FIRST **light**

See an interactive 360° model of this camera at **www.skyatnightmagazine.com/ASI224**

ZWO ASI224 high frame rate colour camera

A colour camera that has excellent infrared capability and hidden depth

WORDS: PETE LAWRENCE

VITAL STATS

- **Price** £299.80
- **Sensor** Sony Exmor IMX224 1/3-inch CMOS, 3.75µm pixels, 4.8x3.6mm chip size
- **Resolution** 1.2 megapixels (1304x976)
- **Frame rate** Up to 64fps (12-bit) or 150fps (10-bit)
- **Extras** 1.25-inch adaptor, USB 3.0 cable, autoguiding cable, T- to C-mount adaptor, 2.1mm CCTV lens
- **Dimensions** 62mm diameter, 36mm depth
- **Weight** 108g
- **Supplier** 365Astronomy
- **www.**365astronomy.com
- **Tel** 020 3384 5187

ZWO's ASI224 high frame rate colour camera is a device with a split personality thanks to its impressive infrared sensitivity. From the outside, there's little that makes it stand out from the other cameras in the ZWO range: its red, cylindrical body giving little away about the capabilities of the technology inside.

SKY SAYS...
It's an excellent choice if you want to avoid the hassle of a mono camera and filters

The ASI224 uses a Sony IMX224 sensor. As with most colour sensors, this is a monochrome chip overlaid with a Bayer matrix – a repeating 2x2 pattern of coloured filters. The pattern consists of one red, one blue and two green filters, with one filter per pixel. The resulting greyscale image has to be 'deBayered' to restore the colour, a process performed either at the point of capture or during the registration and stacking phase, depending on the software you use.

For our tests, we used the freeware FireCapture control program for capture and AutoStakkert for registration and stacking. We deferred deBayering to AutoStakkert to maintain as high a frame rate as possible via FireCapture. ZWO supplies the drivers necessary to get the camera working, but we needed to make sure we were using the latest version of FireCapture to get everything working properly.

The IMX224 sensor has excellent infrared sensitivity. Leakage through the Bayer matrix filters is similar from 840nm, meaning that all pixels work at the same sensitivity irrespective of the colour filter they're fitted with. This means that the camera can be used for true infrared imaging when a suitable infrared-pass filter is fitted. This is great for imaging objects exhibiting detail in infrared, for example the bright planets. It's especially useful for Jupiter and Saturn when using speciality filters, such as methane (CH4), which is centred on 889nm.

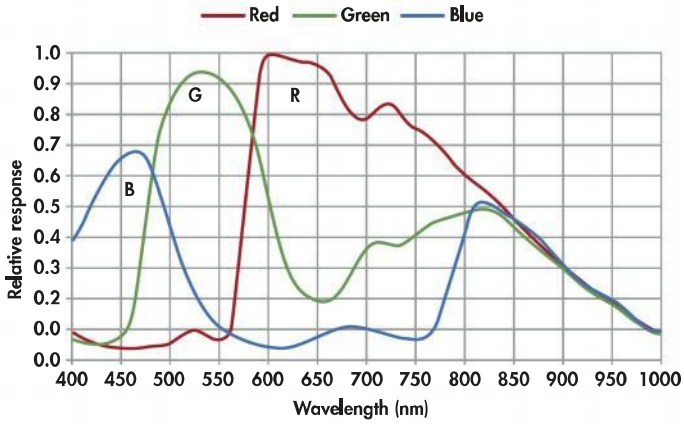
Probing the ice giants

The ASI224 is especially good on the ice giants, Uranus and Neptune. The camera's infrared sensitivity means it's possible to record the tiny discs presented by these distant worlds at reasonable frame rates. Subsequent processing can then pull out faint bands and bright spots. Using a 14-inch scope at f/28, we recorded Uranus ▸

INFRARED SENSITIVITY

The ASI224 is an exciting camera thanks to its amazing IMX224 chip. This has a good level of response across the normal one shot colour red-green-blue range, with the lowest performance being in the blue part of the spectrum where response drops to around 68 per cent that of the peak at 600nm (red). However, it's the fact that the camera has good response in the red and into the infrared portion of the spectrum that makes it interesting. Chip sensitivity for blue and green drop through the normal red range (as they should) but all climb to around 50 per cent of the sensor's peak sensitivity at the 840nm wavelength.

This means that an infrared-pass filter will show similar response from every pixel site irrespective of its Bayer filter (R, G or B) colour. With such a filter, the camera effectively behaves as a monochome near-infrared device between 840-1000nm. The means you can use the ASI224 as a regular colour camera by fitting an infrared-blocking filter, or as a near-infrared camera by fitting an 840-1000nm infrared-pass filter.



▲ The camera's colour response across the spectrum adds to its flexibility

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AUTOGUIDER PORT

The ST-4 autoguider port is on the side and allows the camera to be directly connected to a mount for autoguiding. A 2m cable is supplied with the camera for this connection. The high sensitivity of the IMX224 sensor is well suited to picking up guide stars.

