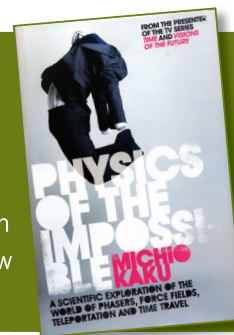


In the shops

Nick Howes takes an in-depth look at two new CCD cameras from The Imaging Source, with which he has produced some spectacular images, plus we interview Professor Michio Kaku about his new book, *Physics of the Impossible* and **Steve Ringwood** has his regular round-up in *Astroloot*.



Astronomy
HOT
Product

The Imaging Source USB 2.0 CCD cameras

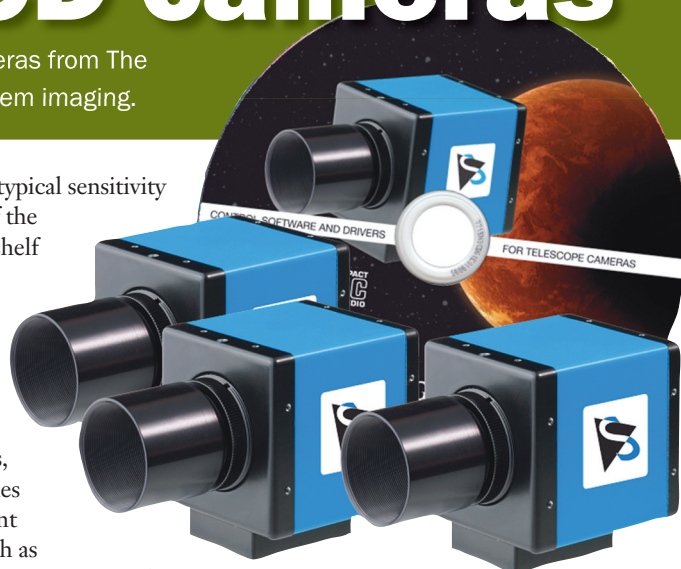
Nick Howes looks at two new high quality CCD cameras from The Imaging Source that are set to revolutionise Solar System imaging.

Until the turn of this century, imaging Solar System objects was either something you spent a huge sum of money on a professional CCD on, or you used film. The images printed in many astronomy books and magazines up to that date, even from the largest professional ground-based telescopes, were often relatively poor. Then, with the coming of the Phillips ToUcam, video images combined with simple to use software to stack and combine them transformed amateur lunar and planetary imaging. Exponents of such equipment, like Damian Peach, began producing shots of our Solar System's finest that were often better than any ground-based telescope had been able to deliver over the previous 15–20 years.

After a few years of deserved success, the limitations of the ToUcam, being a USB1.1 interface, began to become evident. Uncompressed video, something serious imagers required to maintain high quality, was limited to ten frames

per second, and the typical sensitivity and colour nature of the CCD of an off-the-shelf ToUcam limited the quality of the final image. Amateurs modified the ToUcam with more sensitive monochrome CCDs, but still the ten frames per second rate meant that with objects such as Mars or Jupiter, only a certain number of frames could actually be captured before the planet rotated enough to blur the image. This limit in the number of frames, combined with the average seeing, would ultimately determine and limit the final image quality.

Recently, cameras offering much higher frame rates and outstanding sensitivity have become available, two of which, from the leading scientific and industrial manufacturer The Imaging Source, are the subject of this review.

