Collins

ROYAL OBSERVATORY GREENWICH

INSIGHT ASTRONOMY PHOTOGRAPHER OF THE YEAR

PLANETARIUM PRESENTATION 2017

Sponsored by

Insight INVESTMENT

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Each year, the Royal Observatory, Greenwich creates a fulldome presentation to accompany the competition. Featuring personal favourites from the shortlist, we try and distribute this as widely as we can, so as many people as possible see these stunning images.

2017 is the ninth year of Insight Astronomy Photographer of the Year, the competition that showcases the best celestial images taken from Planet Earth. The competition is organized by the Royal Observatory, Greenwich with generous sponsorship from Insight Investment Management, and is run in association with *BBC Sky at Night Magazine*.

Over 3,800 awe-inspiring images have been submitted from 79 nationalities and taken in 91 countries around the world, covering all seven continents (including five from Antarctica). This year's competition saw a huge increase in entries from Iran, which rose from 12 to 47 entrants to become the third biggest country in the competition. This year also welcomed the first image of Uranus into the competition, as well as two shortlisted images taken on mobile phones.

This presenter's guide provides a reference for the images used in the fulldome presentation. Rather than create a script that has to be followed, we want users to be able to present the show in the way that suits them best. The content works as an ambient experience, as aspects of an education curriculum, or as a showcase of amazing astrophotography.

The images featured in the presentation are a fantastic way to inspire a love of astronomy and astrophotography in others. In future presentations, we hope to see lots of entries from people motivated to submit their work by what they have seen in the Insight Astronomy Photographer of the Year competition!

JUDGES

The judging panel is made up of individuals from the world of astronomy, photography, art and science:

Chris Bramley
Editor of *BBC Sky at Night Magazine*, which launched in 2005.

Jon Culshaw
Comedian, impersonator and regular guest on the BBC's *The Sky at Night*.

Will Gater
Astronomer, journalist and astrophotographer.

Marek Kukula
Public Astronomer at the Royal Observatory Greenwich.

Pete Lawrence
World-class astrophotographer, presenter on the BBC's *The Sky at Night* and writer for *BBC Sky at Night Magazine*.

Chris Lintott
Co-presenter of the BBC's *The Sky at Night* and a professor of astrophysics at the University of Oxford.

Ed Robinson
Award-winning photographer, creative director and visual consultant. Founder of OneRedEye Visual Communications.

Rebecca Roth
Image coordinator and social media specialist at NASA's Goddard Space Flight Center in Maryland, USA.

Oana Sandu
Community Coordinator for the European Southern Observatory.

Melanie Vandenbrouck
Curator of Art (post-1800) at the National Maritime Museum, Royal Museums Greenwich.

AUTHORS

Background text for the featured images was created by the following members of staff at Royal Museums Greenwich:

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Melanie Vandenbrouck	Curator of Art (post-1800)
Affelia Wibisono	Astronomy Programmes Assistant

AURORAL CROWN

Yulia Zhulikova (Russia)
Murmansk, Russia, 3 January 2017

This photo was taken in the Murmansk region during an astrophotography tour with Stas Korotkiy, an amateur astronomer and popularizer of astronomy in Russia. The radiance flared swiftly and I photographed it near the house, while the trees were illuminated by street lamps.

Canon EOS 6D camera, 14 mm f/2.8 lens, ISO 3200, four 2-second exposures combined

ASTRONOMER: The aurora's unearthly green makes a striking contrast to the candy-floss pink of the trees in this surreal scene. All is not quite as it seems: the snow-covered trees are lit up by the artificial glow of streetlights, giving them this unusual technicolour appearance. However, similar physics is involved in the generation of both colours when excited atoms of gas give out light at characteristic wavelengths: green from oxygen in the aurora, and pink from the neon used in the low-pressure sodium streetlights. **MK**

ENCOUNTER OF COMET AND PLANETARY NEBULA

Gerald Rhemann (Austria)
Tivoli Farm, Khomas, Namibia, 5 June 2016

At an observatory on Tivoli Farm in Namibia, I installed a mount and telescope with a friend of mine. This observatory is fully remote-controlled and frequently maintained during our visits. I had already created many comet images remotely using this setup and this mosaic was also taken with it. The image shows the encounter of comet C 2013X1 Panstarrs with NGC 7293, the Helix Nebula, on 5 June 2016. This is a mosaic image of two panels. The contrast between comet and planetary is very exciting.

ASA Astrograph 12-inch N 300 mm f/3.6 reflector telescope, ASA DDM 85 mount, FLI Microline ML 16200 camera, 94-minute total exposure

ASTRONOMER: This juxtaposition perfectly captures the delicate and vivid beauty of both objects while still allowing each to shine in its own right. The Helix Nebula is a planetary nebula, which is formed when a dying star puffs off its outer layers. Although it is a very dynamic region in space, over the course of a human life we might detect little or no change in it at all. In contrast, comets moving through space can change rapidly over days and weeks, with some breaking up and not even surviving their trip around the Sun. **LA**

