

Astronomy ✨ Photographer of the Year

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In 2019, the Insight Investment Astronomy Photographer of the Year competition attracted an astonishing 4,602 submissions across its 11 categories – a new record for the beginning of the competition's second decade. With entrants spanning the globe capturing images from all seven continents on Earth, the competition has once again set the standard for astrophotography.

As with previous years, there are eight subject categories featuring an extraordinary range of celestial, meteorological and atmospheric phenomena in our skies. From each category, a winner, a runner-up and a highly commended image are selected by the judges.

There is also a young astronomy photography competition for entrants under the age of 16. This year's Young Competition received an unprecedented range of accomplished and imaginative submissions, reflecting the talented and ever-growing community of emerging astrophotographers.

Finally, two special prizes are awarded. The Robotic Scope prize celebrates the use of increasingly accessible remote telescopes by astronomers unable to reach the darkest skies. The Sir Patrick Moore Prize for Best Newcomer, open to those with less than two years' experience of astronomy photography, embodies the spirit of the man it is named after. It recognizes fledgling astrophotographers and welcomes everyone who has an interest in the field.

The images in this short fulldome presentation are a small sample drawn from the wider competition, to give just a flavour of the talents of the astrophotographers and enthuse audiences about the competition. As always, the fulldome presentation itself is generously hosted on the European Southern Observatory website to ensure it can be downloaded at high resolution by anyone interested. In addition, a wonderful hardback collection of 140 shortlisted images is available from Collins, and a touring exhibition is available from Royal Museums Greenwich, so there are a number of different ways for individuals and institutions to enjoy the results of this year's competition.

Each year, entrants find new ways to capture and represent the sky, blending creativity and technical prowess, and this year they have raised the bar once again. The following pages are filled with wonder, awe and contemplation. It is the hope of everyone involved with the competition that you enjoy them and are inspired to join Royal Museums Greenwich and Insight Investment in celebrating the wonders of the Universe next year.



Titanium Moon

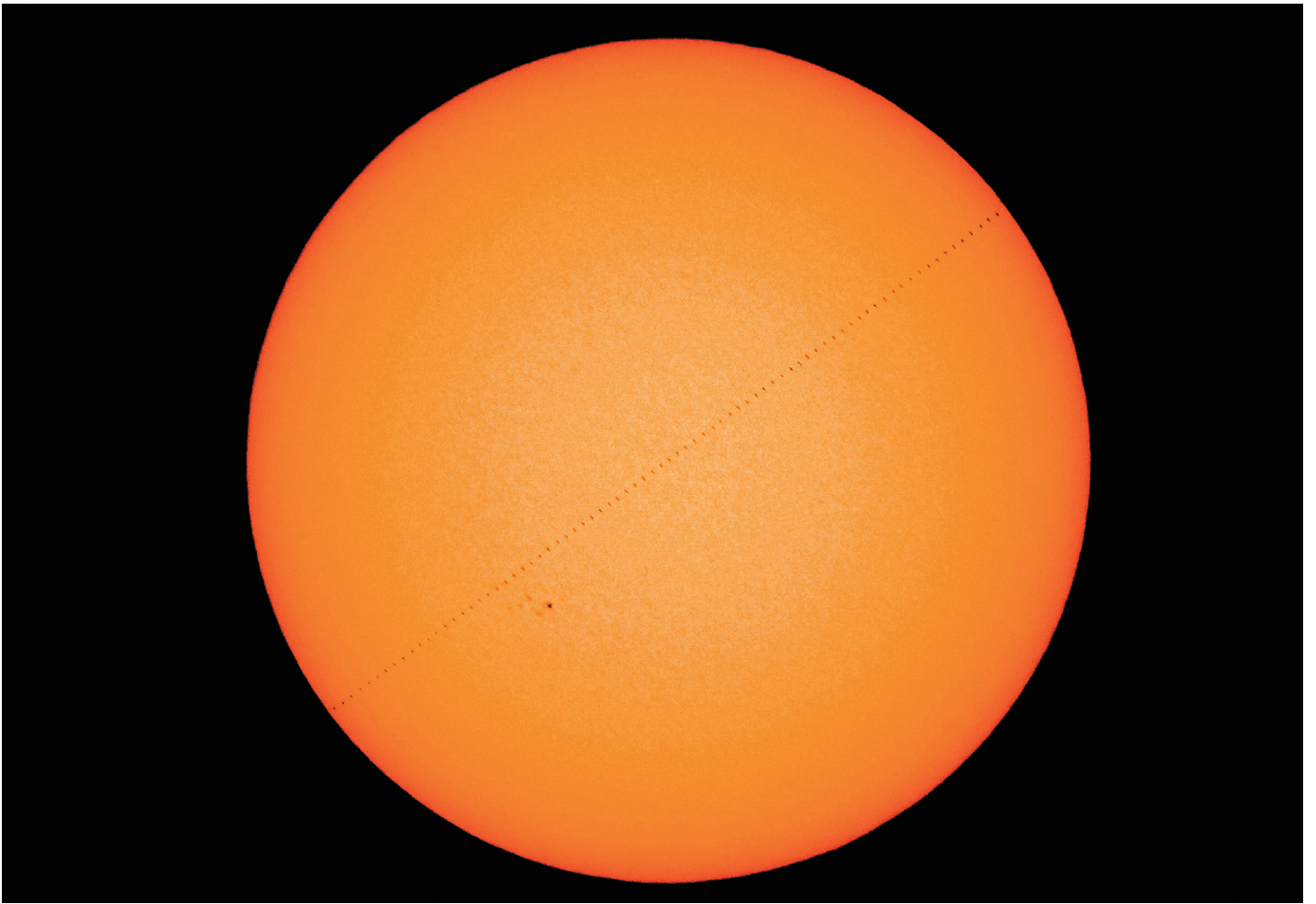
Miguel Claro (Portugal)

