSED SILICA  
AND 8" PLATES FOR  
FORK MOUNTS**  
#1323217FQ



OPTICAL SYSTEM

|                                   |  |
|-----------------------------------|--|
| Aperture                          | 20 inch (508 mm)   |
| Focal Length                      | 3454 mm(135.98 inch)   |
| Focal ratio                       | f/6.8  |
| Central Obstruction               | 15.21% by surface area;<br>39% of the Primary Mirror Diameter        |
| Back Focus from Mounting Surface  | 8.8 inch (223mm)   |
| Back Focus from racked-in Focuser | 5.8 inch (147 mm)  |
| Weight                            | 140 lbs (63.5 kg)  |
| OTA Length                        | 47 inch (1,194 mm)   |
| Optical Performance               | 4.0 micron RMS at 13mm off-axis;<br>11.8 micron RMS at 26mm off-axis |
| UpperCage                         | Carbon Fiber Truss   |
| Lower Cage                        | Carbon Fiber Truss with Light Shroud                                 |
| Optimal Field of View             | 52mm Image Circle  |



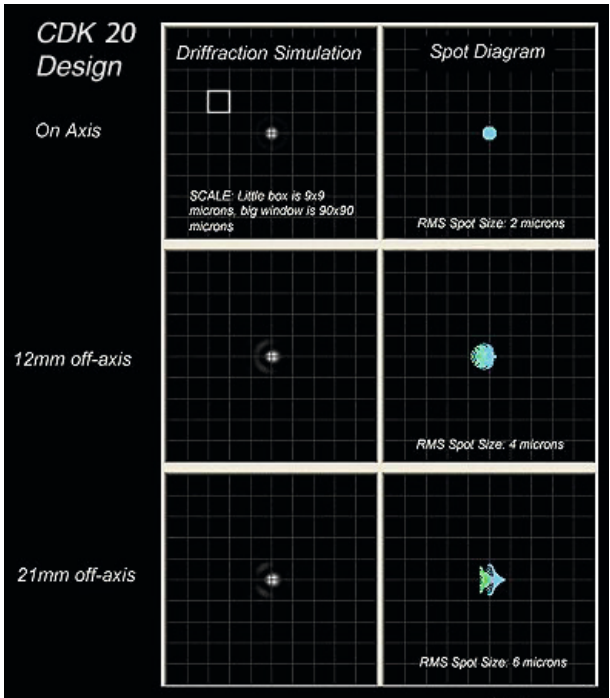
PRIMARY MIRROR

|                  |                         |
|------------------|-------------------------|
| Optical Diameter | 20 inch (508 mm)        |
| Outer Diameter   | 20.5 inch (521 mm)      |
| Shape            | Prolate Ellipsoid       |
| Material         | Fused Silica            |
| Coating          | Enhanced Aluminum - 96% |

SECONDARY MIRROR

|          |                         |
|----------|-------------------------|
| Diameter | 7.5 inch (191mm)        |
| Material | Fused Silica            |
| Shape    | Spherical               |
| Coating  | Enhanced Aluminum - 96% |

Prices, further images and technical information in English and German on:  
[www.planewave.eu/en/cdk20](http://www.planewave.eu/en/cdk20)



PLANEWAVE **CDK/RC 20** IS AVAILABLE IN THE FOLLOWING VERSION

WITH  
**FUSED SILICA**  
OPTICS  
#1323220Q

WITH  
**FUSED SILICA**  
AND 8" PLATES FOR  
FORK MOUNTS  
#1323220FQ

AS DALL-KIRKHAM  
**IRDK**: IR-OPTIMIZED  
W. FUSED SILICA  
#1323270IQ

FUSED  
SILICA  
OPTICS  
#1323221Q

RC

FUSED  
SILICA  
AND 8" PLATES FOR  
FORK MOUNTS  
#1323221Q

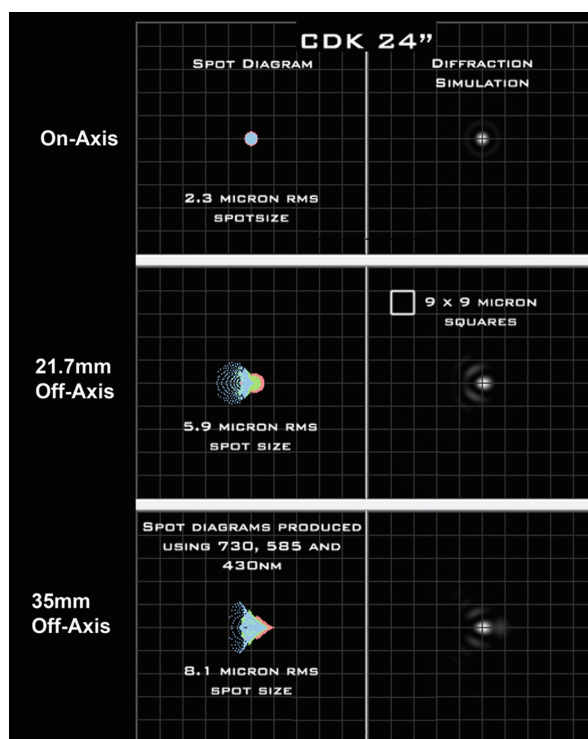
RC





## OPTICAL SYSTEM

|                                   |   |
|-----------------------------------|---|
| Aperture                          | 24 inch (610 mm)  |
| Focal Length                      | 3962 mm (155.98 inch)   |
| Focal ratio                       | f/6.5   |
| Central Obstruction               | 22.09% by surface area;<br>47% of the Primary Mirror Diameter       |
| Back Focus from Mounting Surface  | 14.1 inch (358 mm)  |
| Back Focus from racked-in Focuser | 5.81 inch (148 mm)  |
| Weight                            | 240 lbs (108.9 kg)  |
| OTA Length                        | 56 inch (1,422 mm)  |
| Optical Performance               | 3.1 micron RMS at 13mm off-axis;<br>7.0 micron RMS at 42mm off-axis |
| UpperCage                         | Carbon Fiber Truss  |
| Lower Cage                        | Carbon Fiber Truss with Aluminum Light Shroud                       |
| Optimal Field of View             | 70mm Image Circle   |



## PRIMARY MIRROR

|                  |                         |
|------------------|-------------------------|
| Optical Diameter | 24 inch (610 mm)        |
| Outer Diameter   | 24.5 inch (622 mm)      |
| Shape            | Prolate Ellipsoid       |
| Material         | Fused Silica            |
| Coating          | Enhanced Aluminum - 96% |