"A real contrast of colours here as comet C/2013 X1 PanSTARRS passes the Helix Planetary Nebula in Aquarius. Great skill is required to capture and render moving comets in long-exposure images and this has been shown to excellent effect here. Lots of intricate detail in the comet's thin plasma tail can be seen heading towards the lower left of the image. There's also tremendous detail in the Helix itself, with the outer halo clearly visible."
PETE LAWRENCE

ISS DAYLIGHT TRANSIT

Dani Caxete (Fernández Méndez) (Spain)
Madrid, Spain, 2 April 2017

Is it possible to see the ISS (International Space Station) in broad daylight? This photograph answers that question, although doing so without the aid of a telescope or binoculars can be very difficult. The ISS shone with a magnitude of -3.5 and the Sun was at a height of 9º on the horizon. I always like to photograph the Moon in broad daylight. The lack of contrast and the predominant blue make it much more familiar and close to our planet, although the seeing is not usually the most appropriate. Like the Moon, the ISS also receives solar rays in a similar way during its 15 orbits of the Earth a day, making it possible to see it when the Sun is still up. This is a real shot, with no composite or clipping in the process.

Long Perng Ed 80 mm f/6.28 refractor telescope at f/12.56, Sky-Watcher Allview mount, Nikon D610 camera, ISO 1000, 1/1600-second exposure

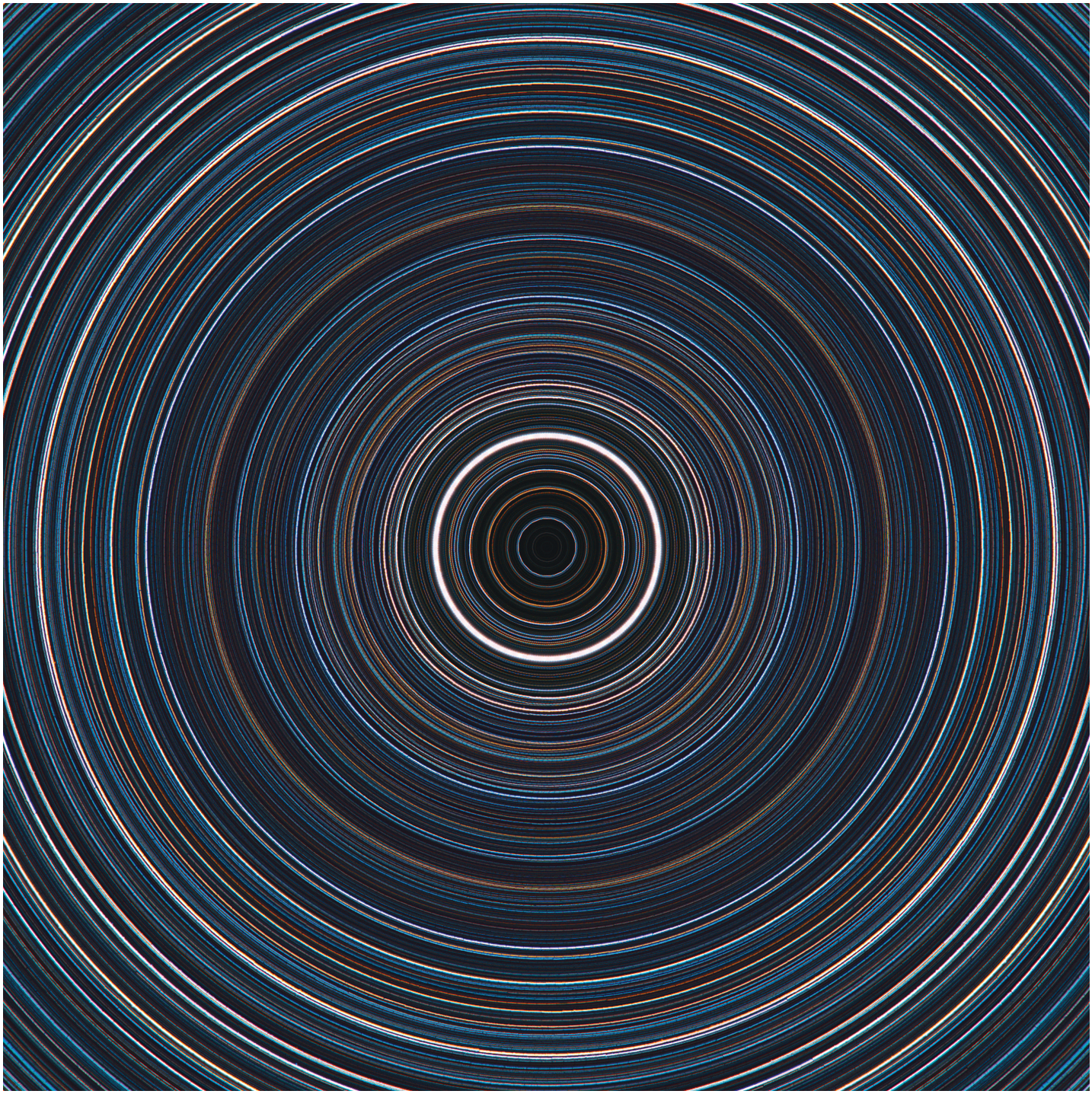
STARBURST GALAXY M82

Bernard Miller (USA)
Animas, New Mexico, USA, 22 February 2017

This is an image of M82, a starburst galaxy about 12 million light years away in the constellation Ursa Major. It is a member of the M81 group and is five times more luminous than the Milky Way galaxy. The starburst activity is thought to be the result of an interaction with the neighbouring galaxy M81.

