

# Cameras for Astronomy

High Performance, Low Maintenance Solutions



# Andor's Astronomy Vision

## Quality is Paramount

As more and more professional astronomers look for high performance commercial alternatives to time consuming, and ultimately costly, 'build it yourself' model, they are turning to Andor's track record as the leading provider of high-end, exceptional quality camera solutions.

Andor excels at the design and manufacture of robust and hassle-free detector solutions, designed to operate with **low maintenance** and **exceptional longevity** in remote observing sites around the globe.

### Example: iKon-XL's Low Maintenance Advantage

Andor's high performance Very Large Area CCD platform, offering TE cooling down to  $-100^{\circ}\text{C}$  has been designed with maximum performance, minimal down time and reduced cost of ownership in mind.

#### NO Liquid nitrogen ( $\text{LN}_2$ )

Many observatories are in remote locations and in some cases unmanned, making  $\text{LN}_2$  at best impractical, at worst impossible.  $\text{LN}_2$  cooled cameras require ready access to  $\text{LN}_2$  supply and routine top up of  $\text{LN}_2$  levels in order to hold temperature, as well as carrying an additional safety concern. The iKon-XL is thermoelectrically cooled to  $-100^{\circ}\text{C}$ .

#### NO Cryo cooler

As many are already painfully aware, cryo coolers are cumbersome and notoriously unreliable. iKon-XL can reach typical cryo-cooled temperatures using only TE cooling and water flow.

#### NO Vacuum repumping

The sensor enclosure design of the iKon-XL is based on Andor's proven, proprietary UltraVac™ process, which carries a Mean Time Between Failure (MTBF) value of  $> 100$  years! Where other very large area CCD cameras require routine re-pumping, you can expect the iKon-XL to hold firm.

#### NO Return to base

No shutter is designed or specified for infinite usage. When it finally fails in a remote observing location, the shutter mounting of the iKon-XL has been purposefully designed such that the shutter can be easily replaced by the user on site.

### Customer Special Request (CSR)

At Andor, we realize that even our adaptable and flexible 'off-the-shelf' products are sometimes not enough to meet the more demanding application requirements of some our customers.

Our Customer Special Request (CSR) process is a bespoke service for our customers, bringing together highly experienced application specialist and senior engineers who will understand your requirements and provide specific solutions specific to your needs.

Our extensive capabilities, married to our flexible and adaptable approach, complements the highly specific needs that often arise within the field of astronomy.

### Key Applications

- Solar Astronomy
- Near Earth Objects (NEO)
- Space Debris Tracking
- Photometry
- Transit Exoplanet Detection
- Radial Velocimetry
- Wide Field Spectroscopic Survey
- High Time Resolution Astrophysics
- Adaptive Optics
- Lucky Imaging
- Speckle Imaging

#### PREFER SHUTTER FREE?

Andor's sCMOS camera portfolio do not require mechanical shutters.

### Customization capabilities include:

- Optical distance tailoring
- Custom windows
- Custom readout modes
- Environmental ruggedization

# Large Area & High Resolution CCDs



Tarantula Nebula in the Large Magellanic Galaxy.  
Courtesy of the Chinese Bright Star Survey Telescope (BSST), Antarctica.

## iKon CCD Camera Range

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Gone are the days of laborious self-build high-end camera solutions. Andor's unwavering approach to 'off-the-shelf' ultra-high performance has delivered **iKon-XL**, a new very large area CCD platform that uniquely cools back-illuminated 16.8 megapixel sensors to  $-100^{\circ}\text{C}$  with thermoelectric cooling.

**iKon-XL** also delivers very low read noise, alongside an innovative 18-bit dynamic range mode. **iKon-XL** is in high demand and is already associated with several high profile observing sites globally, including observatories in China, Antarctica and Russia.

Furthermore, Andor's **iKon-L** 4 megapixel,  $-100^{\circ}\text{C}$  cooled camera has been the mainstay science detector of choice for many installations for well over a decade, including SuperWasp and Next-Generation Transit Survey exoplanet programs.

