ZWO optical ASI120

Can a CMOS-based astronomy camera from the relatively new Chinese company ZWO buck the trend and offer quality equivalent to a CCD-based camera? **Damian Peach** finds out.

▲ The window over the CCD chip. Some early models are lacking the window,leading to dust build up on the chip.

High speed CCD based cameras have long been the mainstay of those interested in taking detailed imagery of the Sun, Moon and planets. With a wide range of models available from a variety of manufacturers planetary astrophotographers are almost spoilt for choice in the cameras to choose from. That said however it has been some years now since a camera really offered a significant leap forward in imaging capability. Would the ASI120MM camera finally offer any significant leap forward from the competition? I for one did not expect what I was to find.

Quite unlike the most popular competing cameras on the market the ASI is based around a CMOS detector rather than CCD. In the past CMOS technology had always proved inferior to CCD for the task of capturing high resolution images of the moon and planets. Ultimately this has resulted in almost all of the foremost astro-cameras in use today being CCD based.

CCD and CMOS technology are very similar with both consisting of an array of light sensitive pixels that convert light into electrical charge. Previously CMOS chips had always been of generally lower quality, both in the images they delivered and also in their sensitivity to light and levels of noise produced. With modern CMOS sensors however this is no longer the case, and many camera manufacturers are now turning to CMOS technology thanks to their cheaper manufacturing costs, resulting in a less expensive product for the end user.

The ASI120MM is based around the Aptina MT9M034 CMOS sensor. This one-third inch-sized chip offers a 1.2 megapixel array (1,280 × 960) with tiny 3.75 micron pixels. This marks quite a change from many of its CCD counterparts in that the pixel size is very small while offering a larger array (most CCD based systems in use are 640 × 480 with larger pixels.)

The camera operates via a USB2 cable (included) and can offer a wide variety of frame rates and frame sizes. At full frame and full resolution it runs at a steady 30fps, while if you crop the frame size down using the region of interest (ROI) function, speed dramatically increases. Rates of over 100fps are available at 640 x 480 which is great news when using the camera for planetary work where only a small portion of the field is required.

The camera outputs data in high quality uncompressed 12-bit format giving good dynamic range. The USB2 connection seems to work very well and no separate power supply unit is required to power the camera as this is accomplished straight from the computer USB port. The camera also has an RS232 style port and cable allowing it to operate as a high quality autoguider in similar fashion to the old SBIG ST-4.

The camera body itself is well made and very lightweight coming in at only 100 grams. It is supplied with a 1.25-inch nosepiece for easy connection to almost any telescope. An especially neat inclusion is a 150-degree wide angle lens that screws directly onto the camera itself. This is very handy for capturing wide angle views of the sky and is a great way to use the camera as a low cost, all sky camera.

Image capture

Once the camera software is installed you are ready to start using the camera. For my own personal use I operated the camera on a mid-range laptop that proved more than capable of running the camera adequately. You must operate the camera via a USB 2.0 port as problems can occur if used via a USB 3.0 port (something mentioned in the installation instructions). For operating the camera software called *Sharpcap* is supplied that, although fairly basic, works well. Many will undoubtedly prefer to download the popular free software *Firecapture* from http://firecapture.wonderplanets.de that offers more capturing options. Indeed this is exactly what I did, being very familiar with *Firecapture* from other cameras I've used. The camera can capture into a variety of formats such as AVI or SER.

My primary targets during camera testing were Jupiter, Saturn and the Moon. All were well placed throughout April, although Jupiter presented a good challenge being far past opposition and would prove to be a good test for the camera during the early evenings.

Quite unlike the CMOS-based cameras of old the ASI is a completely different package. The live feed from the

▼ The ASI camera attached to the telescope.

