HUBBLE

A New Beginning

HUBBLE

A new beginning

September 9 • 2009

Colorful stars galore inside Globular Star Cluster Omega Centauri

NASA's Hubble Space Telescope snapped this panoramic view of a colorful assortment of 100,000 stars residing in the crowded core of a giant star cluster.

The image reveals a small region inside the massive globular cluster Omega Centauri, which boasts nearly 10 million stars. Globular clusters, ancient swarms of stars united by gravity, are the homesteaders of our Milky Way galaxy. The stars in Omega Centauri are between 10 billion and 12 billion years old. The cluster lies about 16,000 light-years from Earth.

This is one of the first images taken by the new Wide Field Camera 3 (WFC3), installed aboard Hubble in May 2009, during Servicing Mission 4. The camera can snap sharp images over a broad range of wavelengths.

The photograph showcases the camera's color versatility by revealing a variety of stars in key stages of their life cycles.

The majority of the stars in the image are yellow-white, like our Sun. These are adult stars that are shining by hydrogen fusion. Toward the end of their normal lives, the stars become cooler and larger. These late-life stars are the orange dots in the image.

Even later in their life cycles, the stars continue to cool down and expand in size, becoming red giants. These bright red stars swell to many times larger than our Sun's size and begin to shed their gaseous envelopes.

After ejecting most of their mass and exhausting much of their hydrogen fuel, the stars appear brilliant blue. Only a thin layer of material covers their super-hot cores. These stars are desperately trying to extend their lives by fusing helium in their cores. At this stage, they emit much of their light at ultraviolet wavelengths.

When the helium runs out, the stars reach the end of their lives. Only their burned-out cores remain, and they are called white dwarfs (the faint blue dots in the image). White dwarfs are no longer generating energy through nuclear fusion and have gravitationally contracted to the size of Earth. They will continue to cool and grow dimmer for many billions of years until they become dark cinders.

Other stars that appear in the image are so-called "blue stragglers." They are older stars that acquire a new lease on life when they collide and merge with other stars. The encounters boost the stars' energy-production rate, making them appear bluer.

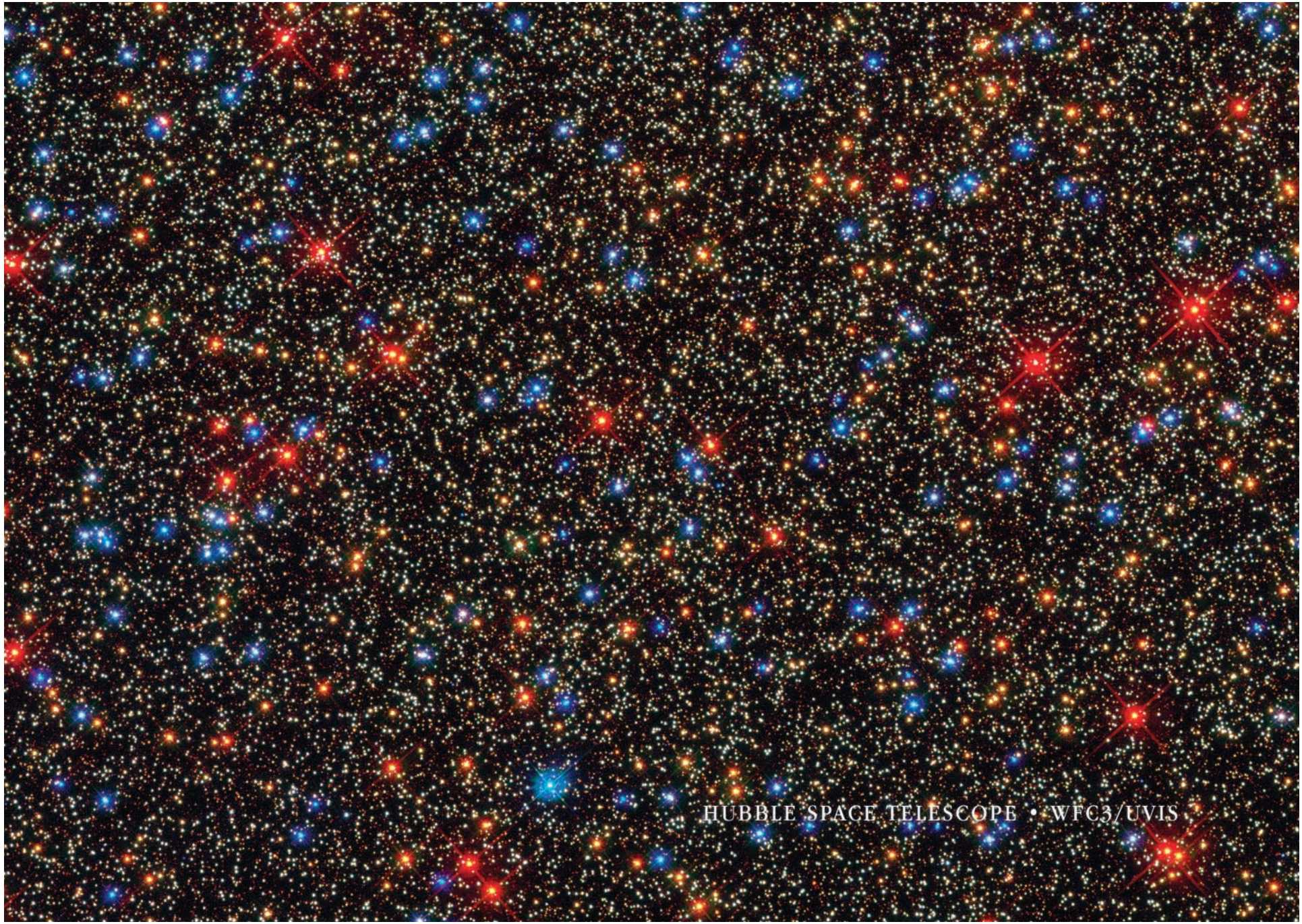
All of the stars in the image are cozy neighbors. The average distance between any two stars in the cluster's crowded core is only about a third of a light-year, roughly 13 times closer than our Sun's nearest stellar neighbor, Alpha Centauri. Although the stars are close together, WFC3's sharpness can resolve each of them as individual stars. If anyone lived in this globular cluster, they would behold a star-saturated sky that is roughly 100 times brighter than Earth's sky.