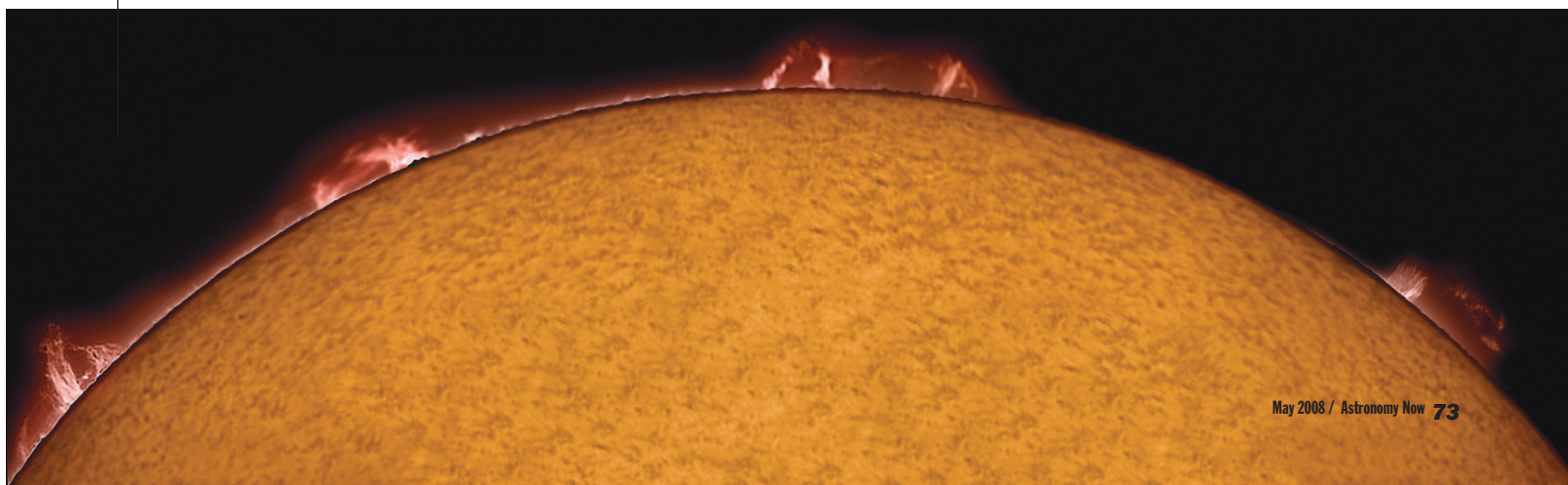


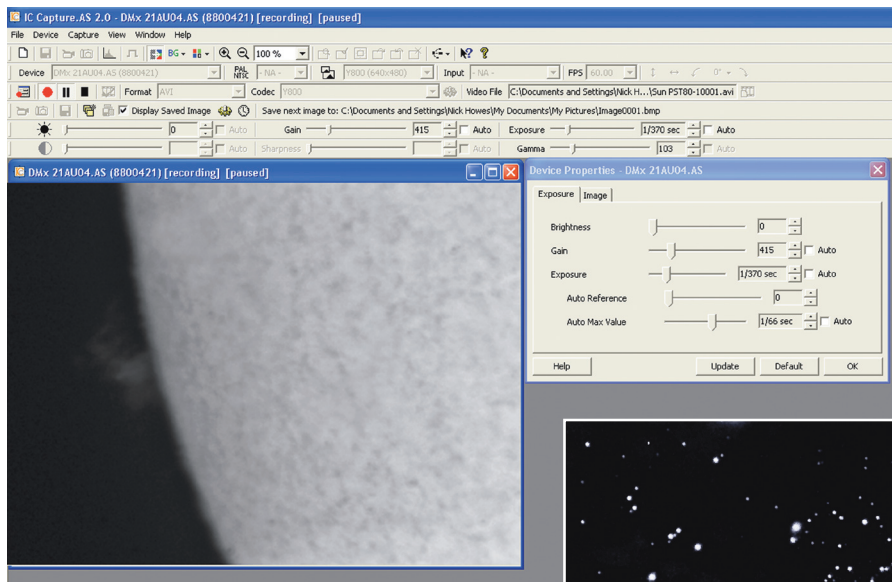
The USB family of The Imaging Source CCDs. The bottom of the cameras also feature standard tripod threading, and both can accept, via adapters, camera lenses for ultra-wide field use. One possible use in this context could be for meteor capture.

Getting started

The Imaging Source make a vast number of cameras, with a range of interface types, including IEEE1394, commonly referred to as Firewire. As most PC laptops however tend to have a four-pin DV/Firewire interface, the cameras

The 60 frames per second rate of the DMK 21AU04.AS camera made this huge scale image possible. The image is comprised of a total of eight frames, imaged at f/40 using a modified Coronado PST telescope, and then stitched together. The high frame rate meant that the total imaging time for the entire shot was only a few minutes, limiting the possibility of prominences moving, or large-scale changes in seeing conditions. Image: Nick Howes.

