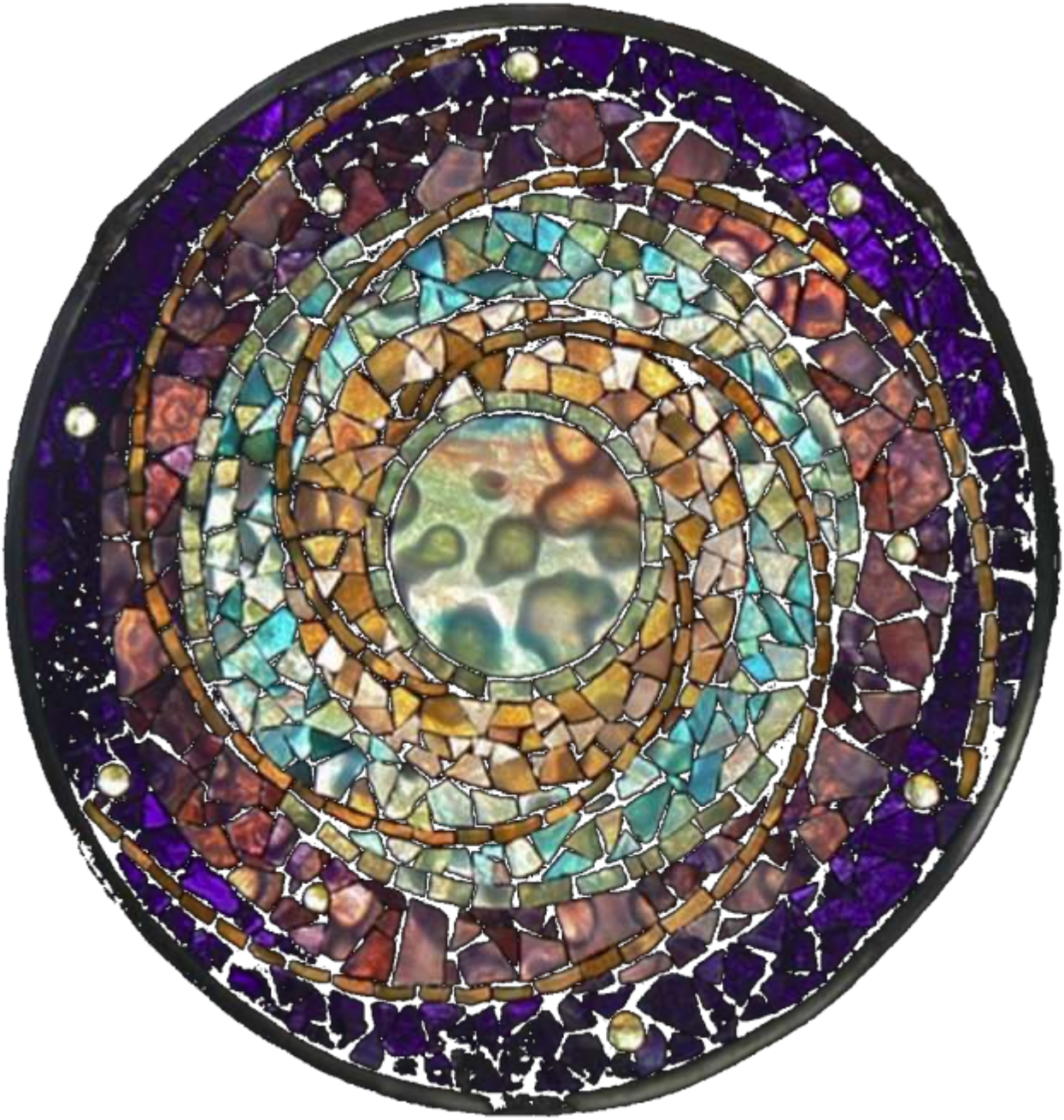
MUSIC OF THE SPHERES



Special BENEDICTUS Service

Saturday 30 July 2016

MUSIC OF THE SPHERES – a special BENEDICTUS service

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Note the following acronyms:

- European Space Agency (ESA)
- National Aeronautics and Space Administration (NASA).

Hubble image of MACS J0717

This enormous image shows Hubble's view of massive galaxy cluster MACS J0717.5+3745. The large field of view is a combination of 18 separate Hubble images.

Studying the distorting effects of gravity on light from background galaxies, a team of astronomers has uncovered the presence of a filament of dark matter extending from the core of the cluster. This is one of the first positive detections of a filament, and the most precise to date.

Using additional observations from ground-based telescopes, the team were able to map the filament's structure in three dimensions, the first time this has ever been done.

Credit: NASA, ESA, Harald Ebeling (University of Hawaii at Manoa) and Jean-Paul Kneib (LAM).

Pillars of Creation

The Eagle Nebula's Pillars of Creation. This image shows the pillars as seen in visible light, capturing the multi-coloured glow of gas clouds, wispy tendrils of dark cosmic dust, and the rust-coloured elephants' trunks of the nebula's famous pillars.

