
CELESTRON
Astroimaging | 2014

Introduction

Many amateur astronomers are drawn to capture images of the night sky through their telescope and camera. Astrophotography, now more commonly called astroimaging, is both an art and a science.

Although it looks very different than the view through a telescope's eyepiece, what you see in an astroimage is real. The light in an astroimage has traveled for eons in space before it reaches the imager's telescope on Earth. The telescope gathers the photons of light and delivers them to the camera's imaging sensor where they are recorded.

With some practice and patience, you can create beautiful celestial images like the ones on posters and in magazines. Astrophotography has progressed greatly over the last few years, especially with the rise of digital camera technology and modern low-cost equipment. Astrophotography is a challenging and rewarding hobby within reach of any enthusiastic amateur astronomer.

IMAGER: Andre Paquette
OBJECT: M27, Dumbell Nebula
TELESCOPE: EdgeHD 14"
CAMERA: Nightscape 8300

Digital Camera Adapter 93626

Piggyback Mount 93609

Piggyback Mount 93609

Getting Started

DIGISCOPING

You can start snapping cool astroimages with any digital camera you already own—even the one built into your smartphone! With a modest telescope, it's possible to start taking impressive photos of solar system objects such as the Moon, Jupiter and Saturn. Add an affordable solar filter to your setup and you can also image the Sun.

Positioning a camera or smartphone up to your telescope's eyepiece is called "digiscoping." It's an effective technique for Solar System imaging, but you can also digiscope during the day. Point your telescope at a terrestrial subject like wildlife and you'll get the effect of a large telephoto lens.

DSLR ASTROIMAGING

Another inexpensive way to explore astrophotography is with a DSLR. Try bringing your camera out at night to image star trails and nighttime landscapes. If you have a Celestron computerized telescope, you can create Milky Way panoramas and other wide-angle compositions of the night sky using the Celestron Piggyback Adapter. Attach the adapter to your telescope, and then secure your camera. Now you can take advantage of your telescope's built-in tracking abilities to image the sky. You might even capture a meteor during your exposure!

01

02

03

01 Moretus
02 Iris
03 Murdroit
04 Moon

IMAGER: Thierry Legault
OBJECT: Lunar Images
TELESCOPE: EdgeHD 1400

04

NexStar Evolution
A motorized telescope like the NexStar Evolution combined with a NexImage camera is one of the best systems to start planetary imaging without breaking the bank.

NexStar 8SE
11069

Luminos Barlow
93436

X-Cel LX
93423

The Next Step

PLANETARY, LUNAR, AND SOLAR IMAGING

While the Moon can be photographed by digiscoping with just about any telescope and camera, the planets need more magnification because their apparent size is so much smaller. The full Moon is half a degree in the sky (about half the size of your pinky at arm's length), while the largest planet in our Solar System, Jupiter, is only about 2.5% the size of the Moon as seen from Earth.

The planets are bright, but they require much more magnification to see them well. It's a common practice to use a 2x or 3x (or higher) Barlow lens to further boost the power on the planets to photograph them. But adding more magnification with an eyepiece or Barlow darkens the image. Planetary imagers must be careful to avoid using too much power and creating dim and soft images.

You'll need a motorized German equatorial (EQ) or Altitude-Azimuth (AZ) mount to track your Solar System object in the sky while you image it. The NexStar Evolution and NexStar SE are great choices for planetary imaging because they contain high-powered Schmidt-Cassegrain optics and automatically track celestial objects.

OBJECT: Jupiter
CAMERA: NexImage5

NexImage Solar System Imagers

Sometimes when you view a planet through your telescope at high magnification, it appears wavy or blurry. This is the result of poor seeing conditions caused by instability in the atmosphere. To minimize the negative effects of the atmosphere, astroimagers use dedicated planetary cameras like Celestron's NexImage, NexImage 5, and NexImage Burst. These cameras use rapid capture to record hundreds of video frames. Astroimagers then stack and align the frames of video, tossing out blurry images and enhancing overall image sharpness and detail.