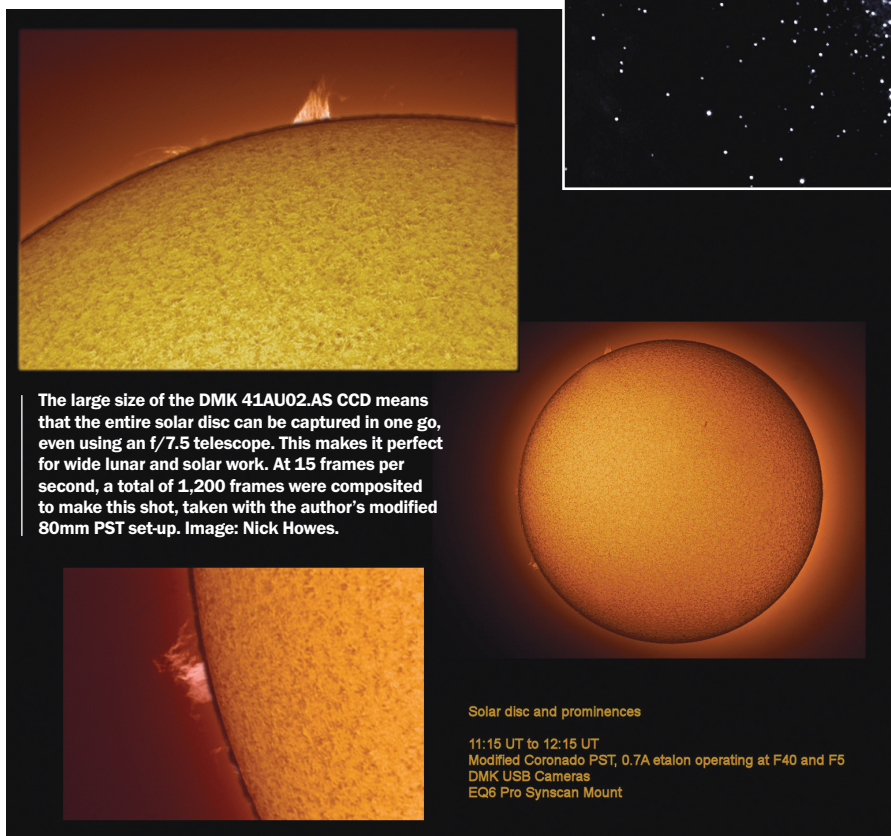




Above: The IC Capture.AS 2.0 software, which is supplied free with the cameras, is an exceptional application, boasting features that many other applications do not have. Here we can see that the capture has been paused, as clouds were about to cross the path of the solar disc. Note also that the cameras' dynamic range allows both the surface and prominence details to be seen at the same time. Image: Nick Howes.



Above: Although not designed as dedicated deep sky cameras, the ability of the DMKs to take exposures of up to 60 minutes, when combined with proper flat and dark frame subtraction, can yield more than acceptable results for many of the brighter deep sky objects, as this shot of Messier 13 shows. Image: Nick Howes.



The large size of the DMK 41AU02.AS CCD means that the entire solar disc can be captured in one go, even using an f/7.5 telescope. This makes it perfect for wide lunar and solar work. At 15 frames per second, a total of 1,200 frames were composited to make this shot, taken with the author's modified 80mm PST set-up. Image: Nick Howes.

Solar disc and prominences
11:15 UT to 12:15 UT
Modified Coronado PST, 0.7A etalon operating at F40 and F5
DMK USB Cameras
EQ6 Pro Synscan Mount

a software development background, it is always good to see a well-written and professionally designed installation suite. The software package also includes a software development kit for programmers of applications aimed at supporting The Imaging Source range. The software really does ooze quality, and within a few minutes you are literally up and running. Unlike Firewire cameras, the USB variety have just one cable to connect to your laptop, so there is absolutely no need ever to plug in a separate power supply, which is a real boost for imagers in the field.

Software

The CD installs drivers (The Imaging Source supply drivers for Windows XP, Windows Vista (fully supported) and Apple Mac OSX, so no imagers are left out in the cold), that are supported by a wide range of popular applications such as *K3CCD*, *Registax* and *PHD Guiding* (both cameras, through their high sensitivity, will make excellent autoguider as well), along with a really superb and fully featured imaging package known as *IC Capture.AS*

The feeling that this is a package that

of this type need additional power supplies. Mac owners usually have the better six- or nine-pin options, which provide power down the 1394 cable. For this review, The Imaging Source provided the much more convenient USB models, so power was not an issue.

The DMK 21AU04.AS (snappy name!) utilises the sensitive Sony ICX098BL chipset, which combined with the ultra-fast USB 2.0 interface,

can deliver up to 60 frames per second of 640 x 480 uncompressed video. The larger Sony ICX205AL in the second model, the DMK 41AU02.AS, delivers a huge 1280 x 960 resolution, which over USB 2.0 can deliver up to 15 frames per second uncompressed. Both cameras are able to act as deep sky imaging devices as well, with image exposure times up to a whopping 60 minutes.