Dark Sky Observatory, Alqueva, Portugal, 25 October 2018

This Full Moon image is a high-resolution mosaic composed of four panels. Each one is made from 30 images combined together to reveal a sharp and detailed surface up to the lunar limb (the edge of the visible surface).

The final image shows that the Moon is much richer than the grey body we normally perceive with the human eye. The colour of this RGB (red, green, blue) image has been slightly increased, revealing a strange but real appearance. This corresponds to the differences in the chemical composition of the lunar surface, as changes in mineral content can produce subtle colour differences in reflected light. The blue hues that can be seen on the seas like Mare Tranquillitatis or Mare Fecunditatis (right centre and edge) are revealing areas rich in titanium. According to Hawaii's Institute of Geophysics and Planetology, the presence of this unusual titanium-rich layer was produced by the crystallization of a huge ocean of magma that surrounded the Moon when it formed.

Celestron 14" EdgeHD 355 mm Schmidt-Cassegrain reflecting telescope at f/11, Celestron CGEM mount, Nikon D810A camera, ISO 250, 120 x 1/320-second exposures



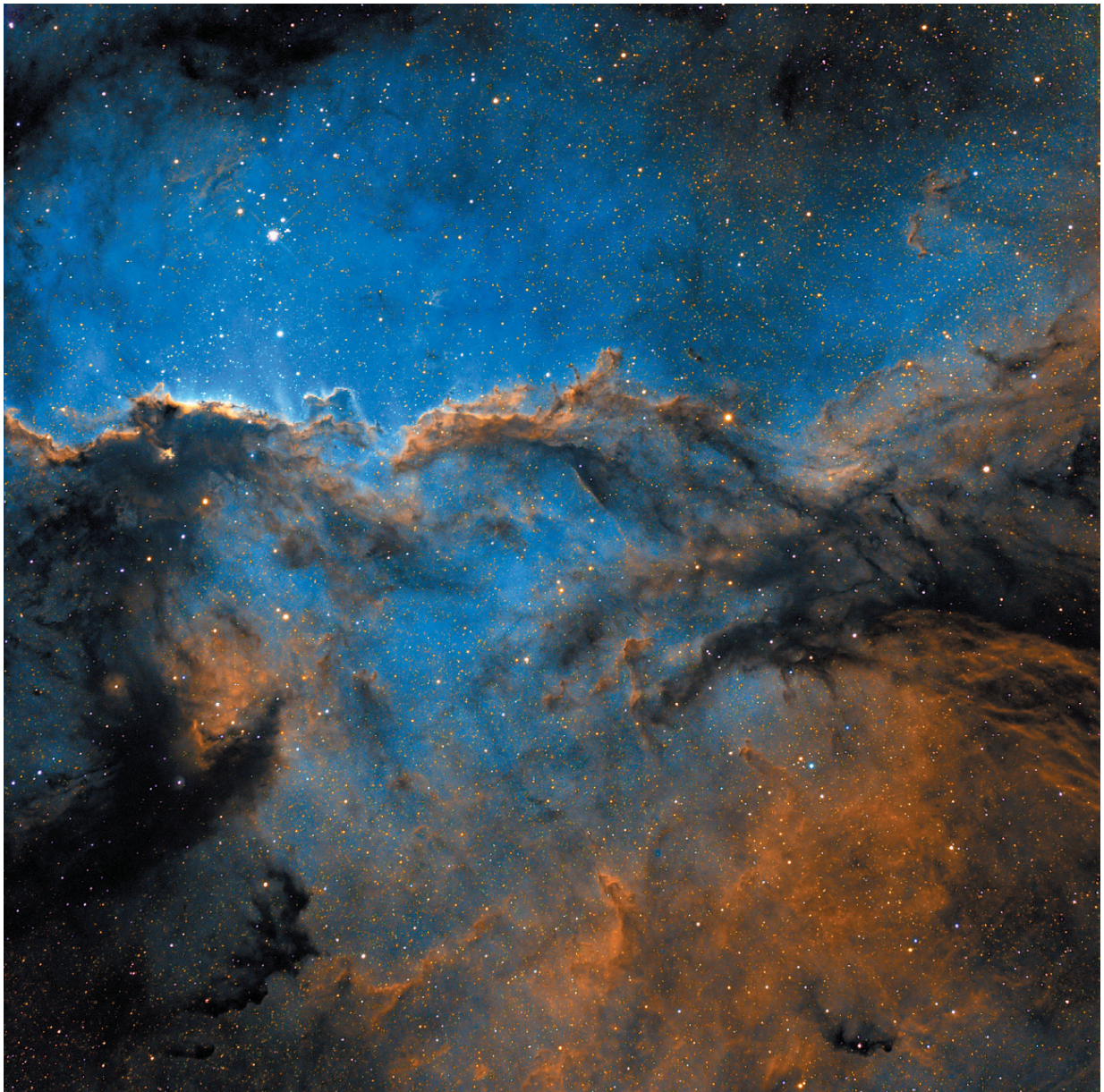
Hubble Crosses the Disc of the Sun

Michael Marston (Australia)

Brisbane, Queensland, Australia, 1 June 2018