## SECONDARY MIRROR

|          |                         |
|----------|-------------------------|
| Diameter | 9.45 inch (240 mm)      |
| Material | Fused Silica            |
| Shape    | Spherical               |
| Coating  | Enhanced Aluminum - 96% |

Prices, further images and technical information in English and German on:

[www.planewave.eu/en/cdk24](http://www.planewave.eu/en/cdk24)

PLANEWAVE **CDK/RC 24** IS AVAILABLE IN THE FOLLOWING VERSIONS

WITH  
**FUSED SILICA OPTICS**  
#1323224Q

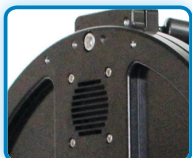
WITH  
**FUSED SILICA AND 8" PLATES FOR FORK MOUNTS**  
#1323224FQ

AS DALL-KIRKHAM  
**IRDK: IR-OPTIMIZED W. FUSED SILICA**  
#1323224IQ

**FUSED SILICA OPTICS**  
**RC**  
#1323225Q



## STANDARD FEATURES FOR ALL CDK TELESCOPES



**COOLING FANS** – Three cooling fans blow air inside the back of the telescope. Internal diverting fans circulate air flow behind the mirror for even cooling to help the telescope reach thermal equilibrium quickly. The fans are controlled with PWI PC software with the optional *Electronic Focus Accessory (EFA Kit)*.



**CARBON FIBER TRUSS DESIGN** – Rigid and lightweight. Minimizes thermal expansion which causes focus shift with changes in temperature.



**DELTA-T READY** – for added dew prevention, the CDKs are internally wired with polyimide film pads and temperature sensors, ready to be controlled with the optional *Delta-T controller*.



**DOVETAIL EXPANSION JOINT** – allows for the difference in thermal expansion between carbon fiber and aluminum. The expansion joint allows the aluminum dovetail to expand and contract without stressing the carbon fiber lower truss.

## RECOMMENDED ACCESSORIES

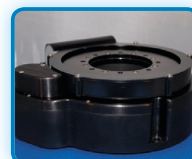
### DELTA-T HEATER (CDK 12,5: #1329112 / 14: #1329110 / 17: #1329117 / 20: #1329120 / 24: #1329124)

- have Full Control of Primary and Secondary Heater using PlaneWave Interface (PWI 3) Software
- Monitor current temperature of primary mirror, secondary mirror and surrounding ambient temperature
- Automatically maintains mirror temperature set point as outside temperature changes
- Displays real time graph of all temperature sensors



### IRF 90 – INTEGRATED ROTATING FOCUSER (#1329070)

Large capacity Integrated Focuser and Rotator. The Focuser is capable of lifting 40 lbs (18 kg) with a range 30 mm (30000 microns). It has a 90mm aperture with a range of 365 degrees with hardstops to eliminate any chance of cord wrap. The IRF90 is compatible with CDK14 – CDK700. It requires a standard Electronic Focuser Assembly (EFA-Kit) and the software PlaneWave Interface and ASCOM drivers.



### 3.5" HEDRICK FOCUSER (#1329050)

Heavy duty no-slip focuser capable of handling an imaging payload of up to 20lbs (9,1 kg). The focus tube runs on 5 bearings and is driven by a leadscrew so there is no chance of slipping. Focus may be automated through a computer using PlaneWave's EFA Kit add-on. The focuser comes with pre-installed motor that can be controlled with the EFA hand control or PWI PC software. The draw tube travel is 1.3 inch.



### EFA KIT (ELECTRONIC FOCUS ACCESSORY)

(CDK 12,5: #1329020 / 14: #1329020 / 17: #1329024 / 20: #1329020 / 24: #1329024)

The EFA Kit automates focusing (on optional Hedrick focuser), monitors temperature (on optional Delta T Dew Heater), and controls fans built-in to CDK telescopes. The EFA control box can be mounted to the back plate of any CDK telescope. The EFA Kit plugs into the temperature sensors and fan control wires that come standard with each telescope. A Hand Control is provided to control a optional Focuser or Rotator when standing at the eyepiece. The EFA kit comes with PlaneWave Interface (PWI), a software package that controls all external devices from a PC. All the cables are provided to attach the EFA kit to a PC. The EFA kit is ASCOM compatible.







Telescopes not included

## MOUNT SYSTEM

|                       |  |
|-----------------------|--|
| Mount type            | Alt-Az or Equatorial configuration   |
| Mount weight          | L-350: 110 lbs (50 kg)<br>L-500: 257 lbs (100 kg)<br>L-600: 338 lbs (153 kg) |
| Payload Capacity (kg) | L-350: 100 lbs (45 kg)<br>L-500: 200 lbs (91 kg)<br>L-600: 300 lbs (136 kg)  |
| Latitude range        | 0 to 90 degrees, Northern and Southern hemispheres                           |
| Cable management      | Equipment cables can be wired through mount                                  |

## MOTION CONTROL

|               |  |
|---------------|--|
| Motor Control | Industrial grade brushless motor control system and built in electronics   |
| Motor         | Azimuth and Altitude: Direct Drive 3 Phase Axial-Flux Torque Motors)   |
| Encoder       | 152mm disk built into the azimuth and altitude axes with stainless steel encoder on the circumference with reader yields 18,880,000 counts per revolution of the telescope. This translates to about 0.069 arcsecond resolution. |
| Motor Torque  | Approximately 20 ft-lbs continuous; 50 ft-lbs peak   |

## CONTROL SYSTEM

|                            |   |
|----------------------------|---|
| Control System Electronics | PlaneWave Interface dual axis telescope control   |
| Software                   | PlaneWave Interface (PWI4). Incorporates PointXP mount modeling software by Dave Rowe All ASCOM compatible. |
| Homing Sensors             | Home position sensors are included allowing the mount can find its home position on power up. (L-500)       |
| Slew speeds                | 20 degrees per second (standard); 50 degrees per second (maximum), both axes                                |
| Power requirements         | Accepts 120 VAC. Supplied with 12VDC 15A Regulated Power Adapter (L-500)                                    |