PlaneWave CDK-17 17-inch reflector telescope at f/6.8, Paramount ME mount, Apogee CG16M camera, 18-hour total exposure

ASTRONOMER: The M81 group, which contains the M82 starburst galaxy, is a collection of 34 bright galaxies and one of the closest to our own local group. A starburst galaxy is one in which new stars are being formed at an abnormally high rate. Interaction with neighbouring galaxies can cause the gas and dust in molecular clouds to be compressed, which leads to the collapse and eventual fusion of the gas, bringing new stars to life. **DP**



ONE STELLAR DAY

Andras Papp (Hungary)
Ágasvár, Veszprémvarsány, Hungary, 2 November 2016

I planned, for some time, how to capture a full stellar day without making a trip beyond the Arctic Circle. After many failed tests, I eventually found a way to set up my photo equipment that was stable and easily replicated. With this set-up, the series of exposures taken could be stacked with those taken weeks or even months later. Using this foundation, I collected the segments until the full circle had been accomplished in 2016.

Canon EOS 700D camera, 18–135 mm at 135 mm f/7.1, Sky-Watcher HEQ5 mount with home-made camera holder, ISO 800, 287 x 300-second exposures

ASTRONOMER: The clocks we use to tell the time are based on a solar day: every 24 hours the Sun crosses the Prime Meridian at Greenwich followed by each imaginary line of longitude on Earth. However, as our planet spins on its axis, it actually takes 23 hours, 56 minutes and 4 seconds to complete one rotation. This is the true rotational period of Earth and this is called the 'sidereal day' or 'stellar day'. As the Earth rotates, it also orbits the Sun, and so from our perspective the Sun moves out of position by about 1 degree every day against 'fixed stars'. The star trail image here captures the motion of stars over the course of one sidereal day. **DP**

"As much as the subtlety of the colours – a dizzying array of turquoise, ochre, maroon or cyan – it's the precision that is so compelling here. The concentric circles are so perfectly delineated that the result looks artificial, as if drawn by a computer, pixel by pixel."

MELANIE VANDENBROUCK

OVERALL WINNER 2017

THE RHO OPHIUCHI CLOUDS

Artem Mironov (Russia)

Hakos Farm, Windhoek, Namibia, 6 August 2016

The Rho Ophiuchi Cloud Complex, known as 'Rho Oph' for short or the Ophiuchus Molecular Cloud, is named after a bright star in the region. It is a dark emission and reflection nebula about 14 light years across that is located about 460 light years away from Earth in the constellation of Ophiuchus (the 'Serpent-Bearer'). It is one of the closest star-forming regions to the Solar System. The image was taken at a farm in Namibia near Gamsberg Mountain over three nights.

Sky-Watcher 200 mm f/4 reflector telescope, Sky-Watcher HEQ5 Pro mount, Canon 5D Mark II camera, ISO 1600, 15-hour total exposure

ASTRONOMER: Rho Ophiuchus contains vast amounts of molecular hydrogen, the main ingredient in the formation of stars. Recent x-ray and infrared studies revealed a cluster of more than 300 protostars in this beautiful stellar nursery. The youngest stars are surrounded by thick clouds of dust. More evolved stars peer through and their high-energy light causes the surrounding gases to glow. The cold dust is an exciting chemical laboratory: astrochemists have discovered molecules here such as hydrogen peroxide (H_2O_2) and formamide (NH_2CHO). On Earth, hydrogen peroxide can be found in bleach. The presence of hydrogen peroxide in this star factory points to the formation of water molecules around young stars while formamide is linked to the formation of amino acids – the building blocks of proteins, which are used in cells for a variety of biological processes. **RT**

"This is a superb photograph and a deserved winner of its category and the competition. The photographer has produced a beautiful balance between the blue reflection nebula in the lower left and the red emission nebula in the upper right. A dark-looking dust cloud forces itself in front of them, dividing the scene in two. The image is superbly processed, with the stars sharp from edge to edge. The result is an image that has an elegant complexity to it – simply exquisite."

PETE LAWRENCE

"An amazing image and deserving winner. As you stare into the wonderful composition of this shot, and see the pin-sharp details of individual stars and textures, you wonder what could possibly exist within it all. Take a step back and the deep silvery blue and salmon pink shades seem to be reaching towards each other, almost like Michelangelo's 'Creation of Adam'.