Globular clusters were thought to be assemblages of stars that share the same birth date. Evidence suggests, however, that Omega Centauri has at least two populations of stars with different ages. Some astronomers think that the cluster may be the remnant of a small galaxy that was gravitationally disrupted long ago by the Milky Way, losing stars and gas.

Omega Centauri is among the biggest and most massive of some 200 globular clusters orbiting the Milky Way. It is one of the few globular clusters that can be seen with the unaided eye. Named by Johann Bayer in 1603 as the 24th brightest object in the constellation Centaurus, it resembles a small cloud in the southern sky and might easily be mistaken for a comet.

Hubble observed Omega Centauri on July 15, 2009, in ultraviolet and visible light. These Hubble observations of Omega Centauri are part of the Hubble Servicing Mission 4 Early Release Observations.

CREDIT: NASA, ESA, AND THE HUBBLE SM4 ERO TEAM


HUBBLE SPACE TELESCOPE • WFC3/UVIS


Planetary Nebula
NGC 6302
HUBBLE SPACE TELESCOPE • WFC3/UVIS

A butterfly emerges from stellar demise in Planetary Nebula NGC 6302

This celestial object looks like a delicate butterfly. But it is far from serene.

What resemble dainty butterfly wings are actually roiling cauldrons of gas heated to more than 36,000 degrees Fahrenheit. The gas is tearing across space at more than 600,000 miles an hour—fast enough to travel from Earth to the Moon in 24 minutes!

A dying star that was once about five times the mass of the Sun is at the center of this fury. It has ejected its envelope of gases and is now unleashing a stream of ultraviolet radiation that is making the cast-off material glow. This object is an example of a planetary nebula, so-named because many of them have a round appearance resembling that of a planet when viewed through a small telescope.

The Wide Field Camera 3 (WFC3), a new camera aboard NASA's Hubble Space Telescope, snapped this image of the planetary nebula, catalogued as NGC 6302, but more popularly called the Bug Nebula or the Butterfly Nebula. WFC3 was installed by NASA astronauts in May 2009, during the servicing mission to upgrade and repair the 19-year-old Hubble telescope.

NGC 6302 lies within our Milky Way galaxy, roughly 3,800 light-years away in the constellation Scorpius. The glowing gas is the star's outer layers, expelled over about 2,200 years. The "butterfly" stretches for more than two light-years, which is about half the distance from the Sun to the nearest star, Alpha Centauri.

The central star itself cannot be seen, because it is hidden within a doughnut-shaped ring of dust, which appears as a dark band pinching the nebula in the center. The thick dust belt constricts the star's outflow, creating the classic "bipolar" or hourglass shape displayed by some planetary nebulae.