The dust and gas in the pillars is seared by the intense radiation from young stars and eroded by strong winds from massive nearby stars.

Credit:NASA, ESA/Hubble and the Hubble Heritage Team.

Out of this whirl: The Whirlpool Galaxy (M51) and companion galaxy

The graceful, winding arms of the majestic spiral galaxy M51 (NGC 5194) appear like a grand spiral staircase sweeping through space. They are actually long lanes of stars and gas laced with dust. It is located approximately 25 million light-years away in the constellation Canes Venatici (the Hunting Dogs).

Credit: NASA, ESA, S. Beckwith (STScI) and the Hubble Heritage Team (STScI/AURA).

The Twin Jet Nebula

The Twin Jet Nebula, or PN M2-9, is a striking example of a bipolar planetary nebula. Bipolar planetary nebulae are formed when the central object is not a single star, but a binary system. Studies have shown that the nebula's size increases with time, and measurements of this rate of increase suggest that the stellar outburst that formed the lobes occurred just 1200 years ago.

Credit: ESA/Hubble and NASA; **Acknowledgement:** Judy Schmidt.

Revisiting the Veil Nebula

This image shows a small section of the Veil Nebula, as it was observed by the NASA/ESA Hubble Space Telescope. This section of the outer shell of the famous supernova remnant is in a region known as NGC 6960 or — more colloquially — the Witch's Broom Nebula.

Credit: NASA, ESA and the Hubble Heritage Team.

Light and Shadow in the Carina Nebula

Previously unseen details of a mysterious, complex structure within the Carina Nebula (NGC 3372) are revealed by this image of the 'Keyhole Nebula,' obtained with the Hubble Space Telescope. The picture is a montage assembled from four different April 1999 telescope pointings with Hubble's Wide Field Planetary Camera 2, which used six different colour filters. The picture is dominated by a large, approximately circular feature, which is part of the Keyhole Nebula, named in the 19th century by Sir John Herschel. This region, about 8000 light-years from Earth, is located adjacent to the famous explosive variable star Eta Carinae, which lies just outside the field of view toward the upper right. The Carina Nebula also contains several other stars that are among the hottest and most massive known, each about 10 times as hot, and 100 times as massive, as our Sun.

Credit: NASA/ESA and the Hubble Heritage Team (AURA/STScI).

A perfect storm of turbulent gases

Like the fury of a raging sea, this anniversary image from the NASA/ESA Hubble Space Telescope shows a bubbly ocean of glowing hydrogen, oxygen, and sulphur gas in the extremely massive and luminous molecular nebula Messier 17. This Hubble photograph captures a small region within Messier 17 (M17), a hotbed of star formation. M17, also known as the Omega or Swan Nebula, is located about 5500 light-years away in the Sagittarius constellation. The release of this image commemorates the thirteenth anniversary of Hubble's launch on 24 April 1990. The wave-like patterns of gas have been sculpted and illuminated by a torrent of

ultraviolet radiation from young, massive stars (which lie outside the picture to the upper left). The glow of these patterns highlights the 3D structure of the gases. The ultraviolet radiation is carving and heating the surfaces of cold hydrogen gas clouds. The warmed surfaces glow orange and red in this image. The intense heat and pressure cause some material to stream away from the surface, creating the glowing veil of even hotter green-coloured gas that masks background structures. The pressure on the tips of the waves may trigger new star formation within them. The image, roughly 3 light-years across, was taken on 29 to 30 May 1999, with Hubble's Wide Field Planetary Camera 2. The colours in the image represent various gases. Red represents sulphur; green, hydrogen; and blue, oxygen.

Credit: European Space Agency, NASA, and J. Hester (Arizona State University).

Infrared view of the Horsehead Nebula

This Hubble image shows part of the sky in the constellation of Orion (The Hunter). Rising like a giant seahorse from turbulent waves of dust and gas is the Horsehead Nebula, otherwise known as Barnard 33.

This image shows the region in infrared light, which has longer wavelengths than visible light and can pierce through the dusty material that usually obscures the nebula's inner regions.

Credit: NASA, ESA, and the Hubble Heritage Team (AURA/STScI).

The Cone Nebula (in NGC 2264) – a star-forming pillar of gas and dust

Resembling a nightmarish beast rearing its head from a crimson sea, this celestial object is actually just a pillar of gas and dust. Called the Cone Nebula (in NGC 2264) – so named because in ground-based images it has a conical shape – this monstrous pillar resides in a turbulent star-forming region. This picture, shows the upper 2.5 light-years of the Cone, a height that equals 23 million roundtrips to the Moon. The entire pillar is seven light-years long.