## Key Features

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16.8 Megapixel back-illuminated CCDs

TE cooled to  $-100^{\circ}\text{C}$ , with no liquid nitrogen or cryo-cooling

Near Infra-Red optimization

18-bit Extended Dynamic Range technology

Low maintenance design - maximum observing time

## Key Applications

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Wide field spectroscopic survey

Deep space observation

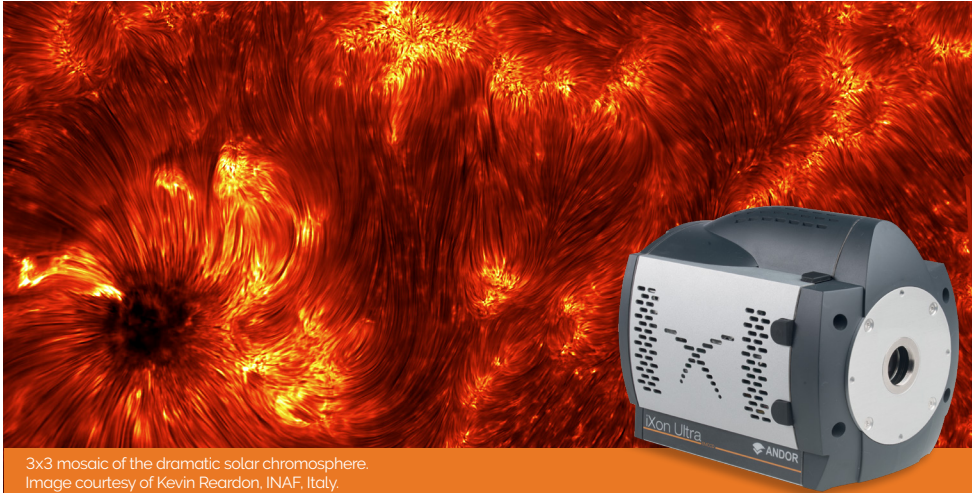
Exoplanet Discovery - Transit and Radial Velocity

Large sky surveys



Specification sheets  
available at  
[andor.oxinst.com/ikon](http://andor.oxinst.com/ikon)

# EMCCDs for Fast Time Resolution



3x3 mosaic of the dramatic solar chromosphere.  
Image courtesy of Kevin Reardon, INAF, Italy.

## iXon EMCCD Camera Range

For more than 17 years, Andor's **iXon** EMCCD cameras have been the high time resolution detectors of choice at a great many cutting edge observatories worldwide.

Featuring single photon sensitivity, TE cooling to  $-100^{\circ}\text{C}$  and  $>95\%$  QE, the **iXon** EMCCD range has been central to many demanding observing initiatives, such as the RAVEN 'Multi-Object Adaptive Optics' system at the Subaru Telescope (Hawaii), CHIMERA, the Caltech high speed multi-color camera for detecting transiting objects in the Kuiper Belt and SOFIA, NASA's large-scale airborne observatory.



Factor of 100 improvement in  
Signal to Noise Ratio! We can now  
successfully guide on  $>95\%$  of the  
fields.

Pasquale Temi and E.E. Becklin, SOFIA, NASA



## Key Features

- Single photon sensitivity
- Quantum efficiency  $> 95\%$
- Up to 1 Megapixel
- 26 - 56 full frames per second  
(faster with binning / sub-array)

## Key Applications

- Wavefront sensors
- High time resolution  
astrophysics
- Speckle imaging
- Guiding / Stabilization Systems



Specification sheets  
available at  
[andor.oxinst.com/ixon](http://andor.oxinst.com/ixon)

# sCMOS for Fast Time Resolution



Orbital debris, or space debris, is defined as any man-made, defunct object in near-Earth space.

## Andor sCMOS Camera Range

Scientific CMOS (sCMOS) technology is especially relevant in fast time resolution astronomy, combining high resolution / large field of view coverage of the sky with very fast time resolution, without sacrificing any of the ultra-low noise performance.

Andor's Bolor, Marana, Neo and Zyla sCMOS cameras have been used successfully in fast time resolution applications such as solar astronomy, Near Earth Object (NEO) detection, space junk tracking, lucky imaging and wavefront sensing.