I was hoping for a clear sky with little atmospheric distortion to try a difficult capture of the Hubble Space Telescope (HST) crossing in front of the Sun. I was also keen to see Hubble pass next to solar sunspot region AR 2712. The image was manually composited into a single photo to show the HST transit path using 80 individual frames captured from a 4K video sequence. All settings were manual and the HST transited from left to right across the Sun.

**Canon EOS-1D X Mark II camera, 1120 mm f/8 lens,
ISO 160, 78 × 1/1600-second exposures**



The Dragons of Ara

Tian Lee (China)

Chilescope, Atacama Region, Chile, 8 July 2018

NGC 6188 is an emission nebula in the southern sky. 4,000 light years away from us, the diffused hydrogen is ionized by the high-energy radiation emitted by the OB1 stellar association in the constellation Ara, which emits light with a wavelength of 6,536 angstroms. This deep-exposure image uses the narrowband filter to record the H-alpha line, the SII line and the OIII line in the nebula respectively, and synthesizes the famous Hubble pattern photos. The sky area covered by this image is as big as four full moons. It took me some time to confirm what object I wanted to capture. Finally, I found this area where there was enough OIII so when it is taken in narrowband and processed in the Hubble pattern palette, it will show as an elegant blue colour. The results were satisfying – both in the details and the contrast.