## SYSTEM PERFORMANCE

|                          |   |
|--------------------------|---|
| Pointing accuracy        | <10 arcseconds RMS with PointXP Model     |
| Pointing precision       | 2 arcsecond                               |
| Tracking accuracy        | < .3 arcsecond error over 5 minute period |
| System natural frequency | 10 Hz or greater                          |

Prices, further images and technical information in English and German on:

[www.planewave.eu/en/l-mount](http://www.planewave.eu/en/l-mount)

PLANEWAVE **L-MOUNT** IS AVAILABLE IN THE FOLLOWING VERSIONS

**L-350**

**DIRECT DRIVE MOUNT**

**PAYLOAD: 100 LBS (45 KG)**

**#1321102**

**L-500**

**DIRECT DRIVE MOUNT**

**PAYLOAD: 200 LBS (91 KG)**

**#1321100**

**L-600**

**DIRECT DRIVE MOUNT**

**PAYLOAD: 300 LBS (136 KG)**

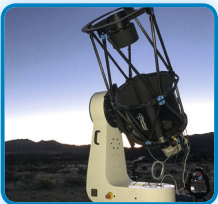
**#1321101**



## PLANEWAVE L-SERIES DIRECT DRIVE MOUNT

The L-Series combines versatility, simplicity and affordability by combining all the technology of our Observatory class telescopes into a compact stand-alone mount. In its Alt/Az configuration it is considerably more compact than its equatorial counterpart, allowing a larger telescope to fit in a smaller enclosure. The mass it takes to make a rigid alt/az mount is substantially less, leading to cost savings. Unlike German Equatorial mounts, there are no meridian flips to deal with, and no large protruding counterweights to create a dangerous hazard in a public observatory. Alt/Az is more intuitive to use and no polar alignment is needed. Besides, it is the way the pros do it!

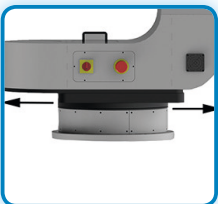
### L-SERIES SPECIAL FEATURES



**INCREDIBLE SLEW SPEED** – The direct drive motors can move the telescope at speeds up to 50 degrees per second for tracking satellites or just to minimize target acquisition time.



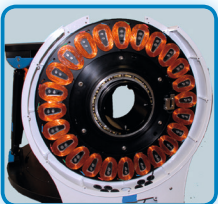
**DUAL MOUNTING BRACKET** – PlaneWave style mounting bracket to hold CDK17/20 onto inside of fork arm with additional option of mounting a scope on the outside of the fork arm. Optional dovetail clamp required.



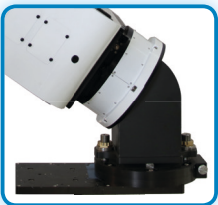
**AZIMUTH DOVETAIL BALANCE SYSTEM** – For precise center of gravity balance whether in Alt-Az or Equatorial configuration.



**THROUGH THE MOUNT CABLING** – Access panels in the fork arm and azimuth axis allow for camera equipment cabling through the inside of the mount.



**DIRECT DRIVE MOTORS AND ENCODERS** – no gears to cause backlash and periodic error. With high-resolution encoders providing the feedback for the direct drive motors, not only will the telescope track without periodic error or have any backlash at all, but the mount will be able to counter against wind gusts. The direct drive motors can move the telescope at incredible speeds for tracking satellites or just to minimize target acquisition time.



**OPTIONAL: POLAR WEDGES FOR ALL LATITUDES AVAILABLE** – Add to the versatility of your L-Series Direct Drive mount with PlaneWave's EQ-wedge for precise polar alignment and tracking accuracy. Each wedge is made for your specific latitude and has an alignment range of  $\pm 3$  degrees. Uses oversized fine thread adjustment screws and brass tightening nuts for fine latitude adjustment.

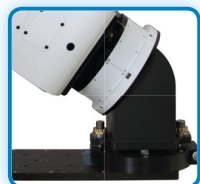




## OBSERVATORY TELESCOPE (MOUNT & OPTICS)

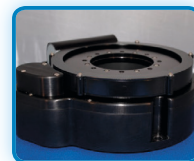
Set consisting of:

- **CDK14**, 14 inch (0.35 m) f/7.2 Corrected Dall-Kirkham Astrograph. The telescope features 3 cooling fans ejecting air from the back of the telescope. *More Information on [page 7](#)*
- **L-350 Direct Drive Mount**, with 100 lbs (45 kg) loading capacity. Incredible slew speed, dual-mounting options, Azimuth dovetail balance system, through the mount cabling, Direct-Drive motors/encoders and much more. *More Information on [pages 12/13](#)*



- **Optional: Polar Wedge** – for precise polar alignment and tracking accuracy. Each wedge is made for your specific latitude and has an alignment range of +/- 3 degrees. *More Information on [page 13](#)*

- **Optional: IRF 90** – Integrated rotating focuser. Large capacity Integrated Focuser and Rotator. The Focuser is capable of lifting 40 lbs (18 kg) with a range 30 mm (30000 microns) *More Information on [page 11](#)*



### CDK FEATURES:

see CDK 14 (p. 7) and Standard Features for all CDK's (p. 11)

### MOUNT FEATURES:

see L-Mount Special Features (p. 13)

- **Optional: EFA Kit** (Electronic Focus Accessory). This Kit automates focusing (on optional Hedrick focuser), monitors temperature (on optional Delta T Dew Heater), and controls fans built-in to CDK telescopes. *More Information on [page 11](#)*



Prices, further images and technical information in English and German on:  
[www.planewave.eu/en/cdk350](http://www.planewave.eu/en/cdk350)

PLANEWAVE **CDK 350** IS AVAILABLE IN THE FOLLOWING VERSION

WITH  
**FUSED SILICA  
OPTICS**  
#1323235Q



## OBSERVATORY TELESCOPE (MOUNT & OPTICS)

Set consisting of:

- **CDK17**, 17" (0.43 m) f/6.5 Corrected Dall-Kirkham Astrograph. The telescope has a dual carbon-fiber truss design, with 3 cooling fans ejecting air from the back of the telescope, and 4 fans blowing across the boundary layer of the mirror's surface.

More Information on [page 8](#)



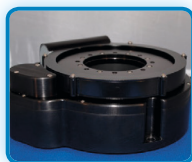
- **L-500 Direct Drive Mount**, with 200 lbs (91 kg) loading capacity. Incredible slew speed, dual-mounting options, Azimuth dovetail balance system, through the mount cabling, Direct-Drive motors/encoders and much more.