Radiation from hot, young stars (located beyond the top of the image) has slowly eroded the nebula over millions of years. Ultraviolet light heats the edges of the dark cloud, releasing gas into the relatively empty region of surrounding space. There, additional ultraviolet radiation causes the hydrogen gas to glow, which produces the red halo of light seen around the pillar. A similar process occurs on a much smaller scale to gas surrounding a single star, forming the bow-shaped arc seen near the upper left side of the Cone. This arc, seen previously with the Hubble telescope, is 65 times larger than the diameter of our Solar System. The blue-white light from surrounding stars is reflected by dust. Background stars can be seen peeking through the evaporating tendrils of gas, while the turbulent base is pockmarked with stars reddened by dust.

Over time, only the densest regions of the Cone will be left. But inside these regions, stars and planets may form. The Cone Nebula resides 2500 light-years away in the constellation Monoceros.

The ACS made this observation on 2 April 2002. The colour image is constructed from three separate images taken in blue, near-infrared, and hydrogen-alpha filters.

Image credit: NASA, the ACS Science Team (H. Ford, G. Illingworth, M. Clampin, G. Hartig, T. Allen, K. Anderson, F. Bartko, N. Benitez, J. Blakeslee, R. Bouwens, T. Broadhurst, R. Brown, C. Burrows, D. Campbell, E. Cheng, N. Cross, P. Feldman, M. Franx, D. Golimowski, C. Gronwall, R. Kimble, J. Krist, M. Lesser, D. Magee, A. Martel, W. J. McCann, G. Meurer, G. Miley, M. Postman, P. Rosati, M. Sirianni, W. Sparks, P. Sullivan, H. Tran, Z. Tsvetanov, R. White, and R. Woodruff) and ESA

Credit: NASA, Holland Ford (JHU), the ACS Science Team and ESA.

Galaxy Playing Twister

The Hubble telescope has captured an image of an unusual edge-on galaxy, revealing remarkable details of its warped dusty disk and showing how colliding galaxies spawn the formation of new generations of stars. The dust and spiral arms of normal spiral galaxies, like our own Milky Way, appear flat when viewed edge-on. This Hubble Heritage image of ESO 510-G13 shows a galaxy that, by contrast, has an unusual twisted disk structure, first seen in ground-based photographs.

Credit: NASA/ESA and The Hubble Heritage Team (STScI/AURA).

A Tantalising Veil

This image shows a small portion of a nebula called the Cygnus Loop. Covering a region on the sky six times the diameter of the full Moon, the Cygnus Loop is actually the expanding blastwave from a stellar cataclysm - a supernova explosion - which occurred about 15,000 years ago.

This delicate Hubble Space Telescope image shows a tiny portion of the Cygnus loop, a supernova remnant in the constellation of Cygnus, the Swan. Measurements on this super-detailed image of a cosmic veil shows that the original supernova explosion took place only 5000 years ago.

Credit: ESA and the Digitized Sky Survey (Caltech).

Hubble view of M 106

This image combines Hubble observations of M 106 with additional information captured by amateur astronomers Robert Gendler and Jay GaBany. Gendler combined Hubble data with his own observations to produce this stunning colour image.

M 106 is a relatively nearby spiral galaxy, a little over 20 million light-years away.

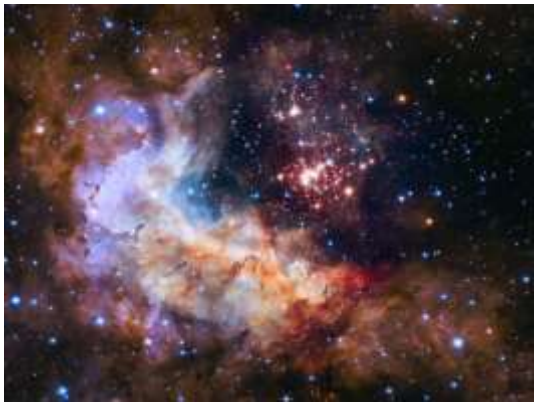
Credit: NASA, ESA, the Hubble Heritage Team (STScI/AURA), and R. Gendler (for the Hubble Heritage Team); **Acknowledgment:** J. GaBany.

Stellar fireworks are ablaze in galaxy NGC 4449

Hundreds of thousands of vibrant blue and red stars are visible in this new image of galaxy NGC 4449 taken by the NASA/ESA Hubble Space Telescope. Hot bluish white clusters of massive stars are scattered throughout the galaxy, interspersed with numerous dustier reddish regions of current star formation. Massive dark clouds of gas and dust are silhouetted against the flaming starlight.

Credit: NASA, ESA, A. Aloisi (STScI/ESA) and the Hubble Heritage (STScI/AURA)-ESA/Hubble Collaboration.

Westerlund 2



This NASA/ESA Hubble Space Telescope image of the cluster Westerlund 2 and its surroundings has been released to celebrate Hubble's 25th year in orbit and a quarter of a century of new discoveries, stunning images and outstanding science.

The image's central region, containing the star cluster, blends visible-light data taken by the Advanced Camera for Surveys and near-infrared exposures taken by the Wide Field Camera 3. The surrounding region is composed of visible-light observations taken by the Advanced Camera for Surveys.