Chilescope T2 ASA 500 mm Newtonian reflecting telescope at f/3.8, ASA DDM85 mount, FLI 16803 camera, Ha-OIII-SII composite, 2-hour total exposure



Ageless

Marcin Zajac (Poland)

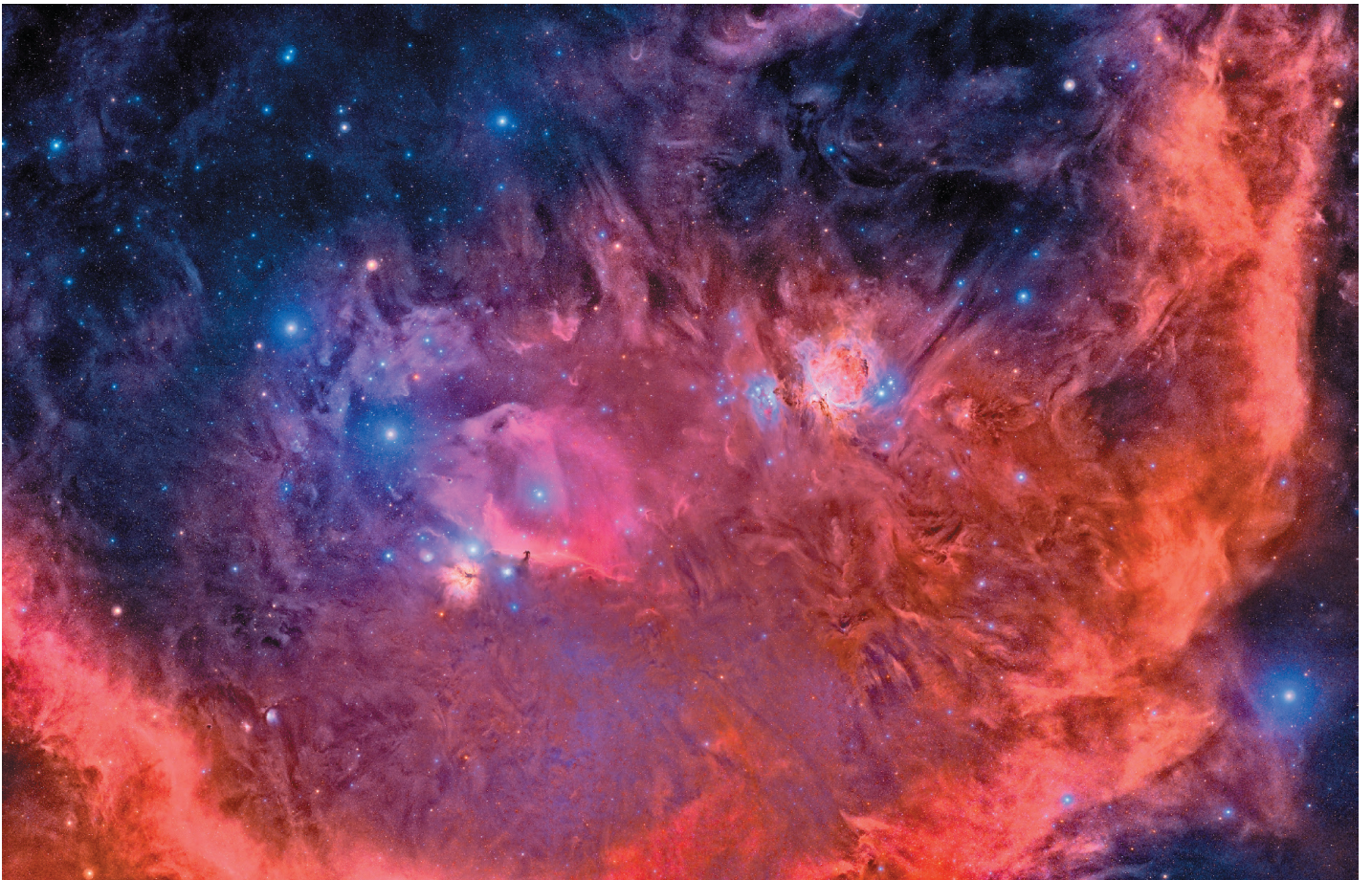
Point Arena, California, USA, 2 September 2018

These strange spherical boulders on the Mendocino Coast in northern California are revealed only during low tide. Resembling bowling balls, they are actually called concretions and were formed as the softer surrounding sandstone was eroded by the Pacific Ocean over millions of years. There are at least four conditions that need to be satisfied to make this photo possible. First, the right time of year – the galactic core of the Milky Way is only visible during the summer season (April to September). Second is the phase of the Moon – around new moon is best so that the light from the Moon doesn't wash out the Milky Way. Third, the tide needs to be low – otherwise the boulders are completely submerged. Finally, the weather – during the summer, this area is often engulfed in fog resulting in poor visibility. One Sunday night all these factors were favourable so I decided to make the eight-hour round trip from San Francisco Bay where I live to capture this image.