More Information on [pages 12/13](#)



- **Optional: IRF 90** – Integrated rotating focuser. Large capacity Integrated Focuser and Rotator. The Focuser is capable of lifting 40 lbs (18 kg) with a range 30 mm (30000 microns)

More Information on [page 11](#)



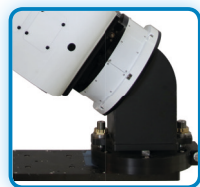
- **Optional: EFA Kit** (Electronic Focus Accessory). This Kit automates focusing (on optional Hedrick focuser), monitors temperature (on optional Delta T Dew Heater), and controls fans built-in to CDK telescopes.

More Information on [page 11](#)



- **Optional: Polar Wedge** – for precise polar alignment and tracking accuracy. Each wedge is made for your specific latitude and has an alignment range of +/- 3 degrees.

More Information on [page 13](#)



### CDK FEATURES:

see CDK 17 (p. 8) and Standard Features for all CDK's (p. 11)

### MOUNT FEATURES:

see L-Mount Special Features (p. 13)

Prices, further images and technical information in English and German on:

[www.planewave.eu/en/cdk400](http://www.planewave.eu/en/cdk400)

PLANEWAVE **CDK 400** IS AVAILABLE IN THE FOLLOWING VERSION

WITH  
**FUSED SILICA  
OPTICS**  
#1323240Q





## OBSERVATORY TELESCOPE (MOUNT & OPTICS)

Set consisting of:

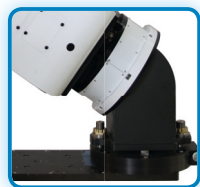
- **CDK20**, 20 inch (0.51 m) f/6.8 Corrected Dall-Kirkham Astrograph. has a dual carbon-fiber truss design, with 3 cooling fans ejecting air from the back of the telescope.

More Information on [page 9](#)



- **L-500 Direct Drive Mount**, with 200 lbs (91 kg) loading capacity. Incredible slew speed, dual-mounting options, Azimuth dovetail balance system, through the mount cabling, Direct-Drive motors/encoders and much more.

More Information on [pages 12/13](#)



- **Optional: Polar Wedge** – for precise polar alignment and tracking accuracy. Each wedge is made for your specific latitude and has an alignment range of +/- 3 degrees. More Information on [page 13](#)

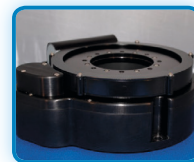
### CDK FEATURES:

see CDK 20 (p. 9) and Standard Features for all CDK's (p. 11)

### MOUNT FEATURES:

see L-Mount Special Features (p. 13)

- **Optional: IRF 90** – Integrated rotating focuser. Large capacity Integrated Focuser and Rotator. The Focuser is capable of lifting 40 lbs (18 kg) with a range 30 mm (30000 microns) More Information on [page 11](#)



- **Optional: EFA Kit** (Electronic Focus Accessory). This Kit automates focusing (on optional Hedrick focuser), monitors temperature (on optional Delta T Dew Heater), and controls fans built-in to CDK telescopes. More Information on [page 11](#)



Prices, further images and technical information in English and German on:  
[www.planewave.eu/en/cdk500](http://www.planewave.eu/en/cdk500)

PLANEWAVE **CDK 500** IS AVAILABLE IN THE FOLLOWING VERSIONS

WITH  
**FUSED SILICA  
OPTICS**  
#1323250Q

WITH  
**FUSED SILICA OPTICS**  
#1323251Q

**RC**



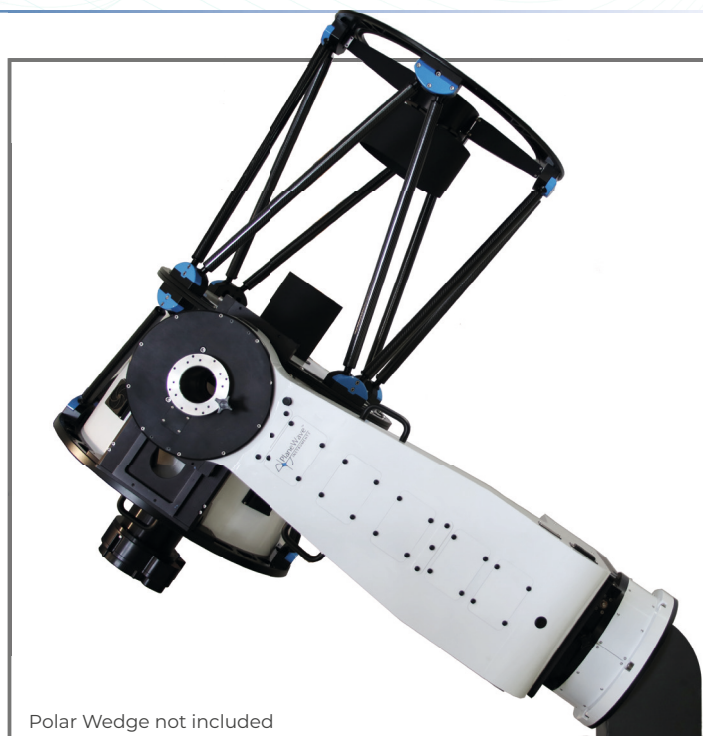
## OBSERVATORY TELESCOPE (MOUNT & OPTICS)

Set consisting of:

- **CDK24**, 24" (0.61 m) f/6.5 Corrected Dall-Kirkham Astrograph. The telescope has a dual truss design, with 3 cooling fans for the back of the primary mirror and 4 fans for the front surface of the primary mirror. *More Information on [page 10](#)*

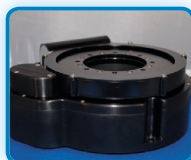


- **L-600 Direct Drive Mount**, with 300 lbs (136 kg) loading capacity. Incredible slew speed, dual-mounting options, Azimuth dovetail balance system, through the mount cabling, Direct-Drive motors/encoders and much more. *More Information on [pages 12/13](#)*



Polar Wedge not included

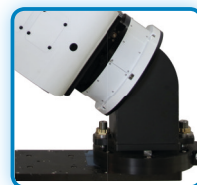
- **Optional: IRF 90** – Integrated rotating focuser. Large capacity Integrated Focuser and Rotator. The Focuser is capable of lifting 40 lbs (18 kg) with a range 30 mm (30000 microns) *More Information on [page 11](#)*