Credit: NASA, ESA, the Hubble Heritage Team (STScI/AURA), A. Nota (ESA/STScI), and the Westerlund 2 Science Team.

The original observations of Westerlund 2 were obtained by the science team: Antonella Nota (ESA/STScI), Elena Sabbi (STScI), Eva Grebel and Peter Zeidler (Astronomisches Rechen-Institut Heidelberg), Monica Tosi (INAF, Osservatorio Astronomico di Bologna), Alceste Bonanos (National Observatory of Athens, Astronomical Institute), Carol Christian (STScI/AURA) and Selma de Mink (University of Amsterdam). Follow-up observations were made by the Hubble Heritage team: Zoltan Levay (STScI), Max Mutchler, Jennifer Mack, Lisa Frattare, Shelly Meyett, Mario Livio, Carol Christian (STScI/AURA), and Keith Noll (NASA/GSFC).

Mystic Mountain

This craggy fantasy mountaintop enshrouded by wispy clouds looks like a bizarre landscape from Tolkien's *The Lord of the Rings*. The NASA/ESA Hubble Space Telescope image, which is even more dramatic than fiction, captures the chaotic activity atop a pillar of gas and dust, three light-years tall, which is being eaten away by the brilliant light from nearby bright stars. The pillar is also being assaulted from within, as infant stars buried inside it fire off jets of gas that can be seen streaming from towering peaks.

This turbulent cosmic pinnacle lies within a tempestuous stellar nursery called the Carina Nebula, located 7500 light-years away in the southern constellation of Carina. The image celebrates the 20th anniversary of Hubble's launch and deployment into an orbit around the Earth.

Scorching radiation and fast winds (streams of charged particles) from super-hot newborn stars in the nebula are shaping and compressing the pillar, causing new stars to form within it. Streamers of hot ionised gas can be seen flowing off the ridges of the structure, and wispy veils of gas and dust, illuminated by starlight, float around its towering peaks. The denser parts of the pillar are resisting being eroded by radiation.

Nestled inside this dense mountain are fledgling stars. Long streamers of gas can be seen shooting in opposite directions from the pedestal at the top of the image. Another pair of jets is visible at another peak near the centre of the image. These jets, (known as HH 901 and HH 902, respectively, are signposts for new star birth and are launched by swirling gas and dust discs around the young stars, which allow material to slowly accrete onto the stellar surfaces.

Hubble's Wide Field Camera 3 observed the pillar on 1 to 2 February 2010. The colours in this composite image correspond to the glow of oxygen (blue), hydrogen and nitrogen (green), and sulphur (red).

Credit: NASA, ESA, M. Livio and the Hubble 20th Anniversary Team (STScI).

Hubble view of star-forming region S106

This image shows Sh 2-106, or S106 for short. This is a compact star forming region in the constellation Cygnus (The Swan). A newly-formed star called S106 IR is shrouded in dust at the centre of the image, and is responsible for the surrounding gas cloud's hourglass-like shape and the turbulence visible within. Light from glowing hydrogen is coloured blue in this image.

Credit: NASA and ESA.

WFC3 visible image of the Carina Nebula

Composed of gas and dust, the pictured pillar resides in a tempestuous stellar nursery called the Carina Nebula, located 7500 light-years away in the southern constellation of Carina.

Taken in visible light, the image shows the tip of the three-light-year-long pillar, bathed in the glow of light from hot, massive stars off the top of the image. Scorching radiation and fast winds (streams of charged particles) from these stars are sculpting the pillar and causing new stars to form within it. Streamers of gas and dust can be seen flowing off the top of the structure.

Hubble's Wide Field Camera 3 observed the Carina Nebula on 24 to 30 July 2009. WFC3 was installed aboard Hubble in May 2009 during Servicing Mission 4. The composite image was made from filters that isolate emission from iron, magnesium, oxygen, hydrogen and sulphur.

These Hubble observations of the Carina Nebula are part of the Hubble Servicing Mission 4 Early Release Observations.

Credit: NASA, ESA and the Hubble SM4 ERO Team.

Star on a Hubble diet

The star cluster Pismis 24 lies in the core of the large emission nebula NGC 6357 that extends one degree on the sky in the direction of the Scorpius constellation. Part of the nebula is ionised by the youngest (bluest) heavy stars in Pismis 24. The intense ultraviolet radiation from the blazing stars heats the gas surrounding the cluster and creates a bubble in NGC 6357. The presence of these surrounding gas clouds makes probing into the region even harder.

One of the top candidates for the title of 'Milky Way stellar heavyweight champion' was, until now, Pismis 24-1, a bright young star that lies in the core of the small open star cluster Pismis 24 (the bright stars in the Hubble image) about 8000 light-years away from Earth. Pismis 24-1 was thought to have an incredibly large mass of 200 to 300 solar masses. New NASA/ESA Hubble measurements of the star, have, however, resolved Pismis 24-1 into two separate stars, and, in doing so, have 'halved' its mass to around 100 solar masses.