## Key Features

- Extremely low noise down to  $0.9 e^-$
- Rapid frame rates up to 100 fps (full frame)
- High resolution up to 16.9 megapixel
- Extended dynamic range and superb linearity
- Quantum efficiency up to 95%
- No mechanical shutter

## Key Applications

- Solar astronomy
- NEO detection
- Orbital debris tracking
- Occultations
- Wavefront sensors
- High time resolution astrophysics
- Speckle imaging
- Large sky surveys

## Introducing...

# BALOR

## Very Large Area sCMOS

- 16.9 Megapixel
- $12 \mu\text{m}$  pixel size
- 18.5 ms readout
- 54 fps
- $< 3 e^-$  noise



Enquire at [andor.oxinst.com/bolor](http://andor.oxinst.com/bolor)



Specification sheets  
available at  
[andor.oxinst.com/scmos](http://andor.oxinst.com/scmos)

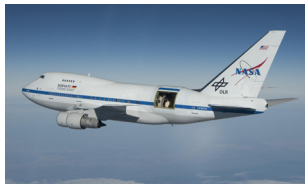
# Featured Projects



## Next-Generation Transit Survey, Chile

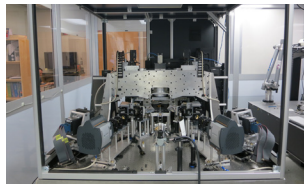
The Next-Generation Transit Survey (NGTS) is a wide-field photometric survey designed to discover transiting exoplanets of Neptune-size and smaller. NGTS is sited at the European Southern Observatory's Paranal Observatory in Chile, using an

array of customized  $-100^{\circ}\text{C}$  TE-cooled Andor iKon-L cameras, incorporating NIR optimized back-illuminated 4.2 Megapixel sensors.



## SOFIA - NASA and DLR

SOFIA is the world's largest airborne observatory, capable of making observations that are impossible for even the largest and highest ground-based telescopes. SOFIA uses flight-ruggedized iXon 888 EMCCD cameras for both guide stabilization and as the visible science camera.



## RAVEN - Uni. of Victoria, Canada

Utilizing multiple single photon sensitive iXon EMCCD cameras operating at hundreds of frames per second, Raven is a Multi-Object Adaptive Optics (MOAO) technical and science demonstrator installed on the, 8m class, Subaru Telescope located at the summit of Mauna Kea in Hawaii.

## DKIST, Haleakala, Hawaii

The world's largest (4 meter) solar telescope with first light in late 2019, DKIST will use multiple new Balor, very large area sCMOS cameras, across multiple instruments; including broadband, narrow band imagers and spectropolarimeters.



## CHIMERA - Caltech, USA

CHIMERA was primarily developed to enable the characterization of the size distribution of sub-km Kuiper Belt Objects via stellar occultation. Utilizing 1 megapixel iXon 888 EMCCD cameras, the instrument is optimized for monitoring of targets varying on timescales from milliseconds to hours.



**M42 - The Great Orion Nebula.**

M42 is an emission and reflection nebula in the constellation Orion. It is approximately 1,350 lights years from Earth and approximately 25 light years across. Exposures: L:3hrs; R:2 hours; G:2 hours; B:2 hours 10 minutes subs. Total exposure time: 9hrs

Image courtesy of Bill Snyder, Connellsville, Pennsylvania, USA.

# Customer Support

Andor products are regularly used in critical applications and we can provide a variety of customer support services to maximize the return on your investment and ensure that your product continues to operate at its optimum performance.

Andor has customer support teams located across North America, Asia and Europe, allowing us to provide local technical assistance and advice. Requests for support can be made at any time by contacting our technical support team at [andor.oxinst.com/support](http://andor.oxinst.com/support).

Andor offers a variety of support under the following format:

- On-site product specialists can assist you with the installation and commissioning of your chosen product
- Training services can be provided on-site or remotely via the Internet
- A testing service to confirm the integrity and optimize the performance of existing equipment in the field is also available on request.

A range of extended warranty packages are available for Andor products giving you the flexibility to choose one appropriate for your needs. These warranties allow you to obtain additional levels of service and include both on-site and remote support options, and may be purchased on a multi-year basis allowing users to fix their support costs over the operating life cycle of the products.



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