Nikon D600 camera, 24 mm lens

Sky: f/1.4, ISO 1600, 32 × 15-second exposures

Foreground: f/2, ISO 400, 30-second exposure



Orion

Raul Villaverde Fraile (Spain)

Ocentejo, Castile-La Mancha Spain, 6 January 2019

This is a mosaic of nine photographs with a combination of RGB and H-alpha channels. In the image you can see several of the most photographed astronomical objects, from the famous Orion Nebula (Messier 42) to the Horsehead Nebula (IC 434). In the lower left we also see Messier 78. The surrounding ring is known as Barnard's Loop.

Takahashi FSQ-106ED 106 mm apochromatic refractor telescope at f/3.9, IDAS LPS and Baader H-alpha 7 nm filters, Sky-Watcher EQ6 Pro mount, Canon 6D camera, ISO 1600, nine-panel mosaic, RGB-Ha composite, 33 hours 45 minutes total exposure



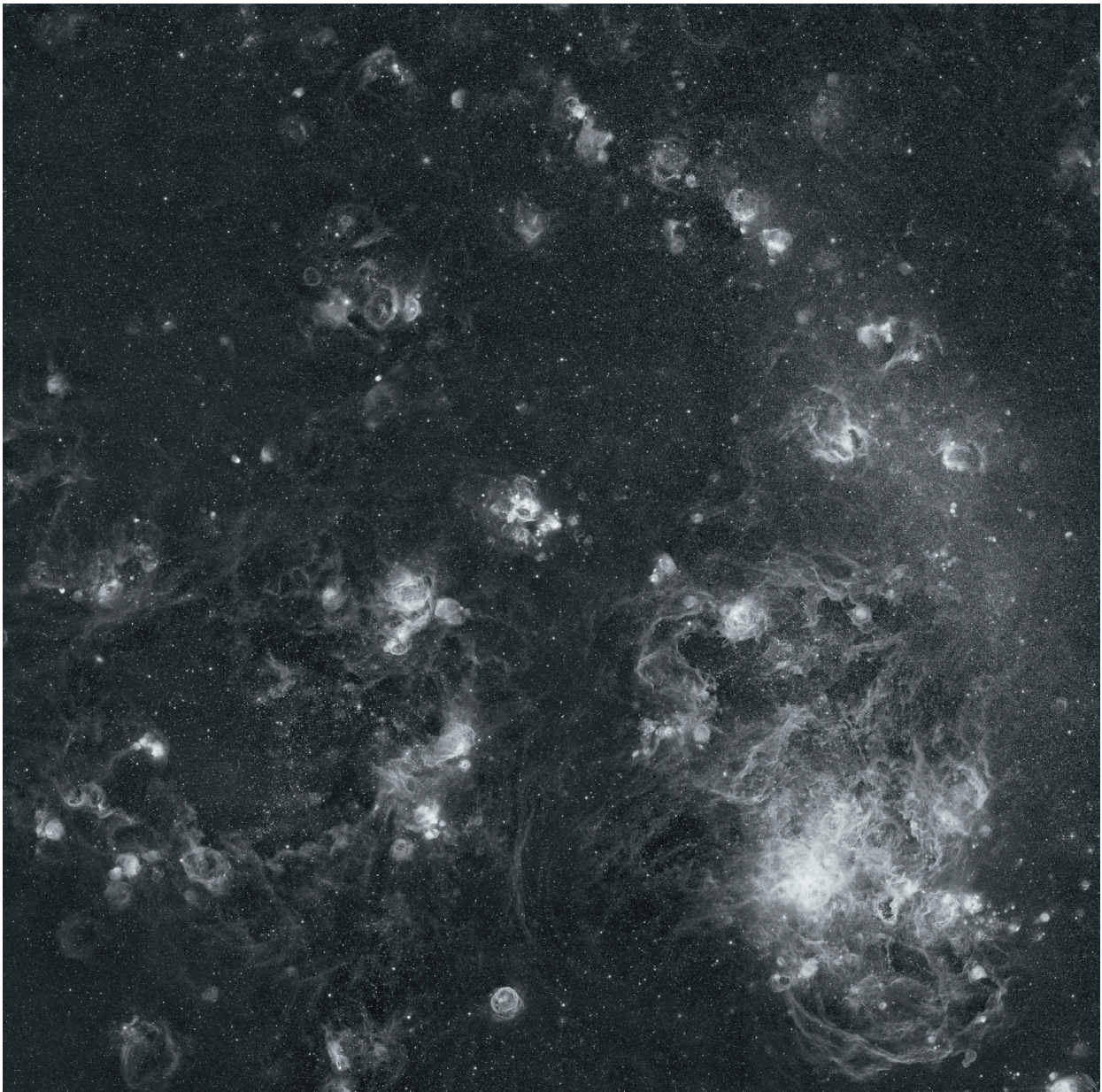
Dolphin Head

Tian Lee (China)

Chilescope, Atacama Region, Chile, 17 November 2018

This giant space dolphin looks really lovely. This nebula is an emission nebula, but it is faint. I used the technique of narrowband imaging on my target. By using the H-alpha band as a red channel and the OIII band as a blue and green channel, this nebula is shown in a fabulous blue colour.

Chilescope T3 ASA 500 mm Newtonian reflecting telescope at f/3.8, ASA DDM85 mount, FLI 16803 camera, Ha-OIII composite, 1 hour 35 minutes total exposure



Hydrogen Sculptures

Ignacio Diaz Bobillo (Argentina)

General Pacheco, Buenos Aires, Argentina, 12 January 2018

This high definition hydrogen-alpha image of most of the Large Magellanic Cloud is composed of a 3×3 mosaic and amounts to over 46 hours of data integration. Its purpose is to display the more active parts of the neighbouring galaxy, in terms of hydrogen atoms ionized by energetic stars. Most prominent is the Tarantula Nebula in the bottom right corner, with its stormy, spider-like core, surrounded by arch-like filaments. The rest of the frame is splattered with cocoons and shells of ionized hydrogen, shaped by intense stellar winds. The whole scene is haunting and mesmerizing and deserves to be explored in its full resolution.