JON CULSHAW

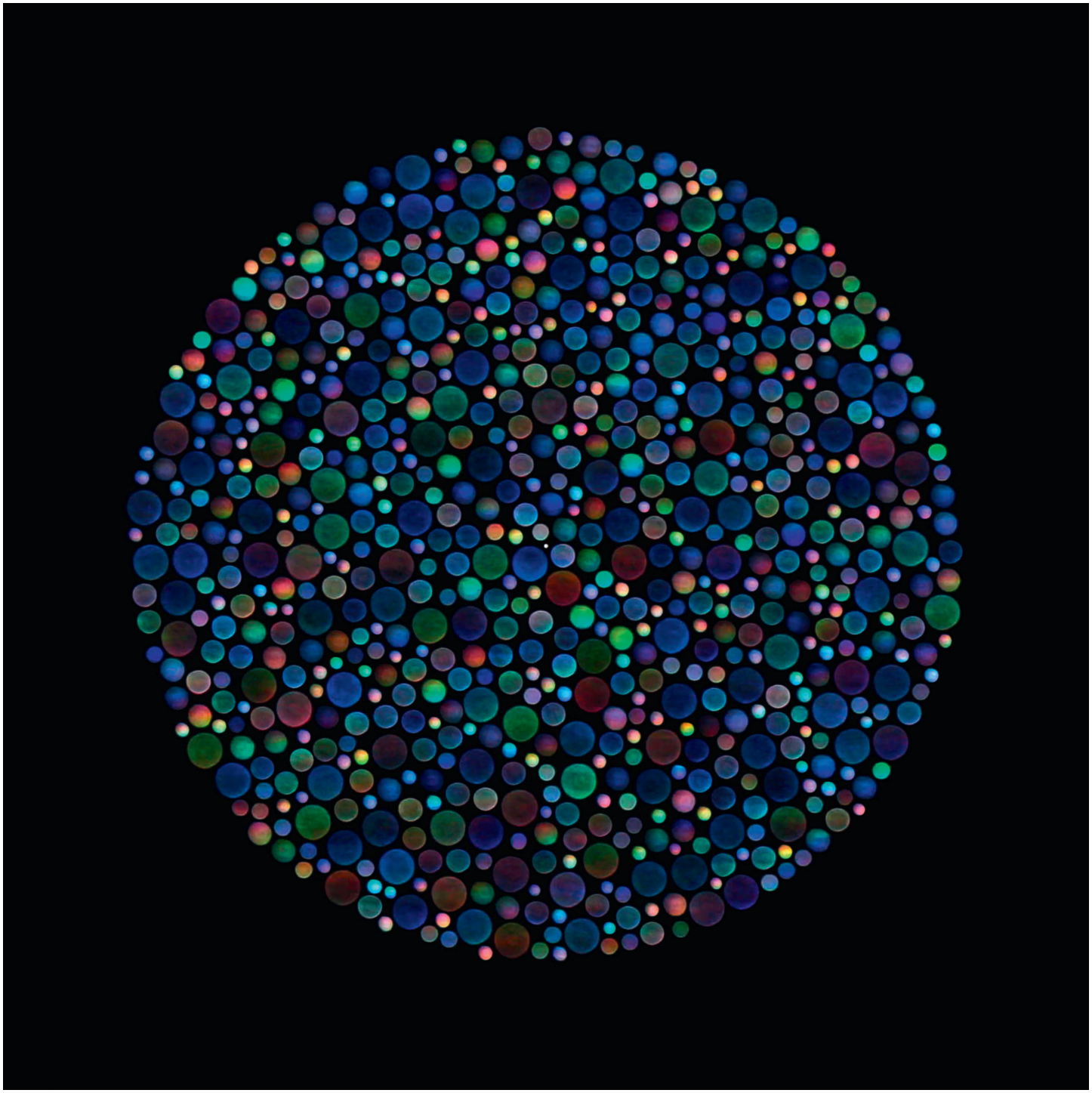
MESSIER 13

Bernhard Hubl (Austria)
Nussbach, Austria, 7 July 2016

Four nights with excellent seeing in July 2016 were used to capture this sharp and deep image of Messier 13 in constellation Hercules, using a self-made 12-inch Newtonian telescope with a focal length of 1120 mm. M13 is a globular star cluster of about 300,000 stars, and about 22,000 light years away from Earth. Many background galaxies are also visible in the image.

Home-made 12.5-inch f/3.8 reflector telescope, ASA DDM85 mount, QSI-660 camera, 6 hours 48 minutes total exposure

ASTRONOMER: Messier 13, also known as the Great Globular Cluster in Hercules, is one of the finest examples of its kind in the whole sky. In 1714 its discoverer Edmund Halley noted, 'It shows itself to the naked eye when the sky is serene and the Moon absent.' A faint patch of light to the eye, M13 comes to life through binoculars and telescopes as an swarm of stars, which are in some cases estimated to be almost 13 billion years old. This image reveals details in the cluster's brilliant core where the largest of its estimated 300,000 stars are concentrated. **TK**