Credit: NASA, ESA and Jesús Maíz Apellániz (Instituto de Astrofísica de Andalucía, Spain); **Acknowledgement:** Davide De Martin (ESA/Hubble).

Hubble snaps NGC 5189

The NASA/ESA Hubble Space Telescope celebrates the holiday season with a striking image of the planetary nebula NGC 5189. The intricate structure of the stellar eruption looks like a giant and brightly coloured ribbon in space.

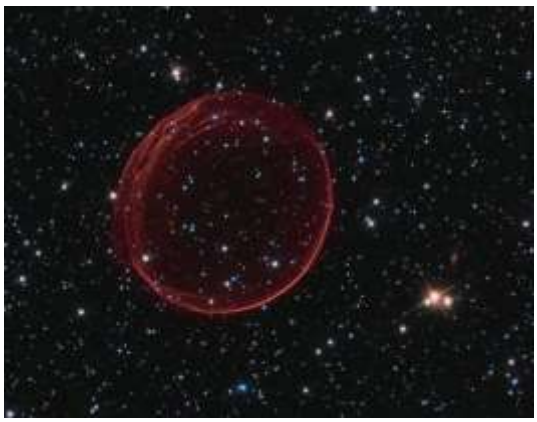
Credit: NASA, ESA and the Hubble Heritage Team (STScI/AURA).

Hubble View of the Helix Nebula

This composite image is a view of the colorful Helix Nebula taken with the Advanced Camera for Surveys aboard NASA/ESA Hubble Space Telescope and the Mosaic II Camera on the 4-meter telescope at Cerro Tololo Inter-American Observatory in Chile. The object is so large that both telescopes were needed to capture a complete view. The Helix is a planetary nebula, the glowing gaseous envelope expelled by a dying, sun-like star. The Helix resembles a simple doughnut as seen from Earth. But looks can be deceiving. New evidence suggests that the Helix consists of two gaseous disks nearly perpendicular to each other.

Credit: NASA, ESA, C.R. O'Dell (Vanderbilt University), and M. Meixner, P. McCullough, and G. Bacon (Space Telescope Science Institute).

Hubble spots a celestial bauble



This delicate shell, photographed by the NASA/ESA Hubble Space Telescope, appears to float serenely in the depths of space, but this apparent calm hides an inner turmoil. The gaseous envelope formed as the expanding blast wave and ejected material from a supernova tore through the nearby interstellar medium. Called SNR B0509-67.5 (or SNR 0509 for short), the bubble is the visible remnant of a powerful stellar explosion in the Large Magellanic Cloud (LMC), a small galaxy about 160 000 light-years from Earth. Ripples in the shell's surface may be caused either by subtle variations in the density of the ambient interstellar gas, or possibly be driven from the interior by fragments from the initial explosion. The bubble-shaped shroud of gas is 23 light-years across and is expanding at more than 18 million km/h.

Hubble's Advanced Camera for Surveys observed the supernova remnant on 28 October 2006 with a filter that isolates light from the glowing hydrogen seen in the expanding shell. These observations were then combined with visible-light images of the surrounding star field that were imaged with Hubble's Wide Field Camera 3 on 4 November 2010.

Credit: NASA, ESA, and the Hubble Heritage Team (STScI/AURA); **Acknowledgement:** J. Hughes (Rutgers University).

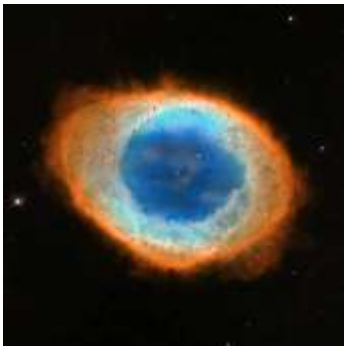
Hubble view of the Lagoon Nebula

This new NASA/ESA Hubble Space Telescope image shows the Lagoon Nebula, an object with a deceptively tranquil name. The region is filled with intense winds from hot stars, churning funnels of gas, and energetic star formation, all embedded within an intricate haze of gas and pitch-dark dust.

Credit:

NASA, ESA, J. Trauger (Jet Propulson Laboratory).

Hubble image of the Ring Nebula (Messier 57)

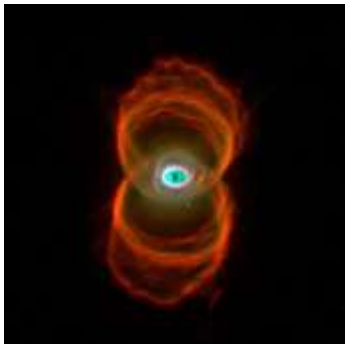


This new image shows the dramatic shape and colour of the Ring Nebula, otherwise known as Messier 57.