The first thing that strikes you about

has been crafted with quality at the forefront of the design continues when you launch *IC Capture.AS*, which is available also as a free trial version download on The Imaging Source website (www.theimagingsource.com). At launch, the application allows you to select the camera that you have connected, and then presents you with a wealth of control over your chosen device. A highly intuitive menu structure, which can even automatically configure all of the controls supported by your camera model, makes the configuration of the camera seem like child's play. Comprehensive and yet still simple to follow, it has you arming the camera to record video with frame rates ranging from a low 3.75 to 60 frames per second for the DMK 21AU04.AS, and 3.75 to 15 frames per second for the DMK 41AU02.AS. The image capture can be either uncompressed, or a range of compression video codecs. The video stream output modes are supported in applications like *Registax* version 4. To maintain the absolute highest quality, most people will opt for either the uncompressed mode, or The Imaging Source's preferred lossless codec, which is referenced in the quick start guide, though be aware that at 60 frames per second you will need a good, fast hard disk drive and plenty of space, as it will fill up quickly. My relatively old Pentium 4 Hewlett Packard laptop coped perfectly well at all frame rates with almost no examples of any frame drop-out. The clever thing in this application is not only can you record video, but you can also pause and then resume the incoming video stream, which is perfect for when clouds go by, or the seeing becomes too poor for a while.

Spectral response

A clear histogram view, which is a really useful aid in determining the optimal input levels for the camera when imaging brighter objects such as the Moon or Sun, and the full control over gain, gamma and other familiar settings using simple to understand and well laid out slider controls, will enable anyone upgrading from a ToUcam to quickly get to grips with this software in a matter of hours. Another brilliant feature is the ROI (Region of interest) function, which allows you to crop the object being imaged (for example a planet), and avoid recording a whole lot of empty space.

In use, the wide spectral response of the Sony CCDs, peaking at around 510 nanometres, combined with their high sensitivity, turns both models into superb planetary cameras, and at this price point (£295 and £660 respectively) they simply have no rivals. With careful use of dark frames and a good time to cool down, they are not bad deep sky cameras either. The

For higher resolution work (this image using a modified Coronado PST at f/40), the DMK 21AU04.AS camera really comes into its own. The exceptionally high frame rates mean that much higher numbers of frames can be captured in a very short space of time, helping to improve the overall image quality and defeat the poor seeing that can plague the UK for many months of the year. This image of the Sun was taken in March when it was still at a relatively low altitude. Image: Nick Howes.

mono IXC098BL, a chip I am familiar with from my own modified ToUcam, makes it perfect for imaging narrowband subjects such as the Sun in both hydrogen-alpha and Calcium-K light, two areas that interest me personally very much but now, at 60 frames per second, the resultant image quality I was able to achieve was noticeably better than anything I had obtained with the ToUcam.

In summary, both cameras are outstanding performers. The DMK 21AU04.AS's price point putting it well within reach of any amateur, and even the larger DMK 41AU02.AS still provides a price/performance ratio that is hard to beat. My one and only gripe with it, and this has been a gripe with many astronomical cameras, is the relatively short length of the supplied USB 2.0 cable. Many imagers will simply find it too short for practical use, but I am aware that extending the cable length much more could introduce problems with signal drop out because of the limits in the USB specification. This is however easily rectified by getting a new cable from your nearest PC supplier, or integrating a powered hub to increase the overall length.

The Imaging Source have delivered cameras and software that offer the serious Solar System imager a product which will deliver outstanding results for years to come.

At a glance

DMK 21AU04.AS

Price: £295
 Sensor: Sony ICX098BL CCD chip
 Pixels: 640 x 480
 Pixel size: 5.6 micrometres
 Details at: www.theimagingsource.com
 or www.astronomycameras.com
 Available at: Ian King Imaging
 (Tel: 01892 834004, www.iankingimaging.com)

SCS Astro (Tel: 01823 665510, www.scsastro.co.uk)

Venturescope (Tel: 01243 379322, www.telescopesaes.co.uk)

The Widescreen Centre (Tel: 020 79 352580, www.widescreen-centre.co.uk)



Being able to capture a huge number of frames in a relatively short space of time, means that less time can be spent capturing composites for larger objects like the Moon and Sun. image: The Imaging Source/Aubry.

If they came up with more memorable names for the products, I am sure they would do even better. The webcam is dead, long live The Imaging Source!

Nick Howes is the Senior Test Engineer at Yamaha R&D. He has previously tested products for Ambergile, Modern Astronomy and Artemis, and is the technical liaison officer for Wiltshire Astronomical Society.

At a glance

DMK 41AU02.AS

Price: £660
 Sensor: Sony ICX205AL CCD chip
 Pixels: 1280 x 960
 Pixel size: 4.65 micrometres
 Details at: www.theimagingsource.com
 or www.astronomycameras.com
 Available at: Ian King Imaging
 (Tel: 01892 834004, www.iankingimaging.com)

SCS Astro (Tel: 01823 665510, www.scsastro.co.uk)

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