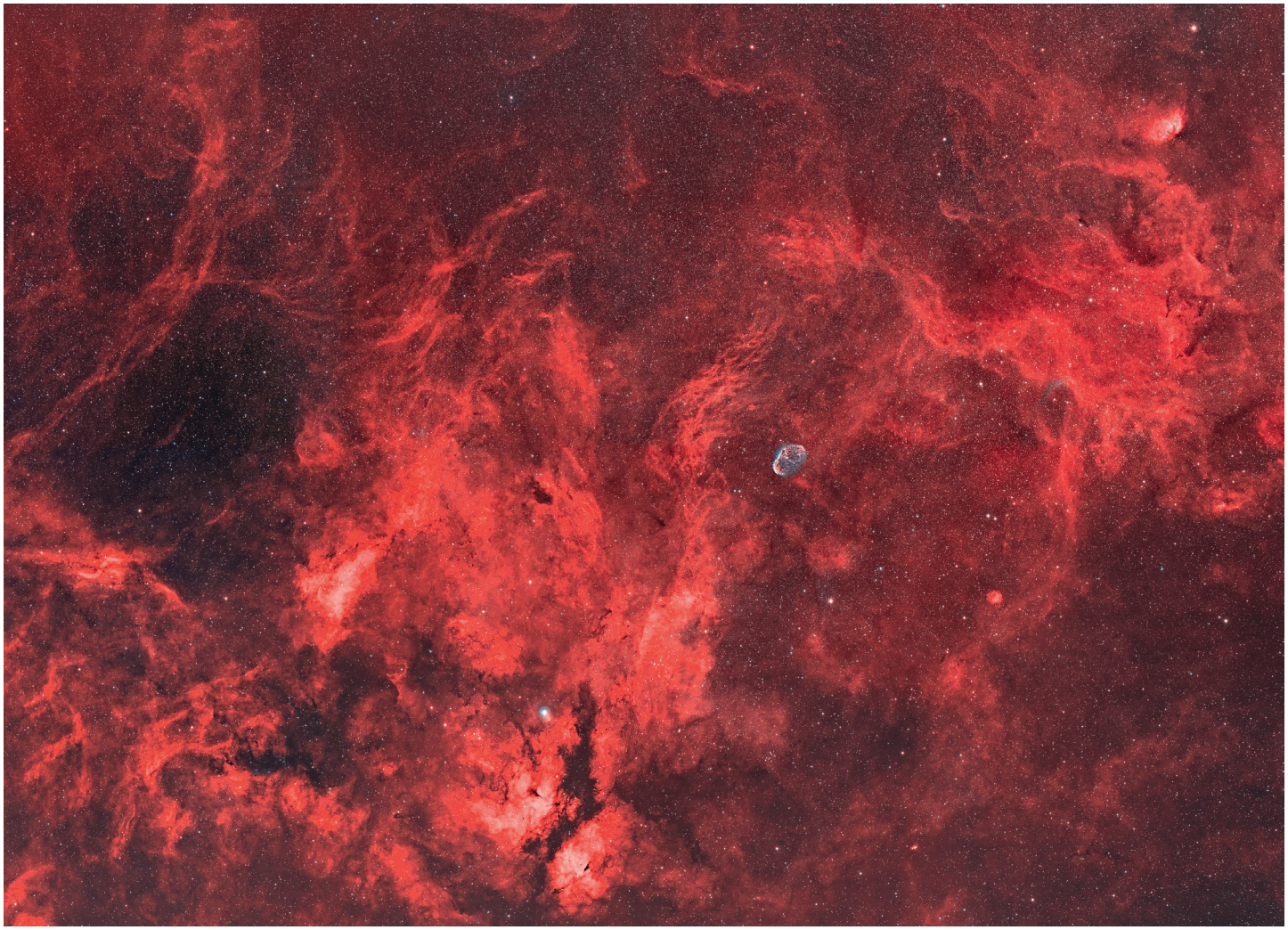


SCINTILLATING SIRIUS

Steve Brown (UK)
Stokesley, North Yorkshire, UK, 11 January 2016

Sirius is the brightest star in the night sky and often displays a dazzling array of colours as it twinkles close to the horizon. These colours are obvious to the naked eye and more so through the eyepiece of a telescope, but are difficult to capture in an image. I wanted to show the flashing colours Sirius displays when viewed through the eyepiece of a telescope. To do this I had to somehow 'freeze' each colour as it happened. I did this by taking a series of videos at different levels of focus and then extracted the frames from each video to make up this composite image. By capturing the star out of focus, the light from Sirius was spread out over a larger area, which resulted in the colours it displayed being more obvious. The image is made up of 782 different frames at different levels of focus. There is a single frame of a focused Sirius in the centre of the image.

Canon EOS 600D camera with Star Adventurer tracking mount, 250 mm lens, ISO 3200, composite of 782 images