NexImage cameras make this process easy by including a Windows-compatible software suite that walks beginners through stacking and assembling their images.

NexImage 5 Solar System Imager 93711

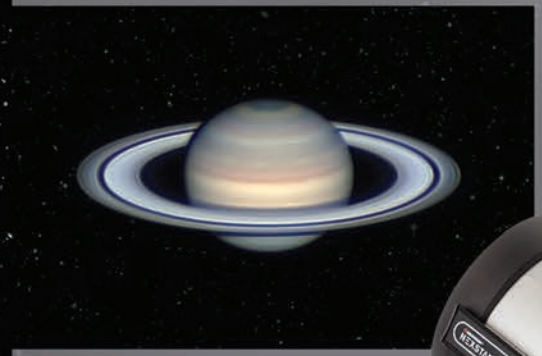
NexStar Evolution
A motorized telescope like the NexStar Evolution combined with a NexImage camera is one of the best systems to start planetary imaging without breaking the bank.

Imaging with Skyris

Celestron's Skyris planetary cameras use the same basic method of capturing hundreds of video frames, but feature much more sensitive imaging sensors that reveal even greater detail in the planets.

When you use a high-resolution Skyris camera to capture Jupiter, you can pick up the Great Red Spot, colorful cloud belts, festoons, and even some features of the Galilean moons! Ultra-fast USB 3.0 connections combined with the best available imaging sensors allow Skyris cameras to capture more quality frames in less time, reducing the number of blurry images caused by atmospheric turbulence.

Planetary imaging benefits from lots of focal length, which makes Schmidt-Cassegrain and EdgeHD telescopes the preferred optical designs. The world's leading planetary imagers use Celestron's 14-inch EdgeHD telescopes. They offer enough aperture and focal length to deliver super high-resolution images.



IMAGER: Christopher Go
OBJECT: Saturn
CAMERA: Skyris 618M

Skyris 618M
95511

IMAGER: Wes Higgins
OBJECT: H-Alpha Sun
TELESCOPE: Lunt 100 mm
CAMERA: Skyris 274

Color vs. Monochrome Imaging Sensors

Imaging cameras are often available in either color or monochrome configurations. Color cameras deliver instant color images using a mosaic of filters over the pixels of the sensor. They're the most convenient and cost-effective way to obtain color planetary images.

Monochrome cameras capture black and white images, but have greater sensitivity. You can create color images with a monochrome camera by adding a series of color filters. A filter wheel, such as the Skyris Filter Wheel, makes it easy to switch between multiple filters during your imaging session. After capturing your images, you can stack images taken with multiple color filters, creating natural-looking color images.

Alternatively, you can add pseudo color to your monochrome images during processing, a method commonly used when imaging the Sun.

Skyris Filter Wheel
Imager 93711

IMAGER: Andre Paquette
OBJECT: NGC 2264
TELESCOPE: EdgeHD 1400

IMAGER: Thierry Legault
OBJECT: H-alpha Sun Monochrome
CAMERA: Skyris 445M

IMAGER: Lance Lucero
OBJECT: H-alpha Sun Colorized
CAMERA: Skyris 274M

IMAGER: Tony Hallas
OBJECT: IC 410, The Tadpole Nebula
Monochrome with filters
TELESCOPE: EdgeHD 11"
CAMERA: QSI583ws

IMAGER: Andre Paquette
OBJECT: NGC 6888, Crescent Nebula
TELESCOPE: EdgeHD 1400
CAMERA: Nightscape

Advanced VX 8" EdgeHD
12031

Venturing Further: Deep Sky Imaging

Imaging distant targets like nebulae, galaxies, and star clusters requires a completely different technique than solar system imaging. Instead of opening the shutter for a fraction of a second, deep sky objects usually require 1 to 10 minutes of exposure or more.