- **Optional: EFA Kit** (Electronic Focus Accessory). This Kit automates focusing (on optional Hedrick focuser), monitors temperature (on optional Delta T Dew Heater), and controls fans built-in to CDK telescopes. *More Information on [page 11](#)*



- **Optional: Polar Wedge** – for precise polar alignment and tracking accuracy. Each wedge is made for your specific latitude and has an alignment range of +/- 3 degrees. *More Information on [page 13](#)*



### CDK FEATURES:

see CDK 24 (p. 10) and Standard Features for all CDK's (p. 11)

### MOUNT FEATURES:

see L-Mount Special Features (p. 13)

Prices, further images and technical information in English and German on:

[www.planewave.eu/en/cdk600](http://www.planewave.eu/en/cdk600)

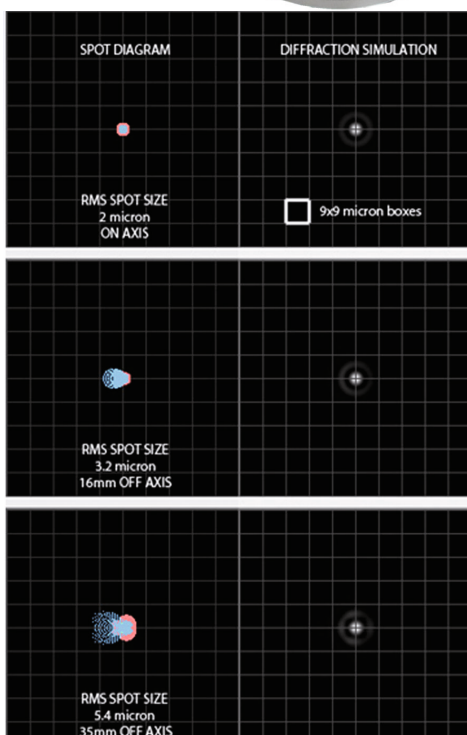
**PLANEWAVE CDK 600 IS AVAILABLE IN THE FOLLOWING VERSIONS**

WITH  
**FUSED SILICA  
OPTICS**  
#1323260Q

WITH  
**FUSED SILICA OPTICS**  
#1323261Q

**RC**





## OPTICAL SYSTEM

|                                  |   |
|----------------------------------|---|
| Aperture                         | 27.56 inch (700 mm)                     |
| Focal Length                     | 4540 mm                                 |
| Focal ratio                      | 6.5                                     |
| Central Obstruction              | 47% of the Primary Mirror Diameter      |
| Back Focus from Mounting Surface | 309 mm (12.2 inch)                      |
| Weight                           | 1,200 lbs (544 kg)                      |
| OTA Tube                         | Dual truss structure with Nasmyth focus |
| Dimensions                       | 93.73" H x 43.25" W x 39" D             |
| Focus Position                   | Nasmyth Focus                           |
| Fully Baffled Field              | 60 mm                                   |
| Image Scale                      | 22 microns per arcsecond                |
| Optimal Field of View            | 70mm (0.68 degrees)                     |

## MECHANICAL STRUCTURE

|                  |   |
|------------------|---|
| Fork Assembly    | Single piece U shaped fork arm assembly for maximum stiffness |
| Azimuth Bearing  | 20 inch diameter thrust bearing                               |
| Altitude Bearing | 2 x 8.5 inch OD ball bearings                                 |
| Optical Tube     | Dual truss structure with Nasmyth focus                       |

## SYSTEM PERFORMANCE

|                           |  |
|---------------------------|--|
| Pointing Accuracy         | 10 arcsecond RMS with PointXP Model  |
| Pointing Precision        | 2 arcsecond  |
| Tracking Accuracy         | <1 arcsecond error over 10 minute period   |
| System Natural Frequency  | 10 Hz or greater   |
| Field De-Rotator Accuracy | 3 microns of peak to peak error at 35 mm off-axis over 1 hour of tracking (18 arc sec) |

Prices, further images and technical information in English and German on:

[www.planewave.eu/en/cdk700](http://www.planewave.eu/en/cdk700)

PLANEWAVE **CDK 700** IS AVAILABLE IN THE FOLLOWING VERSIONS

WITH  
**FUSED SILICA**  
OPTICS  
#1323270Q

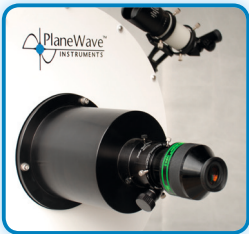
AS DALL-KIRKHAM  
**IRDK: IR-OPTIMIZED**  
W. FUSED SILICA  
#1323270IQ



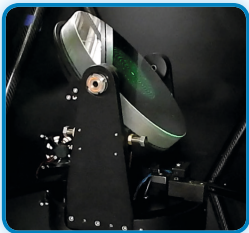
## 0.7 METER OBSERVATORY TELESCOPE-SYSTEM

The CDK700 is a complete observatory class telescope and direct drive alt-azimuth mounting system, designed and engineered by PlaneWave. With a 70mm image circle, the CDK700 is designed to excel at imaging on large format CCD cameras. The optical system utilizes a Nasmyth focus through both altitude bearings allowing your camera or eyepiece to remain at a fixed height while holding heavy instruments without needing to rebalance the optical tube assembly. Instrumentation can be installed on both sides of the fork mount and easily accessed using the included rotating tertiary mirror system. With direct drive motors, high resolution encoders and zero backlash or periodic error the CDK700 sets a new standard for small observatory telescopes.

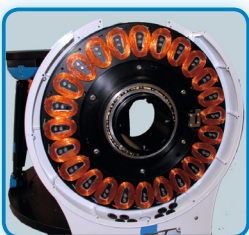
### CDK 700 SPECIAL FEATURES



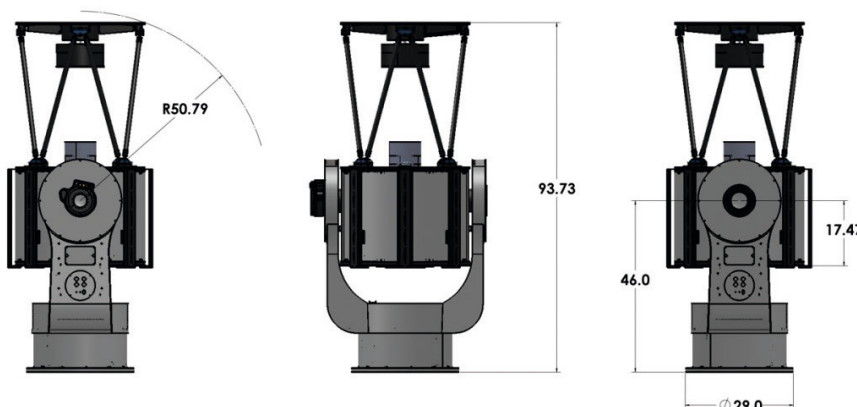
**NASMYTH FOCUS** – Dual Nasmyth Focus along the altitude axis eliminates balancing issues as you change out equipment. Eyepieces remain at a constant wheelchair-accessible height, greatly simplifying access to the telescope for public observatories. Includes the IRF90 field de-rotator/focuser which de-rotates the field and allows for long exposure Alt-Az tracking.