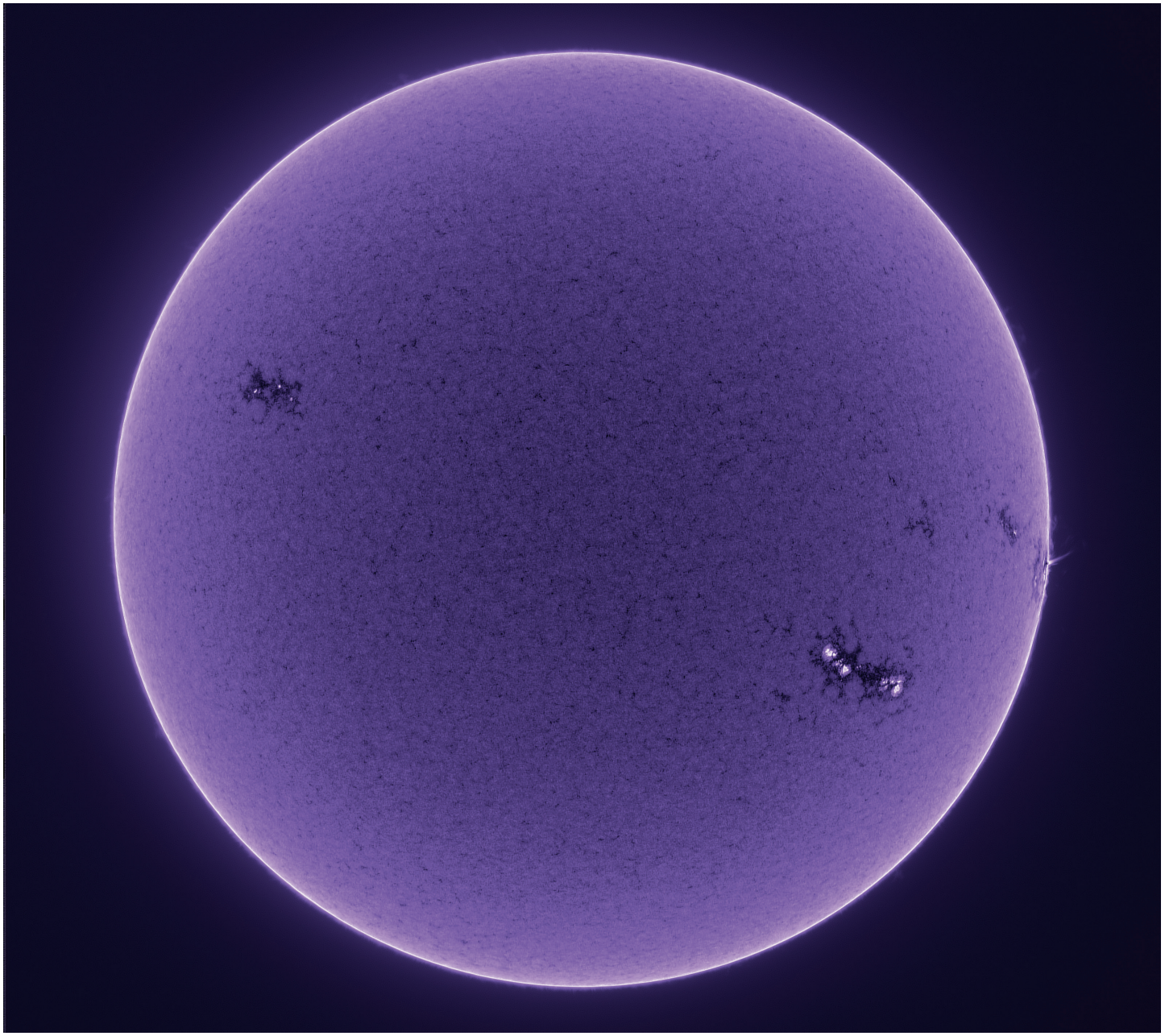


GAMMA CYGNI AND BEYOND

Rob Preston (UK)
Kidderminster, Worcestershire, UK, 23 September 2016

This image takes in a large portion of the sprawling mass of star-forming hydrogen gas and dust contained within Cygnus. By far my largest ever project, it is comprised of 16 panels with a total exposure time of 56 hours (with a full-size resolution of 98 megapixels) – which under UK conditions accounted for the majority of clear sky available to me during the spring and summer of 2016. There are many areas of interest within this image, most notably, the Propeller Nebula (middle left), the Butterfly Nebula (bottom centre), the Crescent Nebula (centre) and the Tulip Nebula (top right). There were a few technical issues to overcome with an image of such scale, including the curvature of the sky, and the multiple gradients in the OIII (doubly ionized oxygen) panels, but the sheer size of the data set made for very slow processing. I therefore had to be very careful because one wrong turn would have meant many wasted hours.

William Optics Star 71 telescope, Sky-Watcher NEQ6 mount, Atik 383L+ Mono camera, 71 mm f/4.9 lens, panorama of 16 panes with 56-hour total exposure