Deep sky objects are extremely faint. Some, like galaxies, are invisible to the unaided eye and require large telescopes to observe visually. However, unlike visual astronomy, photographing a faint object is possible with a smaller telescope. An 8-inch Schmidt-Cassegrain telescope can photograph details that would require a much larger telescope to detect visually.

Because of the long exposure time associated with deep sky imaging, it is critical to have a high-quality German equatorial (EQ) mount with a motor drive capable of ultra-precise tracking.

IMAGER: Bryan Cogdell
OBJECT: NGC2264
TELESCOPE: EdgeHD 8”
CAMERA: Nightscape 8300

Deep Sky Imaging with a DSLR

The best tools for deep sky imaging are DSLR or astronomical CCD cameras. Canon DSLRs are a great choice for deep sky imaging. An “off-the-shelf” Canon EOS can capture impressive images of nebulae, star clusters and brighter galaxies. The Advanced VX mount paired with an EdgeHD and Canon 60Da is one of the best-valued imaging setups available, capable of taking satisfying deep sky images. Use a Celestron T-Adapter to attach your DSLR to the prime focus of your telescope. You will also need a brand-specific T-ring matched to your camera, available from Celestron.

The longer the exposure, the deeper you go, and the more important tracking accuracy becomes. Adding an autoguider to your setup helps you make small corrections to the mount’s tracking so you can increase exposure times while retaining nearly perfect tracking. The result is round, pinpoint stars and very deep exposures containing faint details. The NexGuide Autoguider, when paired with the Advanced VX 8” EdgeHD and Canon 60Da, makes a complete astroimaging setup.

Like planetary imagers, deep sky imagers benefit from digitally stacking their images to increase the signal-to-noise ratio, yielding a smoother image with greater detail. It’s common to stack 5 to 25 long exposure images to achieve the best results.

Long Focal Length Astroimaging with CCD Cameras

The ultimate camera for deep sky imaging is an astronomical CCD camera. These high-sensitivity cameras capture excellent images of distant galaxies and nebulae. Many are equipped with a thermo-electric cooler, which reduces the inherent noise from the camera.

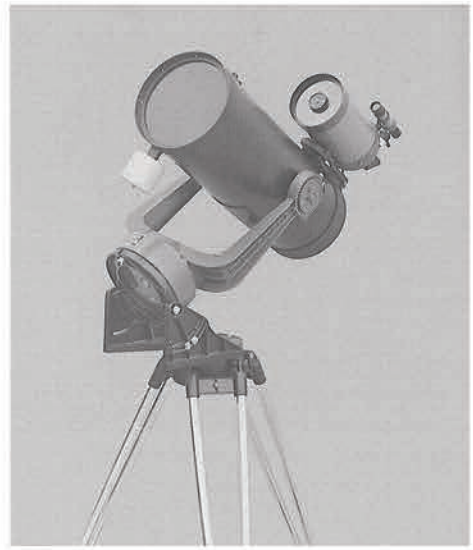
When evaluating astronomical CCD cameras, keep in mind that pixel size is often more important than pixel count when imaging in low light. The larger the pixels, the more light they collect, and the lower noise they have. In general, longer focal length telescopes should be paired with CCD cameras containing larger pixels, and shorter focal length telescopes should use cameras with smaller pixels. Astronomical cameras can also bin pixels by combining 2x2 or more groups of pixels into one super pixel. At the expense of resolution, binning greatly increases the sensitivity by effectively increasing the pixel size.

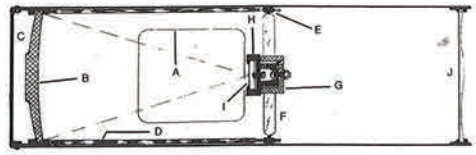
Imaging at long focal lengths is difficult because it leaves little room for error. When you’re tracking a tiny target over long periods of time, even microns of drift or flexure can affect your images! To overcome this challenge, try using a Celestron Off-Axis Guider. These guiders contain pick-off prisms, which intercept a small portion of the telescope’s field of view, but do not disturb the main imaging camera. Because both guider and camera share the same telescope, off-axis guiders provide the most accurate tracking possible.