Astro-Physics 167 mm apochromatic refractor telescope at f/7.2, Astrodon 3 nm H-alpha, Astro-Physics 1100GTO mount, Apogee Alta U16M camera, mosaic of 145×20 -minute exposures



The Elegant Elephant's Trunk

Lluís Romero Ventura (Spain)

Àger, Catalonia, Spain, 21 September 2018

The Elephant Trunk Nebula (vdB 142) is located in the Cepheus constellation and is probably one of the most beautiful nebulae that is actively forming stars (protostars). These regions of dense, cold gas and dust can be thought of as celestial maternity wards. I took this photo with only the three RGB channels, and the luminance is the result of the RGB. **AS-RC380 380mm Ritchey-Chretien reflecting telescope at f/8.5, Astrodon RGB Gen2 I-Series True-Balance filters, ASA DDM85 mount, Moravian G3-11002 camera, RGB composite, 8-hour total exposure**



The Blue Doily

Josep Drudis (Spain)

Coonabarabran, New South Wales, Australia, 28 March 2018

NGC 6164 is a good example of how large stars can evolve. Its central star is so massive that, in its early evolutionary stages, it ejected huge amounts of then abundant oxygen. This is shown in the external bluish structure with its delicate filaments that resemble those of a doily. Later on, in a second phase, it ejected another large amount of gas (red hydrogen in this case). The high rotation speed of the star when this second ejection took place, produced the 'Z' structure that is so apparent. The central star has heated the gas at a temperature so high it emits this red light by itself. The red nebulosity on the right half of the image is just interstellar hydrogen in this area. This is one of my favourite objects in the sky.

Planewave CDK20 508 mm Dall-Kirkham reflecting telescope at f/6.8, Astrodon Gen2 filters, Planewave Ascension 200h mount, SBIG STX16803 camera, RGB-Ha-OIII composite, 17 hours 30 minutes total exposure

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