USB 3.0 PORT

The sensor's 1304x976 pixel array contains 1.2 megapixels. A USB 3.0 interface is used to transport this data with a maximum frame rate of 64 frames per second (fps) for 12-bit data or 150fps for 10-bit data. A 2m USB 3.0 cable is provided for the computer connection.

CAMERA BODY

The body of the ASI224 is machined aluminium. Weighing just 108g, the whole camera is unlikely to put much strain on even lightweight mounts. A nice touch is that the rear of the body is tripod-threaded making it easy to mount and position the camera when it's not connected to a telescope.

CCTV LENS AND ADAPTOR

A T- to C-mount adapter is provided along with a 1.2mm focal length CCTV lens. Fitted to the front of the camera, this allows you to use the ASI224 effectively for all-sky imaging. This is where the tripod fitting at the back of the body comes in really handy, allowing you to position the camera just right.

FIRST light

▸ through a 610nm-pass filter at 15 frames per second. For such a dim target in infrared, this really is pretty impressive.

Longer red and infrared wavelengths tend to give more stable views because they're less affected by seeing. We found this to be especially true when imaging the Moon through ZWO's optional 850nm filter. The shots we obtained through pretty average seeing conditions were sharp and detailed.

However, the infrared sensitivity isn't ideal for RGB imaging because it skews colour balance. This is easily corrected with an an infrared-blocking filter. With this fitted, 'normal' RGB images of the planets can be taken, although effects such as the colour fringing introduced by atmospheric dispersion will still degrade their appearance.

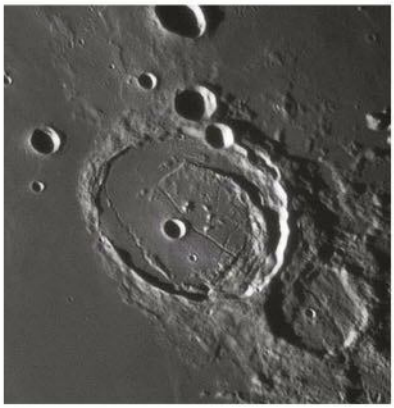
Great exposure range

The camera's excellent RGB sensitivity is well suited to Solar System targets and that echoes through to brighter deep-sky objects as well. Its exposure range runs from 32 microseconds to 1,000 seconds, so it can record a lot of deep-sky targets. With a 4-inch, f/9 scope we found we could grab a decent image of the Orion Nebula's core with sub-second exposures. The camera's small chip size means it's best suited to bright and relatively compact deep-sky objects.

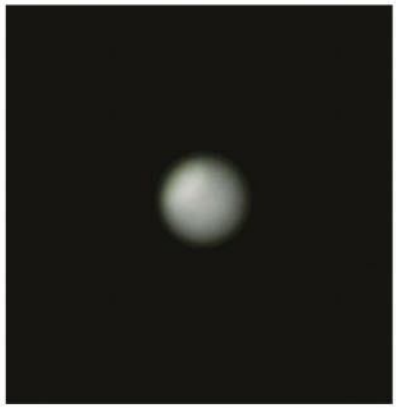
The IMX224 sensor has extremely low read noise (1.5 electrons), giving an excellent signal to noise ratio. Exposures of a few seconds appeared very clean, with noise starting to become noticeable as we moved into the several tens of seconds range. Longer exposures also showed a gradual brightening along two sides of the image frame. In both cases calibration successfully removed these effects.

The ASI224 is a great all-round performer and an excellent choice if you want to avoid the hassle of a monochrome camera and filters. Its excellent infrared sensitivity gives you two devices in one. For the best results, extras such as an atmospheric dispersion corrector, infrared-cut and infrared-pass filters are recommended. We can't help feeling that the infrared-cut and perhaps an 850nm infrared-pass filter should have been included as standard. With a little bit of effort, the ASI224 is capable of delivering some astounding results. S

The Sony IMX224 sensor is surrounded by an 8mm deep, 50.8mm (2-inch) collar designed to slip directly into a 2-inch eyepiece holder. The collar is internally T-threaded (M-42x0.75) to accept male T-threaded accessories such as the supplied 1.25-inch adaptor and T- to C-mount adaptor.



▲ Posidonius, stacked from 530 frames captured with an 850nm infrared-pass filter



▲ Uranus, stacked from 908 frames captured with a 610nm infrared filter

▲ The core of the Orion Nebula, showing the Trapezium Cluster, stacked from 350 two-second exposures

SKY SAYS...
Now add these:

1. ZWO CH4 methane-pass 20nm filter
2. ZWO 850nm infrared-pass filter
3. 365Astronomy imaging flip mirror

VERDICT	
BUILD & DESIGN	★★★★★
CONNECTIVITY	★★★★★
EASE OF USE	★★★★½
FEATURES	★★★★½
IMAGING QUALITY	★★★★½
OVERALL	★★★★½

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