From Earth's perspective, the nebula looks like a simple elliptical shape with a shaggy boundary. However, new observations combining existing ground-based data with new NASA/ESA Hubble Space Telescope data show that the nebula is shaped like a distorted doughnut. This doughnut has a rugby-ball-shaped region of lower-density material slotted into in its central 'gap', stretching towards and away from us.

Credit: NASA, ESA, and C. Robert O'Dell (Vanderbilt University).

The Hourglass Nebula



This is an image of MyCn18, a young planetary nebula located about 8000 light-years away, taken with the Wide Field and Planetary Camera 2 (WFPC2) aboard the Hubble Space Telescope (HST).

This Hubble image reveals the true shape of MyCn18 to be an hourglass with an intricate pattern of 'etchings' in its walls. This picture has been composed from three separate images taken in the light of ionized nitrogen (represented by red), hydrogen (green), and doubly-ionized oxygen (blue).

The results are of great interest because they shed new light on the poorly understood ejection of stellar matter which accompanies the slow death of Sun-like stars. In previous ground-based images, MyCn18 appears to be a pair of large outer rings with a smaller central one, but the fine details cannot be seen.

Credit: Raghvendra Sahai and John Trauger (JPL), the WFPC2 science team and NASA/ESA.

NGC 1275 multi-wavelength composite

The behemoth galaxy NGC 1275, also known as Perseus A, lies at the centre of Perseus Galaxy Cluster. By combining multi-wavelength images into this single composite, the dynamics of the galaxy become visible. Detail and structure from optical, radio and X-ray wavelengths have been combined for an aesthetically pleasing image which shows the violent events in the galaxy's heart. NGC 1275 is an active galaxy well-known for its radio source (Perseus A) and is a strong emitter of X-rays due to the presence of the supermassive black hole in its centre.

Hubble data from the Advanced Camera for Surveys covers visible-light wavelengths and is shown in the red, green and blue. Radio data from NRAO's Very Large Array at 0.91 m was also used. In this composite image, dust lanes, star-forming regions, hydrogen filaments, foreground stars, and background galaxies are contributions from the Hubble optical data. The X-ray data contributes to the soft but violet shells around the outside of the centre. The pinkish lobes toward the centre of the galaxy are from radio emission. The radio jets from the black hole fill the X-ray cavities. Chandra data from the ACIS covers X-ray wavelengths from 0.1771 to 4.133 nm (0.3-7 KeV).

Credit: NASA, ESA, NRAO and L. Frattare (STScI). **Science Credit**: X-ray: NASA/CXC/IoA/A. Fabian et al.; Radio: NRAO/VLA/G. Taylor; Optical: NASA, ESA, the Hubble Heritage (STScI/AURA)-ESA/Hubble Collaboration and A. Fabian (Institute of Astronomy, University of Cambridge, UK).

Hubble view of green filament in galaxy UGC 11185

This new NASA/ESA Hubble Space Telescope image shows ghostly green filaments, lying within galaxy UGC 11185. This filament was illuminated by a blast of radiation from a quasar — a very luminous and compact region that surrounds the supermassive black hole at the centre of its host galaxy.

Its bright green hue is a result of ionised oxygen, which glows brightly at green wavelengths.

Credit: NASA, ESA, W. Keel (University of Alabama, USA).

New stars around Westerlund 2

The red dots scattered throughout the cosmic landscape captured in this NASA/ESA Hubble Space Telescope image are a rich population of forming stars that are still wrapped in their gas and dust cocoons.

These stellar foetuses have not yet ignited the hydrogen in their cores to light-up as stars. However, Hubble's near-infrared vision allows astronomers to identify these fledglings. The brilliant blue stars seen throughout the image are mostly in the foreground.

This is a section of the new NASA/ESA Hubble Space Telescope image of Westerlund 2 and its surroundings, released to celebrate Hubble's 25th anniversary.

Credit: NASA, ESA, the Hubble Heritage Team (STScI/AURA), A. Nota (ESA/STScI), and the Westerlund 2 Science Team.

Pillars around Westerlund 2

This image shows an example of the pillars that surround the star cluster Westerlund 2.

These pillars are composed of dense gas and dust are a few light-years tall and point to the central cluster. They are thought to be incubators for new stars. Besides sculpting the gaseous terrain, intense radiation from the most brilliant of the cluster stars is creating a successive generation of baby stars.

This is a section of the new NASA/ESA Hubble Space Telescope image of Westerlund 2 and its surroundings, released to celebrate Hubble's 25th anniversary.

Credit: NASA, ESA, the Hubble Heritage Team (STScI/AURA), A. Nota (ESA/STScI), and the Westerlund 2 Science Team.

Stellar powerhouses in the Eagle Nebula

A spectacular section of the well-known Eagle Nebula has been targeted by the NASA/ESA Hubble Space Telescope. This collection of dazzling stars is called NGC 6611, an open star cluster that formed about 5.5 million years ago and is found approximately 6500 light-years from the Earth. It is a very young cluster, containing many hot, blue stars, whose fierce ultraviolet glow make the surrounding Eagle Nebula glow brightly. The cluster and the associated nebula together are also known as Messier 16.