Another way to make deep sky imaging more forgiving is to reduce your focal ratio. The shorter the focal ratio, or f-stop, the brighter the images are with an equivalent exposure. Most Schmidt-Cassegrain and EdgeHD telescopes have a focal ratio of f/10. Adding a dedicated focal reducer to an EdgeHD makes your telescope an f/7 system, widening the field of view. A focal ratio of f/7 is twice as bright as f/10 with the same exposure time. Celestron’s EdgeHD focal reducers use rare earth elements for maximum light transmission and are precisely calibrated to work seamlessly with your EdgeHD optics.

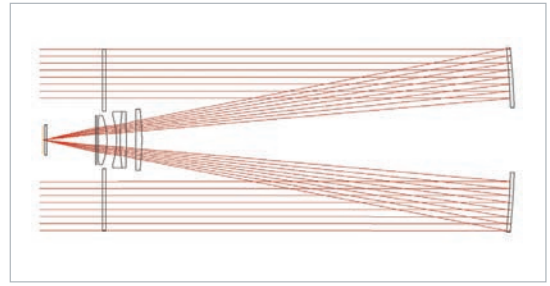
Rowe-Ackermann F/2.2 Schmidt Astrograph
91075

IMAGER: John Davis
OBJECT: IC 417 Spider Nebula
TELESCOPE: RASA 11”
CAMERA: QSI583





The Rowe-Ackermann Schmidt Astrograph is a close relative of Celestron's Schmidt Camera, which allowed imagers to create wide field astrophotos on 35 mm film in the 1970s.



Inventor Dave Rowe and optical engineer Mark Ackermann collaborated to create the Rowe-Ackermann Schmidt Astrograph's unique optical design.

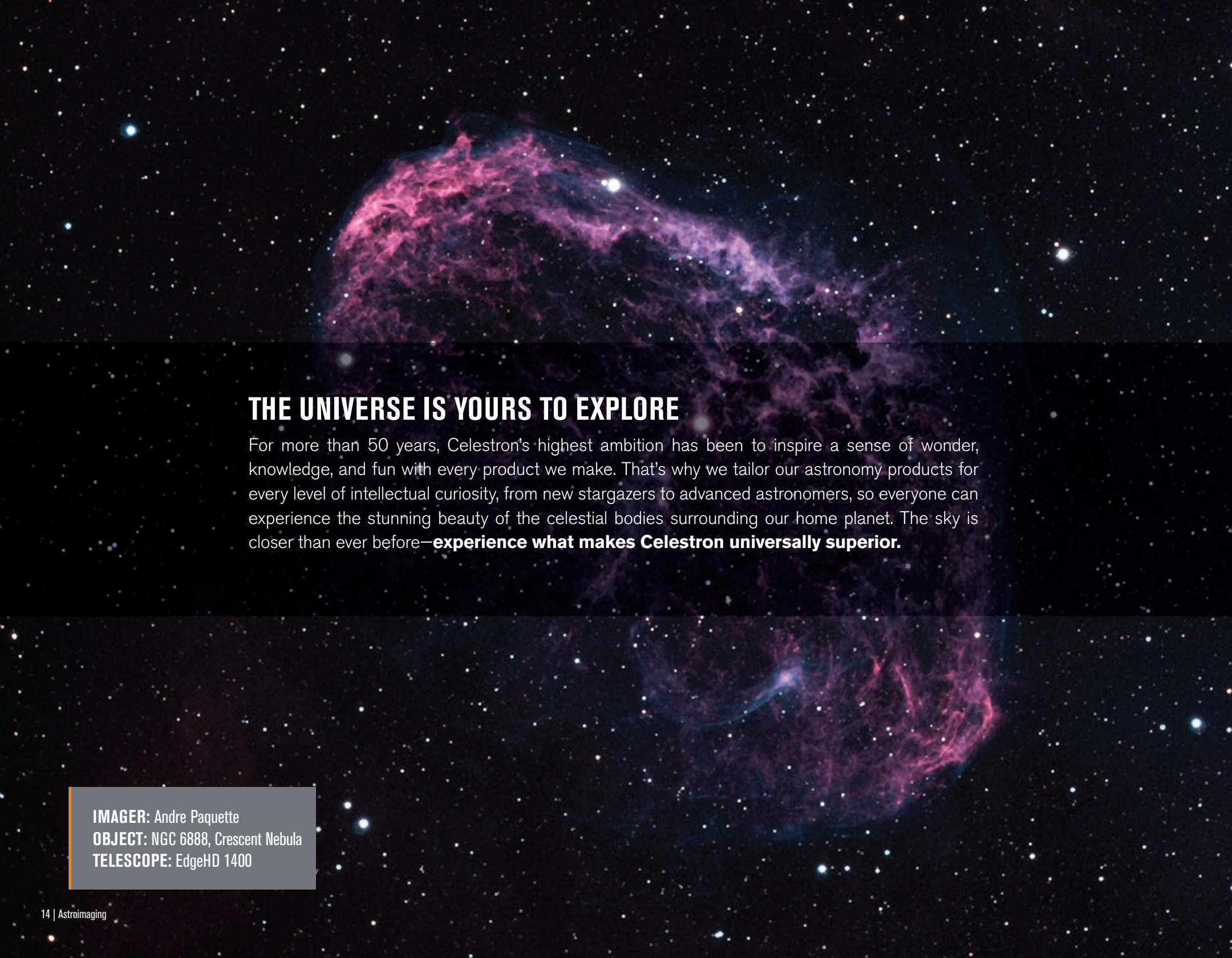
Fast, Wide Field Imaging with Fastar and the Rowe-Ackermann Schmidt Astrograph

