

### ASTRONOMY AND APOGEE

Astronomy is the foundation of our business. You can see us in Sky&Telescope, in Physics Today, and at American Astronomical Society meetings. And you'll see new astronomy products added all the time. Our cameras have been used for high-end astronomical applications like capturing the first images of optical counterparts of gamma ray bursts, plus thousands of discoveries of comets, near-Earth asteroids, and extra-solar planets. But they have also been used for the detection of fingerprints; x-ray inspection of car parts; fluorescent imaging of cell tissues; munitions testing, laser beam profiling, Raman spectroscopy; poacher surveillance, mammography; optics testing, and searching for a lower-cost means to detect anthrax. By expanding into other markets with other demands, Apogee has had to confront many technological hurdles that were not previously considered to be "astronomical" problems. For example, life science markets want SPEED...but as it turns out, our astronomical customers were quite frustrated with long readout times. Improvements created for life science became best sellers in astronomy. Less time waiting for readout means more images per precious cloudless night.

### TIM PUCKETT, ASTRONOMY SALES MANAGER



Tim with Gene Shoemaker at Tim's workshop in Georgia.

Our Astronomy Sales Manager, Tim Puckett, currently operates a supernova search patrol. Puckett uses custom software to keep track of all the telescopes in the network to avoid overlap and to optimize output. To date Puckett has taken more than one million images in the search, and discovered more than 160 supernovae. Tim's photos of comets and deep-sky objects have been published in books and magazines in 25 countries. His work has also been featured on ABC, NBC, CBS, FOX, CNN, BBC, The Discovery and Learning Channels and Good Morning America.



NASA's Astronomical Photo of the Day, December 28, 2006

M31, the Great Spiral Nebula in Andromeda, to scale with the Moon, by Adam Block and Tim Puckett. M31 image acquired with the Apogee Alta U9000 camera.

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NGC 4258. Image courtesy of Jay Gabany. Apogee Instruments Alta U16M (4096 x 4096) camera. RC Optical 20" Truss Telescope. AstroDon LRGB and H-alpha Filters Blackbird Observatory, New Mexico

### FREE CD/ POSTER

Our 24-page astronomy brochure, plus complete set of camera data sheets as well as mechanical drawings are on our website, [www.ccd.com](http://www.ccd.com), or on our Integration Starter Kit CD, available on request. Also available on request is the poster to the right (18" x 24").



**AIS Apogee**  
IMAGING SYSTEMS

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Apogee Imaging Systems manufactures a wide variety of imaging systems, from low cost consumer based systems, up to the high performance Alta used for the deepest images. Our astronomy pricing and all camera specifications are available on our website.

All images captured with cameras designed and manufactured by Apogee Imaging Systems Inc. The Apogee Alta U16M (4096 x 4096) camera, RC Optical 20" Truss Telescope, AstroDon LRGB and H-alpha Filters, Blackbird Observatory, New Mexico. ©2011 Apogee Imaging Systems Inc. All rights reserved.

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## ALTA CAMERA SYSTEMS

Alta cameras integrate the best of the best in imaging components: from back-illuminated CCDs to front-illuminated CCDs to interline transfer CCDs. We know their strengths and weaknesses from first-hand experience. We can guide you to the best trade-offs between price and performance--or we can show you the best of the best if you're done with compromise...

- 5 MHz 12-bit and 1 MHz 16-bit digitization
- 32Mbyte camera memory
- USB 2.0 interface: no plug in cards or external controllers
- Programmable, intelligent cooling to 75°C below ambient
- Standard, High Cooling, Low Profile, and Wide Angle housings available
- Fan or liquid circulation heat transfer
- Binning up to 8 Horizontal x Height of CCD (up to 4095)
- Subarray readout and fast sequencing modes
- Precision time delayed integration (TDI) and kinetics mode readout
- Programmable fan speed for low / zero vibration
- Two serial port outputs for control of peripheral devices
- General purpose programmable I/O port
- External triggering and strobe controls
- ActiveX drivers included with every system
- Field upgradeable firmware
- Fused silica windows with MgF2 coating both sides (optional BBAR)
- Runs from single 12V supply with input voltage monitor
- Compact enclosure
- Programmable status indicators
- Two year warranty with lifetime guarantee against condensation



NGC 1396 by Tony Hallas.  
U16M Camera, 14.5" f/8 RCOSCC  
Astrodon Series II filters  
A/P 1200 GTO mount  
Foresthill, California



## FEATURED PRODUCTS

### ALTA U16M

The U16M is partly new product and partly dramatic change in Kodak's pricing of an old standby for huge field-of-view. Kodak has added anti-blooming and microlenses, maintaining most of the quantum efficiency of the old U16.