GHOSTLY SUN

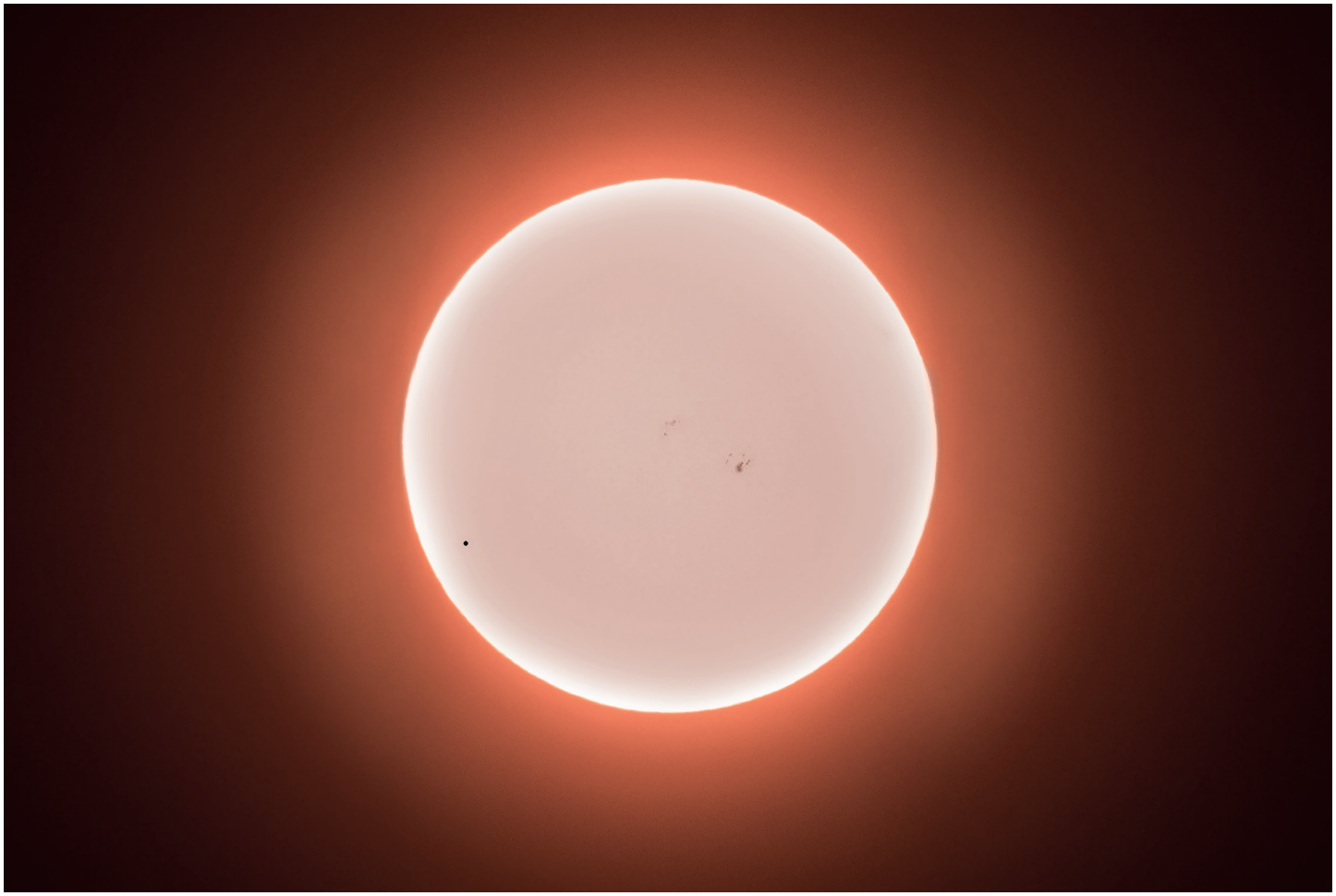
Michael Wilkinson (UK)
Groningen, Netherlands, 4 April 2017

This is an image of the Sun in Calcium-K light, showing the inner chromosphere. In the colour-rendering scheme used, the surface is shown as negative, with the sunspots as bright spots, but the area outside the limb is shown with increased contrast, highlighting a surge on the western limb, and several small prominences. Despite the sun going into a quieter phase, there is still a lot of activity.

APM 80 mm f/6 refractor telescope, Vixen Great Polaris mount, ZWO ASI178MM camera, stack of 400 frames

"Creative applications of the Calcium-K light spectrum, as seen in this image, really do give us an alternative, and refreshing, view of our star. The patterns or activity seen here portray chaos alongside structure; I think quite a fitting visual representation of our star and our universe."