Although reducing your focal ratio from f/10 to f/7 has a significant impact, it still does not widen the telescope's field of view enough to capture very large celestial objects like the Pleiades open star cluster or the Orion Nebula complex. To image these huge structures, you need to go even wider.

In the 1990s, Celestron invented Fastar, which allowed imagers to remove the secondary mirror of their Schmidt-Cassegrain telescope and replace it with a camera. This dramatically reduced the focal length of the optical system, ushering in the era of ultra-fast imaging. Today, all of Celestron's EdgeHD and Schmidt-Cassegrain telecopes are Fastar-compatible.

The world's top imagers use this technique to create huge mosaics of the night sky like John Davis' "Orion Smile." But the real benefit of wide field imaging is its drastically shortened exposure time. Imagers of all skill levels will appreciate the convenience and enhanced image quality that comes from capturing data in a tiny fraction of the time needed to image at f/10.

In 2014, Celestron built upon Fastar technology with the Rowe-Ackermann Schmidt Astrograph. The ultimate astroimaging tool, this telescope cannot be used for visual observing at all. It was optimized as a complete system for wide field imaging. Just attach your DSLR or CCD camera to the front of the telescope and you're ready to produce the next generation of award-winning astrophotos.



THE UNIVERSE IS YOURS TO EXPLORE

For more than 50 years, Celestron's highest ambition has been to inspire a sense of wonder, knowledge, and fun with every product we make. That's why we tailor our astronomy products for every level of intellectual curiosity, from new stargazers to advanced astronomers, so everyone can experience the stunning beauty of the celestial bodies surrounding our home planet. The sky is closer than ever before—**experience what makes Celestron universally superior.**

IMAGER: Andre Paquette
OBJECT: NGC 6888, Crescent Nebula
TELESCOPE: EdgeHD 1400

IMAGER: Bryan Cogdell
OBJECT: M20, The Trifid Nebula
TELESCOPE: CGEM DX 1100 HD
CAMERA: Nightscape 8300

Item # 93885