▼ The ASI camera head and supplied accessories. The small 150-degree wide angle lens is an especially nice inclusion and also offers the possibility of employing the camera as an all-sky camera.

mm camera

camera is smooth without any dropped frames or lock-ups. Even at high frame rates using just a small portion of the camera chip no problems were encountered. One thing immediately of note is the camera sensitivity. It is at least as sensitive, and perhaps slightly more so, than the popular cameras based on the Sony ICX618 CCD chip. This is great news and especially so for difficult, dim targets like Saturn. In comparison to a competing camera based on the ICX618 chip the ASI was both slightly more sensitive and also slightly less noisy, something that surprised me greatly.

One especially great use of the camera is for lunar work. The 1.2 mega-pixel array can offer a large field-of-view at high resolution. This is especially good for larger lunar targets where before you would need to take several captures and create a mosaic. With the ASI I found lunar imaging a real pleasure, and the results off the camera were excellent.

No product is completely perfect, but the niggles with the ASI are very minor. On early models the CCD is exposed to the air with no protective window which means it can get dust on it very easily (which can be very troublesome to clean off). ZWO have now since remedied this and all new cameras are supplied with a window over the camera chip and owners of older models can order a small window to easily retrofit their cameras.

Another tricky situation many imagers will come up against is that the tiny 3.75 micron pixels have difficulty in correctly matching the telescope focal length to achieve an appropriate image scale. With my own 355mm (14-inch) f/11 telescope this presented quite a problem as most methods of amplification will produce too big an image scale on the chip. Users of Newtonians and other telescopes with lower native focal lengths will find this issue less troublesome. Luckily I had various adapters and tubes with which I was able to achieve a suitable image scale with the camera.

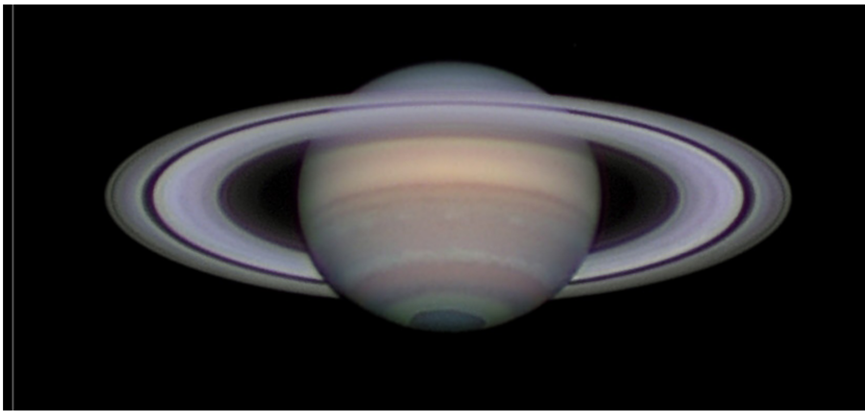
Overall this camera was an unexpected surprise. CMOS technology has really come on leaps and bounds in recent years and this is great news for the consumer. Priced at just $289 the ASI represents excellent value for money. Its capability and performance go far beyond its modest price tag and when all factors are taken into account it is quite possibly the best camera presently available to those interested in imaging the Moon and planets.

Damian Peach is a world-renowned astrophotographer. See his work at www.damianpeach.com.

At a glance:

Sensor:	0.33-inch CMOS AR0130CS (colour)/ MT9M034 (mono)
Resolution:	1.2 mega-pixels, 1,280 × 960
Pixel size:	3.75 microns
Connectivity:	USB 2.0
Weight:	100g
Details at:	www.zwoptical.com
European dealers:	Teleskop-Service (Germany, www.teleskop-express.de, +49 (0) 89-1892870) 365 Astronomy (UK, www.365astronomy.com, 08455 275813)
Price:	£246 (colour) $256 (mono) (prices taken from 365Astronomy website).

▲ Jupiter, as imaged by the camera on a 355mm telescope. Jupiter was far past opposition and presented a tough challenge low in the western sky at sundown. Despite this the ASI did an excellent job. All images: Damian Peach.



▲ Saturn, close to opposition in April, captured using the camera attached to a 355mm telescope.

▼ The ASI camera is especially well suited to lunar work. This view of Clavius at local sunrise over the crater was captured using the full field of the 1280 × 960 CMOS chip.