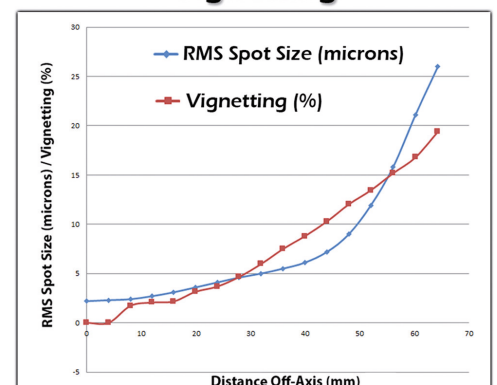
**ROTATING TERTIARY MIRROR** – The CDK700 includes an integrated rotator for the tertiary mirror, with magnetic locks to position the mirror precisely for either Nasmyth focus position. The rotator can move from one port to the other in under 10 seconds, allowing observers to easily transition between imaging and visual use.



**DIRECT DRIVE MOTORS AND ENCODERS** – Direct Drive motors mean there are no gears to cause backlash and periodic error. With high-resolution encoders providing the feedback for the direct drive motors, not only will the telescope track without periodic error or have any backlash at all, but the mount will be able to counter against wind gusts. The direct drive motors can move the telescope at incredible speeds for tracking satellites or just to minimize target acquisition time.



### Vignetting





## OPTICAL SYSTEM

|                            |   |
|----------------------------|---|
| Aperture                   | 1000 mm (39.37inch)                     |
| Focal Length               | 6000 mm                                 |
| Focal ratio                | f/6                                     |
| Central Obstruction        | 47% of the Primary Mirror Diameter      |
| Back Focus from de-rotator | 373 mm (14.7 inches)                    |
| Weight                     | 2600 lbs (1180 kg)                      |
| OTA Tube                   | Dual truss structure with Nasmyth focus |
| Dimensions                 | 135" H x 72" W x 45"                    |
| Focus Position             | Dual Nasmyth Focus Ports                |
| Image Scale                | 29 microns per arcsecond at F/6         |
| Optimal Field of View      | 100 mm (1.0 degrees)                    |

## MECHANICAL STRUCTURE

|                    |  |
|--------------------|--|
| Fork Assembly      | Space Frame Steel Truss  |
| Fork Base          | Welded stainless steel torsion box   |
| Azimuth Bearing    | Dual 11.125 inch tapered roller bearings   |
| Altitude Bearing   | Three 9.5 inch 4 way loaded ball bearings (two pre-loaded on motor side and one on non motor side) |
| Optical Tube       | Dual truss structure with Nasmyth focus  |
| Instrument Payload | 300 lbs (150 ft-lbs) - mounted on the field de-rotator plate                                       |

## SYSTEM PERFORMANCE

|                           |  |
|---------------------------|--|
| Pointing Accuracy         | Better than 10 arcsecond RMS with PointXP Model  |
| Pointing Precision        | 2 arcsecond  |
| Tracking Accuracy         | <1 arcsecond error over 10 minute period   |
| Natural Frequency         | 10 Hz or greater   |
| Field De-Rotator Accuracy | <3 microns of peak to peak error at 35mm off-axis over 1 hour of tracking (18 arc sec) |

Prices, further images and technical information in English and German on:

[www.planewave.eu/en/pw1000](http://www.planewave.eu/en/pw1000)

PLANEWAVE **PW-1000** IS AVAILABLE IN THE FOLLOWING VERSIONS

w. FUSED SILICA  
OPTICS #1323300Q

w. FUSED SILICA  
OPTICS #1323301

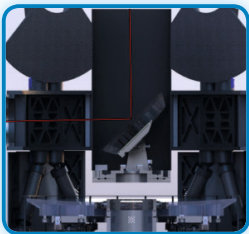
RC



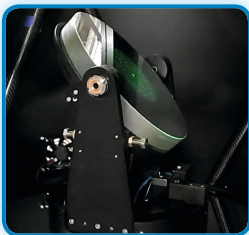
## 1 METER OBSERVATORY TELESCOPE-SYSTEM

The PW-1000 is a complete 1-meter observatory class telescope and direct drive alt-azimuth mounting system, designed and engineered by PlaneWave. With a diffraction limited 100mm image circle, the PW-1000 is designed to excel at imaging on the largest format CCD cameras available today. Light-weighted optics are made of zero expansion fused silica materials for excellent thermal stability and maximum throughput. The optical system utilizes a Nasmyth focus through both altitude bearings allowing instrumentation to be installed on both sides of the fork mount that is easily accessed using the included rotating tertiary mirror system. With direct drive motors, high resolution encoders and zero backlash or periodic error the PW-1000 sets a new standard in 1-meter class observatory telescopes.

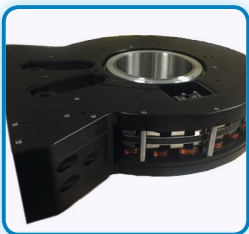
### PW1000 SPECIAL FEATURES



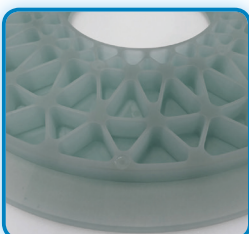
**DUAL NASMYTH FOCUS PORTS** – Dual Nasmyth Focus along the altitude axis eliminates balancing issues when you change equipment. Eyepieces remain at a constant wheel-chair-accessible height, greatly simplifying access to the telescope for public observatories. The computer-controlled tertiary mirror allows either Nasmyth port to be selected in just a few seconds, allowing observers to easily transition between imaging and visual use, or other instrumentation.