Astronomers refer to areas like the Eagle Nebula as HII regions. This is the scientific notation for ionised hydrogen from which the region is largely made. Extrapolating far into the future, this HII region will eventually disperse, helped along by shockwaves from supernova explosions as the more massive young stars end their brief but brilliant lives.

In this image, dark patches can also be spotted, punctuating the stellar landscape. These areas of apparent nothingness are actually very dense regions of gas and dust, which obstruct light from passing through. Many of these may be hiding the sites of the early stages of star formation, before the fledgling stars clear away their surroundings and burst into view. Dark nebulae, large and small, are dotted throughout the Universe. If you look up to the Milky Way with the naked eye from a dark, remote site, you can easily spot some huge dark nebulae blocking the background starlight.

This picture was created from images from Hubble's Wide Field Channel of the Advanced Camera for Surveys through the unusual combination of two near-infrared filters (F775W, coloured blue, and F850LP, coloured red). The image has also been subtly colourised using a ground-based image taken through more conventional filters. The Hubble exposure times were 2000 s in both cases and the field of view is about 3.2 arcminutes across.

Credit: ESA/Hubble and NASA.

Trapezium Cluster in the Orion Nebula

Probing deep within a neighborhood stellar nursery, the NASA/ESA Hubble Space Telescope uncovered a swarm of newborn brown dwarfs. The orbiting observatory's near-infrared camera revealed about 50 of these objects throughout the Orion Nebula's Trapezium cluster about 1500 light-years from Earth.

The brown dwarfs are too dim to be seen in a visible-light image taken by the Hubble telescope's Wide Field and Planetary Camera 2. This view also doesn't show the assemblage of infant stars seen in the near-infrared image. That's because the young stars are embedded in dense clouds of dust and gas. The Hubble telescope's near-infrared camera, the Near Infrared Camera and Multi-Object Spectrometer, penetrated those clouds to capture a view of those objects.

Credit: C.R. O'Dell and S.K. Wong (Rice University) and NASA/ESA.

Hubble image of variable star RS Puppis

This Hubble image shows RS Puppis, a type of variable star known as a Cepheid variable. As variable stars go, Cepheids have comparatively long periods — RS Puppis, for example, varies in brightness by almost a factor of five every 40 or so days.

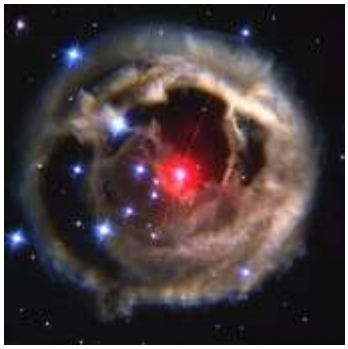
RS Puppis is unusual; this variable star is shrouded by thick, dark clouds of dust enabling a phenomenon known as a light echo to be shown with stunning clarity.

These Hubble observations show the ethereal object embedded in its dusty environment, set against a dark sky filled with background galaxies.

Credit: NASA, ESA, and the Hubble Heritage Team (STScI/AURA)-Hubble/Europe Collaboration.

Acknowledgment: H. Bond (STScI and Penn State University).

Hubble watches light echo from mysterious erupting star (December 2002 image)



This is the first in a sequence of four pictures from the NASA/ESA Hubble Space Telescope's Advanced Camera for Surveys that dramatically demonstrates the echoing of light through space caused by an unusual stellar outburst in January 2002.

The image was taken 17 December 2002. The image is combined from exposures taken through blue (B), green (V), and infrared (I) filters.

Credit: NASA, European Space Agency and H.E. Bond (STScI).

Blue bubble in Carina

Sparkling at the centre of this beautiful NASA/ESA Hubble Space Telescope image is a Wolf–Rayet star known as WR 31a, located about 30,000 light-years away in the constellation of Carina (The Keel).

The distinctive blue bubble appearing to encircle WR 31a, and its uncatalogued stellar sidekick, is a Wolf–Rayet nebula — an interstellar cloud of dust, hydrogen, helium and other gases. Created when speedy stellar winds interact with the outer layers of hydrogen ejected by Wolf–Rayet stars, these nebulae are frequently ring-shaped or spherical. The bubble — estimated to have formed around 20,000 years ago — is expanding at a rate of around 220 000 kilometres per hour!

Unfortunately, the lifecycle of a Wolf–Rayet star is only a few hundred thousand years — the blink of an eye in cosmic terms. Despite beginning life with a mass at least 20 times that of the Sun, Wolf–Rayet stars typically lose half their mass in less than 100 000 years. And WR 31a is no exception to this case. It will, therefore, eventually end its life as a spectacular supernova, and the stellar material expelled from its explosion will later nourish a new generation of stars and planets.

Credit: ESA/Hubble and NASA; **Acknowledgement:** Judy Schmidt.