ED ROBINSON

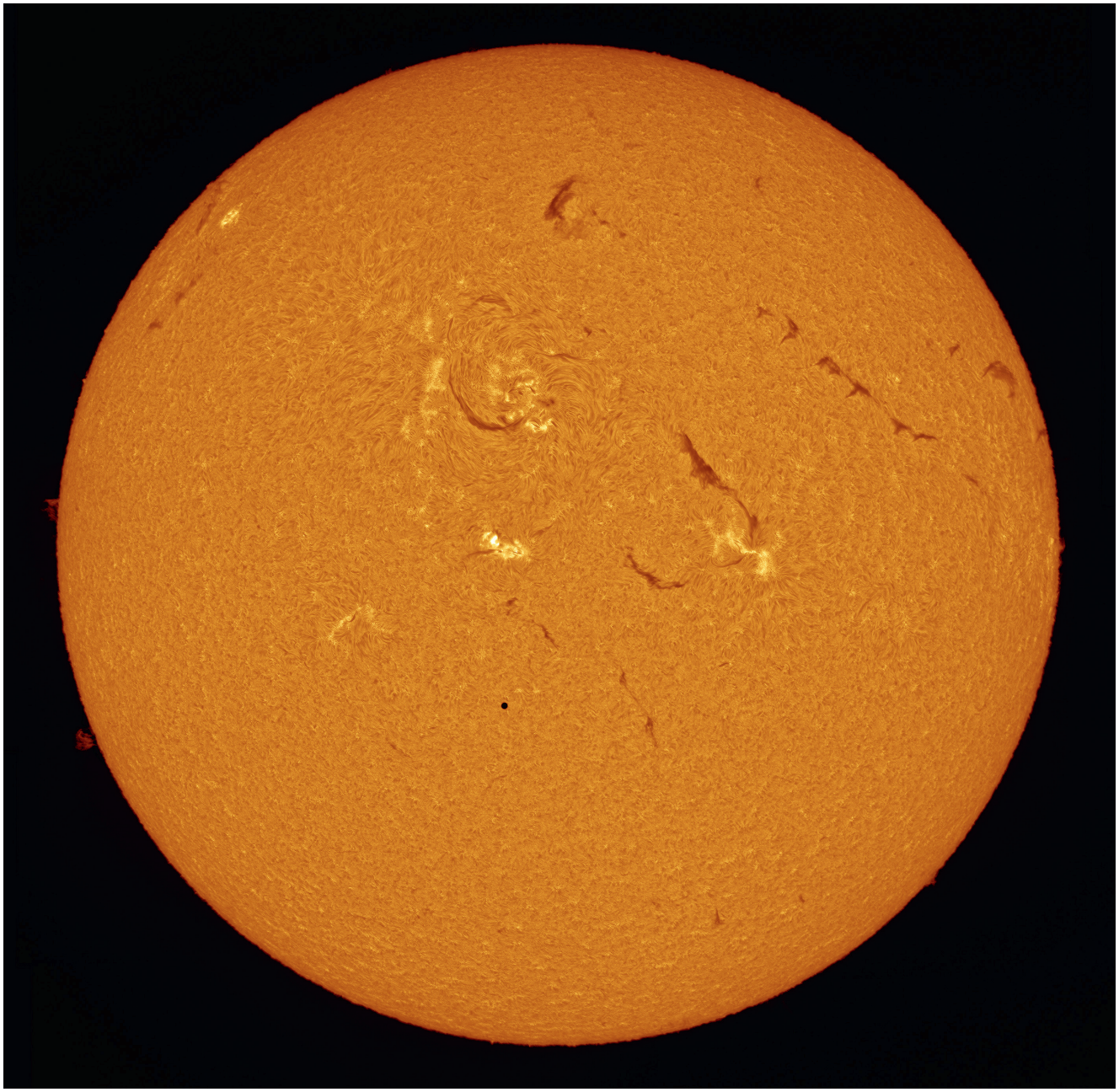


MERCURY'S SILHOUETTE AGAINST OUR STAR

Scott Tully (USA)
Cornwall, Connecticut, USA, 9 May 2016

Mercury's silhouette is captured here with our Sun's brilliant glow. To see this planet backlit by our star was a beautiful and exciting experience and created a magical day for all who were fortunate enough to see these two come together. I wanted to show the Sun with its bright glow without losing the planet's silhouette. I accomplished this by combining two separate images: one that was overexposed to show the sun's glow, and one that was just right to capture the planet and the surface details of our star.

Vixen ED103S 103 mm f/7.7 refractor telescope, Baader Astrosolar filter, Losmandy GM8 mount, Hutech modified Canon EOS 6D camera, composite of two exposures: ISO 800, 1/2000-second; ISO 250, 1/4000-second



MERCURY RISING

Alexandra Hart (UK)
Preston, Lancashire, UK, 9 May 2016

The transit of Mercury across the face of the Sun was a very special event indeed. The day dawned cloudy but weather forecasts showed clear skies to the north. Thankfully a very kind friend offered me the use of his garden and I was able to view the transit from beginning to just past mid-point. It is such a tiny planet when compared to the Sun, but such a big moment to witness.

TEC140 140 mm f/7 refractor telescope at f/9.8, Solarscope DSF100 H-alpha filter, Sky-Watcher EQ6 Pro mount, PGR Grasshopper 3 camera, stacked from multiple exposures

ASTRONOMER: The Moon is not the only heavenly body that can pass directly between the Earth and the Sun – Mercury and Venus can too. However, the two planets are much further away from us than the Moon so they cannot block out the whole of the Sun's disc. Therefore these events are called transits rather than eclipses. The transit of Mercury on 9 May 2016 lasted for 7.5 hours, making it the longest of the century. It was captured by many, including the Royal Observatory Greenwich, whose live stream through the Great Equatorial Telescope allowed almost 150,000 people around the world to watch the event. Magnification is needed (with the proper safety precautions) to see Mercury's silhouette, as its diameter appears 158 times smaller than the Sun's. **AW**

"I remember watching this rare and dramatic transit of Mercury at my local observatory, seen then as a black dot against a solid, flat disc of light. Observing the transit here, where we can see the Sun as spherical and with the features of its photosphere, is magnificent: a snapshot of the Solar System's clockwork."
JON CULSHAW

"This is an excellent image of the Sun's disc taken through a hydrogen-alpha filter. Such shots are difficult to achieve because the filters often produce gradient effects across the whole of the Sun's disc. There's lots of detail to be seen here, including many dark filaments snaking across the Sun's surface, and a number of bright active regions indicating the presence of strong magnetic fields."
PETE LAWRENCE

Collins

ROYAL OBSERVATORY GREENWICH

THANKS. SEE YOU IN 2018.

A guide to the Insight Astronomy Photographer of the Year competition is featured in the official publication, which showcases over 140 breathtaking images of space and the night sky, including all 2017 winning, runner-up, highly commended and shortlisted images. Orders can be made through the Royal Museums Greenwich online shop.

www.rmg.co.uk/astrophoto