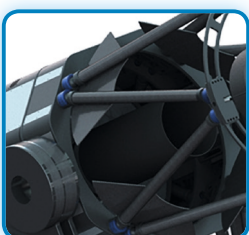
**ROTATING TERTIARY MIRROR** – The PW-1000 includes an integrated rotator for the tertiary mirror, with magnetic locks to position the mirror precisely for either Nasmyth focus position. The rotator can move from one port to the other in less than 10 seconds, allowing observers to easily transition between imaging and visual use.



**DIRECT DRIVE MOTORS AND ENCODERS** – Direct Drive motors and absolute on-axis encoders eliminate the need for reduction gears, thereby eliminating backlash and periodic error. With high-resolution encoders providing the feedback for the direct drive motors, not only will the telescope track without periodic error and backlash, the mount will also counter wind gusts with precise servo feedback. The direct drive motors can move the telescope at incredible speeds for tracking satellites or just to minimize target acquisition time.



**LIGHT-WEIGHT FUSED SILICA OPTICS** – Fused Silica has a coefficient of thermal expansion six times lower than Borosilicate (Pyrex) glass, which means that while it cools down, fused silica preserves its shape to a high degree of accuracy. This translates into consistent optical performance and unchanging focus over temperature changes.



**AUTOMATED PRIMARY MIRROR SHUTTER** – Protects the primary mirror from unwanted dust and moisture with this integrated four shutter automated system, fully controllable with PlaneWave's PWI software.



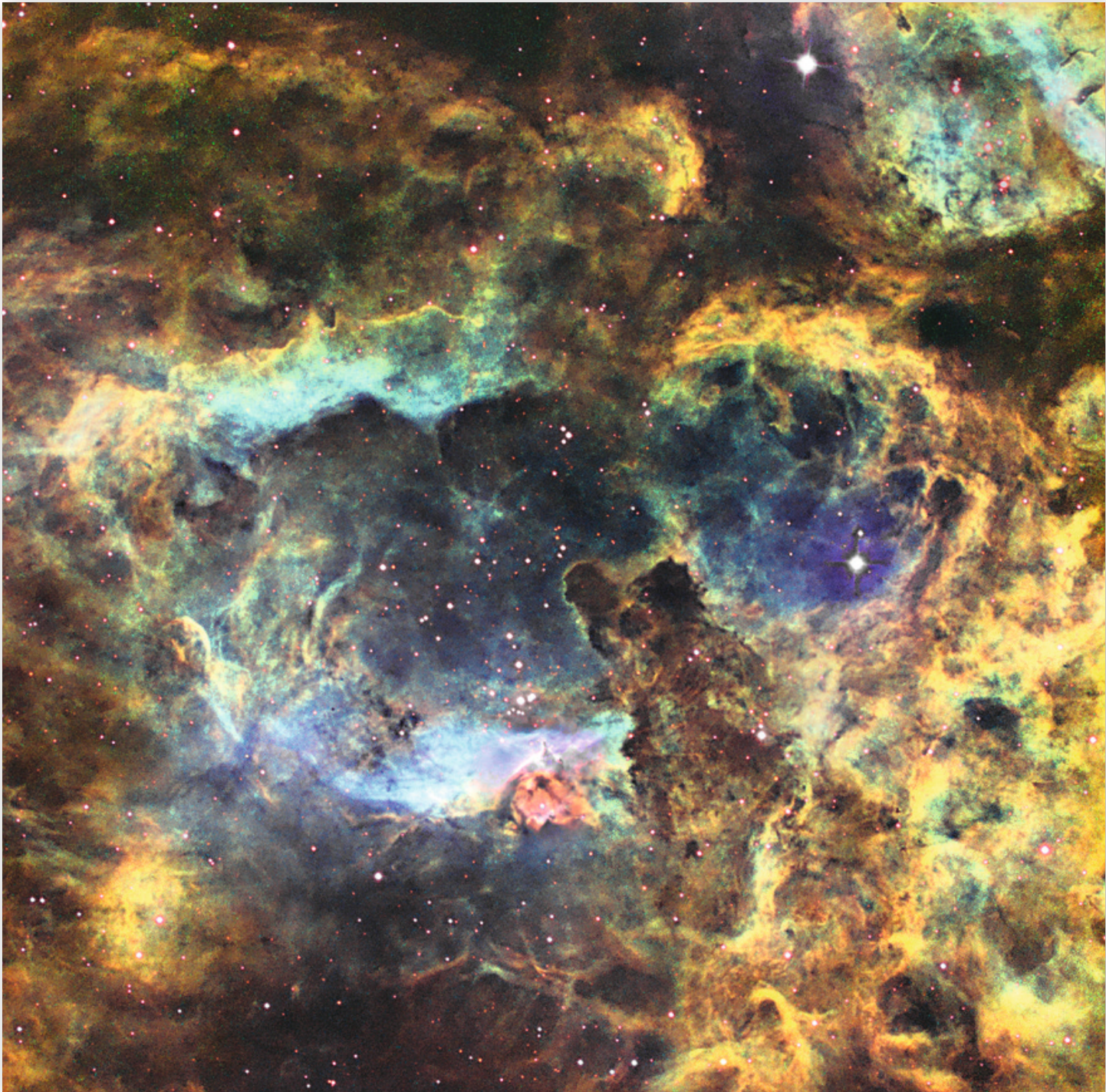
Comparison CDK700 /PW-1000





|           |   |
|-----------|---|
| Author    | © W. Paech, F. Hofmann                  |
| Object    | Sculptor Galaxy (NGC 253)               |
| Telescope | PlaneWave CDK17 w. Televue 0.8x reducer |
| Location  | Namibia, Africa                         |
| CCD       | ALCCD 12                                |
| Exposures | 15 x 600s                               |





|           |  |
|-----------|--|
| Author    | © John Ebersole  |
| Object    | Lobster Nebula (NGC 6357) in HST Narrowband Palette    |
| Telescope | PlaneWave CDK700                                       |
| Location  | iTelescope, Siding Spring, Australia                   |
| CCD       | FLI PLO 9000   |
| Filters   | Astrodon 6nm Ha, OIII, SII                             |
| Exposures | Ha – 100 min 1x1, OIII – 120 min 2x2, SII – 80 min 2x2 |