Hubble image of Herbig-Haro object HH 110

The NASA/ESA Hubble Space Telescope has captured a new image of Herbig-Haro 110, a geyser of hot gas flowing from a newborn star. HH 110 appears different from most other Herbig-Haro objects: in particular, it appears on its own while they usually come in pairs. Astronomers think it may be a continuation of another object called HH 270, after it has been deflected off a dense cloud of gas.

Credit: NASA, ESA and the Hubble Heritage team (STScI/AURA).

A cosmic lightsabre

The two lightsabre-like streams crossing the image are jets of energised gas, ejected from the poles of a young star. If the jets collide with the surrounding gas and dust they can clear vast spaces, and create curved shock waves, seen as knotted clumps called Herbig-Haro objects.

Credit: ESA/Hubble and NASA, D. Padgett (GSFC), T. Megeath (University of Toledo) and B. Reipurth (University of Hawaii).

Hubble sees a cosmic caterpillar

This light-year-long knot of interstellar gas and dust resembles a caterpillar on its way to a feast. But the meat of the story is not only what this cosmic caterpillar eats for lunch, but also what's eating it. Harsh winds from extremely bright stars are blasting ultraviolet radiation at this 'wanna-be' star and sculpting the gas and dust into its long shape.

The culprits are 65 of the hottest, brightest known stars, classified as O-type stars, located 15 light-years away from the knot, towards the right edge of the image. These stars, along with 500 less bright, but still highly luminous, B-type stars make up what is called the Cygnus OB2 association. Collectively, the association is thought to have a mass more than 30 000 times that of our Sun.

The caterpillar-shaped knot, called IRAS 20324+4057, is a protostar in a very early evolutionary stage. It is still in the process of collecting material from an envelope of gas surrounding it. However, that envelope is being eroded by the radiation from Cygnus OB2. Protostars in this region should eventually become young stars with final masses about one to ten times that of our Sun, but if the eroding radiation from the nearby bright stars destroys the gas envelope before the protostars finish collecting mass, their final masses may be reduced.

Spectroscopic observations of the central star within IRAS 20324+4057 show that it is still collecting material quite heavily from its outer envelope, hoping to bulk up. Only time will tell if the formed star will be a 'heavy-weight' or a 'light-weight' with respect to its mass.

This image of IRAS 20324+4057 is a composite of Hubble Advanced Camera for Surveys (ACS) data taken in green and infrared light in 2006, and ground-based hydrogen data from the Isaac Newton Telescope in 2003, as part of the IPHAS H-alpha survey. The object lies 4500 light-years away in the constellation of Cygnus (The Swan).

Credit: NASA, ESA, the Hubble Heritage Team (STScI/AURA) and IPHAS.

A Grazing Encounter Between two Spiral Galaxies

In the direction of the constellation Canis Major, two spiral galaxies pass by each other like majestic ships in the night. The near-collision has been caught in images taken by the NASA/ESA Hubble Space Telescope and its Wide Field Planetary Camera 2.

Credit: NASA/ESA and the Hubble Heritage Team (STScI).

A rose made of galaxies

This image of a pair of interacting galaxies called Arp 273 was released to celebrate the 21st anniversary of the launch of the NASA/ESA Hubble Space Telescope.

The distorted shape of the larger of the two galaxies shows signs of tidal interactions with the smaller of the two. It is thought that the smaller galaxy has actually passed through the larger one.

Credit: NASA, ESA and the Hubble Heritage Team (STScI/AURA).

Lunar Shadow Transit

This snapshot from deep space captures planet Earth on March 9. The shadow of its large moon is falling on the planet's sunlit hemisphere. Tracking toward the east (left to right) across the ocean-covered world the moon shadow moved quickly in the direction of the planet's rotation. Of course, denizens of Earth located close to the shadow track centerline saw this lunar shadow transit as a brief, total eclipse of the Sun. From a spacebased perspective between Earth and Sun, the view of this shadow transit was provided by the Deep Space Climate Observatory (DSCOVR) spacecraft's Earth Polychromatic Imaging Camera (EPIC).

Image Credit: NASA, NOAA/DSCOVR

Milky Way over the Pinnacles in Australia

Explanation: What strange world is this? In the foreground of the featured image are the Pinnacles, unusual rock spires in Nambung National Park in Western Australia. Made of ancient sea shells (limestone), how these human-sized picturesque spires formed remains unknown. In the background, just past the end of the central Pinnacle, is a bright crescent Moon. The eerie glow around the Moon is mostly zodiacal light, sunlight reflected by dust grains orbiting between the planets in the Solar System. Arching across the top is the central band of our Milky Way Galaxy. Many famous stars and nebula are also visible in the background night sky. The featured 29-panel panorama was taken and composed last September after detailed planning that involved the Moon, the rock spires, and their corresponding shadows. Even so, the strong zodiacal light was a pleasant surprise.

Image Credit: Michael Goh (astrophotobear@gmail.com).