**U16M**  
Kodak KAF-16803  
4096 x 4096  
9 micron pixels  
36.9 x 36.9 mm  
1359 mm<sup>2</sup>  
Full Well: 85K e<sup>-</sup>

**U9000**  
Kodak KAF-09000  
3056 x 3056  
12 micron pixels  
36.7 x 36.7 mm  
1346 mm<sup>2</sup>  
Full Well: 110K e<sup>-</sup>

### HIGHEST QUANTUM EFFICIENCY BACK-ILLUMINATED CCDs

#### ALTA U47

e2v CCD47-10  
1024 x 1024  
13 micron pixels  
13.3 x 13.3 mm  
177 mm<sup>2</sup>  
Full Well: 100K e<sup>-</sup>

#### ALTA U42

e2v CCD42-40  
2048 x 2048  
13.5 micron pixels  
27.6 x 27.6 mm  
764 mm<sup>2</sup>  
Full Well: 100K e<sup>-</sup>

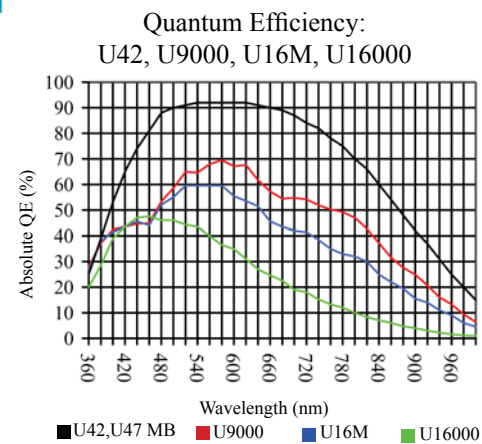
Back-illuminated CCDs have long been the ideal research instruments of the astronomy community. Their exceptional sensitivity and low readout noise make them ideal for minimizing exposure time and maximizing signal-to-noise in low light applications like astronomy.

[www.ccd.com](http://www.ccd.com)

### ALTA U230

e2v CCD230-42  
2048 x 2048  
15 micron pixels  
30.7 x 30.7 mm  
944 mm<sup>2</sup>  
Full Well: 150K e<sup>-</sup>

This large-format back-illuminated CCDs has a somewhat larger pixel size than the CCD42-40 in the U42 camera.



### ALTA U16000

Kodak KAI-16000  
4872 x 3248  
7.4 micron pixels  
36 X 24 mm  
867 mm<sup>2</sup>  
Full Well: 40K e<sup>-</sup>

Kodak's newest large format interline transfer CCD shares the 35mm film format with the KAI-11002, but with lower noise and lower dark current. Smaller pixels are an ideal match for large fields of view on shorter focal length telescopes.

### ALTA U8300

Kodak KAF-8300  
3326 x 2504  
5.4 micron pixels  
18 x 13.5 mm  
243 mm<sup>2</sup>  
Full Well: 25.5K e<sup>-</sup>

The U8300 is an ideal low cost camera for short focal length telescopes. The CCD is available as monochrome or color.

### NEW DEEP COOLING HOUSING



Apogee is pleased to announce an optional, deeper cooling housing, called the D09, that provides cooling to as much as 75°C below ambient without liquid circulation. A wide variety of sensors are supported, including large format and spectroscopic format CCDs.

Blue boxes are actual size of imaging CCD area. For comparison, this is the size of a Kodak KAF-0402ME:



NGC 5128. Image courtesy Don Goldman. U16M camera, RC Optical Carbon 12.5" f/9 scope. Software Bisque Paramount ME. Macedon Ranges Observatory, Australia.

### ALTA U43

Kodak KAI-4320  
2048 X 2048  
24 micron pixels  
49.1 X 49.1 mm  
2416 mm<sup>2</sup>  
Full Well: 500K e<sup>-</sup>

This large format Kodak CCD has a huge field of view as well as very deep full well capacity.

### ALTA U1109

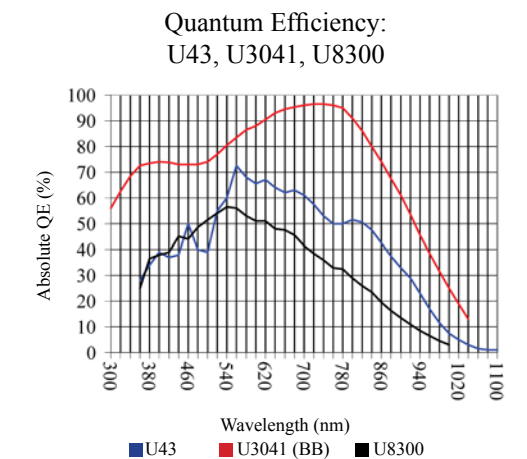
Hamamatsu S10140-1109  
2048 x 512, 12 micron pixels  
24.6 x 6 mm (149 mm<sup>2</sup>)  
Full Well: 75K e<sup>-</sup>

This TDI / spectroscopic format back-illuminated CCD has exceptional QE across the visible and deep into the ultraviolet at a very affordable price point.

### ALTA U3041

Fairchild CCD3041  
2048 x 2048  
15 micron pixels  
30.7 x 30.7 mm  
944 mm<sup>2</sup>  
Full Well: 100K e<sup>-</sup>

This large-format back-illuminated CCD is available with either a broadband or UV coating. The UV version has exceptional QE in the deep UV.



### ALTA FILTER WHEEL



Apogee offers filter wheels for nine 2" round filters, or seven or ten 2" square filters. The filter wheel can be controlled directly from one of the Alta's COM ports.

### CAMERA DATA SHEETS

The cameras featured here are just a few of many systems that we offer. For a complete listing of our products, our 24-page astronomy brochure, and all data sheets and mechanical drawings, please visit [www.ccd.com](http://www.ccd.com).

Prices & specifications subject to change without notice. Alta is a registered trademark of Apogee Imaging Systems Inc.