|           |   |
|-----------|---|
| Author    | © Christoph Kaltseis                    |
| Object    | Crescent Nebula (NGC 6888)              |
| Telescope | PlaneWave CDK14                         |
| Location  | Sarleinsbach, Upper Austria, 562mm      |
| CCD       | Nikon D810A, 0.39" resolution per Pixel |
| Exposures | 20x480s @ ISO800 in RGB                 |





|           |   |
|-----------|---|
| Author    | © Bill Snyder   |
| Object    | Wizard Nebula (NGC 7380)                                |
| Telescope | PlaneWave CDK17   |
| Location  | SRO Sierra Remote Observatories                         |
| CCD       | SBIG STXL 11002 with AO-X                               |
| Filters   | Astrodon 3nm Ha, OIII, SII                              |
| Exposures | Ha – 10 hrs, OIII – 5.5 hrs, SII – 7.5 hrs. 30 min subs |





|           |                        |
|-----------|------------------------|
| Author    | © Sebastian Voltmer    |
| Object    | Iris Nebula (NGC 7023) |
| Telescope | PlaneWave CDK12,5      |
| Location  | Spicheren, France      |
| CCD       | ST-2000XM              |
| Filters   | Baader RGB             |



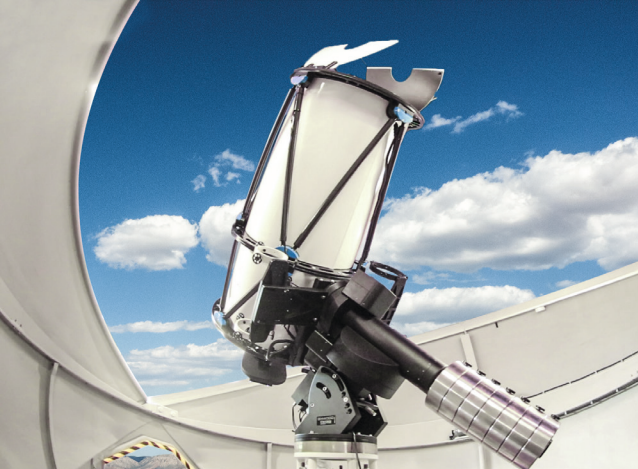


|           |   |
|-----------|---|
| Author    | © Christoph Kaltseis                    |
| Object    | M33 Gx                                  |
| Telescope | PlaneWave CDK14                         |
| Location  | Sarleinsbach, Upper Austria, 562mm      |
| CCD       | Nikon D810A, 0.39" resolution per Pixel |
| Exposures | 16x480s @ ISO800 in RGB                 |



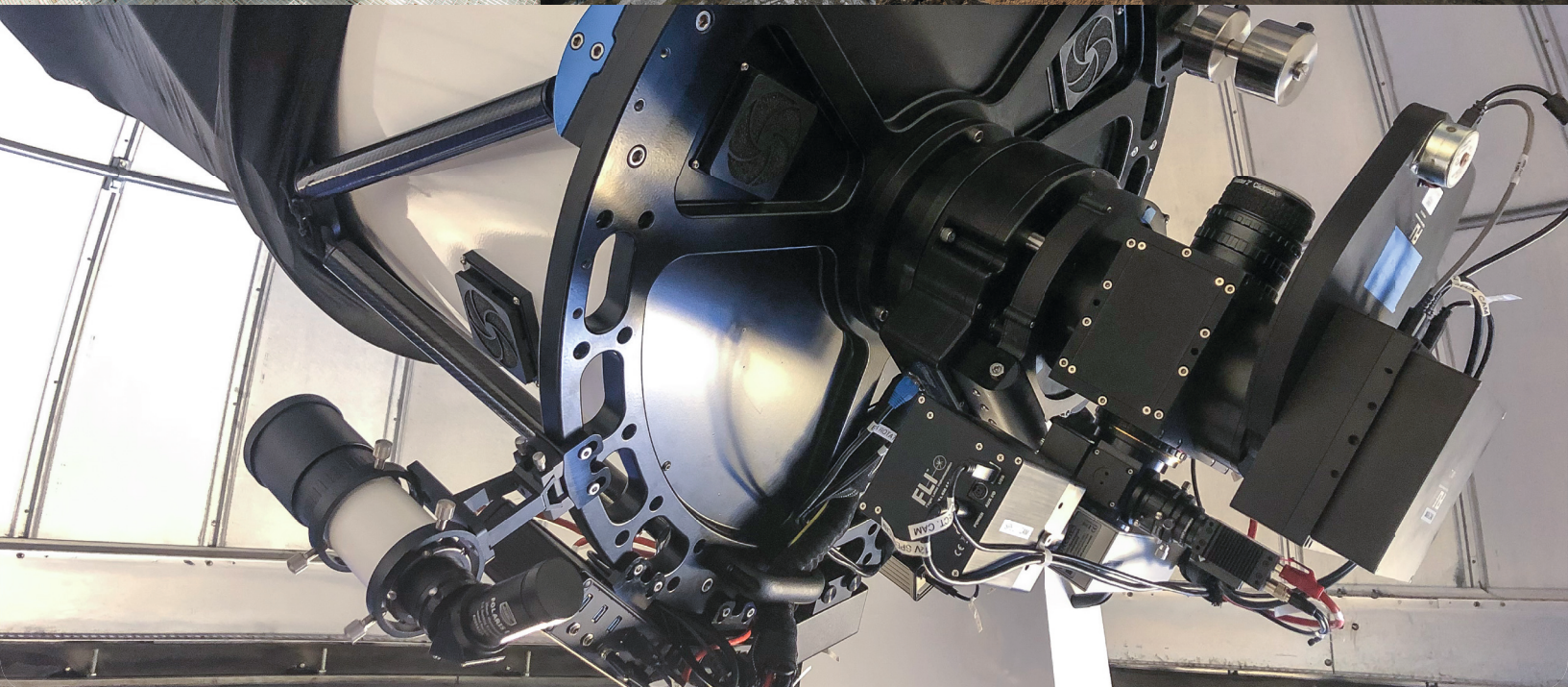
APOD on September 27th, 2018  
<https://apod.nasa.gov/apod/ap180927.html>





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specializes in erecting  
turnkey observatories  
utilizing mainly PlaneWave CDK-,  
IRDK- and RC- telescopes with pro-  
fessional CCD-camera equipment.

[www.baader-planetarium.com](http://www.baader-planetarium.com)



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