The star's surface temperature is estimated to be about 400,000 degrees Fahrenheit, making it one of the hottest known stars in our galaxy. Spectroscopic observations made with ground-based telescopes show that the gas is roughly 36,000 degrees Fahrenheit, which is unusually hot compared to a typical planetary nebula.

The WFC3 image reveals a complex history of ejections from the star. The star first evolved into a huge red-giant star, with a diameter of about 1,000 times that of our Sun. It then lost its extended outer layers. Some of this gas was cast off from its equator at a relatively slow speed, perhaps as low as 20,000 miles an hour, creating the doughnut-shaped ring. Other gas was ejected perpendicular to the ring at higher speeds, producing the elongated "wings" of the butterfly-shaped structure. Later, as the central star heated up, a much faster stellar wind, a stream of charged particles traveling at more than 2 million miles an hour, plowed through the existing wing-shaped structure, further modifying its shape.

The image also shows numerous finger-like projections pointing back to the star, which may mark denser blobs in the outflow that have resisted the pressure from the stellar wind.

The nebula's reddish outer edges are largely due to light emitted by nitrogen, which marks the coolest gas visible in the picture. WFC3 is equipped with a wide variety of filters that isolate light emitted by various chemical elements, allowing astronomers to infer properties of the nebular gas, such as its temperature, density, and composition.

The white-colored regions are areas where light is emitted by sulfur. These are regions where fast-moving gas overtakes and collides with slow-moving gas that left the star at an earlier time, producing shock waves in the gas (the bright white edges on the sides facing the central star). The white blob with the crisp edge at upper right is an example of one of those shock waves.

NGC 6302 was imaged on July 27, 2009 with Hubble's Wide Field Camera 3 in ultraviolet and visible light. Filters that isolate emissions from oxygen, helium, hydrogen, nitrogen, and sulfur from the planetary nebula were used to create this composite image.

These Hubble observations of the planetary nebula NGC 6302 are part of the Hubble Servicing Mission 4 Early Release Observations.

CREDIT: NASA, ESA, AND THE HUBBLE SM4 ERO TEAM

Galactic wreckage in Stephan's Quintet

A clash among members of a famous galaxy quintet reveals an assortment of stars across a wide color range, from young, blue stars to aging, red stars.

This portrait of Stephan's Quintet, also known as Hickson Compact Group 92, was taken by the new Wide Field Camera 3 (WFC3) aboard NASA's Hubble Space Telescope. Stephan's Quintet, as the name implies, is a group of five galaxies. The name, however, is a bit of a misnomer. Studies have shown that group member NGC 7320, at upper left, is actually a foreground galaxy about seven times closer to Earth than the rest of the group.

Three of the galaxies have distorted shapes, elongated spiral arms, and long, gaseous tidal tails containing myriad star clusters, proof of their close encounters. These interactions have sparked a frenzy of star birth in the central pair of galaxies. This drama is being played out against a rich backdrop of faraway galaxies.

The image, taken in visible and near-infrared light, showcases WFC3's broad wavelength range. The colors trace the ages of the stellar populations, showing that star birth occurred at different epochs, stretching over hundreds of millions of years. The camera's infrared vision also peers through curtains of dust to see groupings of stars that cannot be seen in visible light.

NGC 7319, at top right, is a barred spiral with distinct spiral arms that follow nearly 180 degrees back to the bar. The blue specks in the spiral arm at the top of NGC 7319 and the red dots just above and to the right of the core are clusters of many thousands of stars. Most of the quintet is too far away even for Hubble to resolve individual stars.

Continuing clockwise, the next galaxy appears to have two cores, but it is actually two galaxies, NGC 7318A and NGC 7318B. Encircling the galaxies are young, bright blue star clusters and pinkish clouds of glowing hydrogen where infant stars are being born. These stars are less than 10 million years old and have not yet blown away their natal cloud. Far away from the galaxies, at right, is a patch of intergalactic space where many star clusters are forming.

NGC 7317, at bottom left, is a normal-looking elliptical galaxy that is less affected by the interactions.

Sharply contrasting with these galaxies is the dwarf galaxy NGC 7320 at upper left. Bursts of star formation are occurring in the galaxy's disk, as seen by the blue and pink dots. In this galaxy, Hubble can resolve individual stars, evidence that NGC 7320 is closer to Earth. NGC 7320 is 40 million light-years from Earth. The other members of the quintet reside 290 million light-years away in the constellation Pegasus.

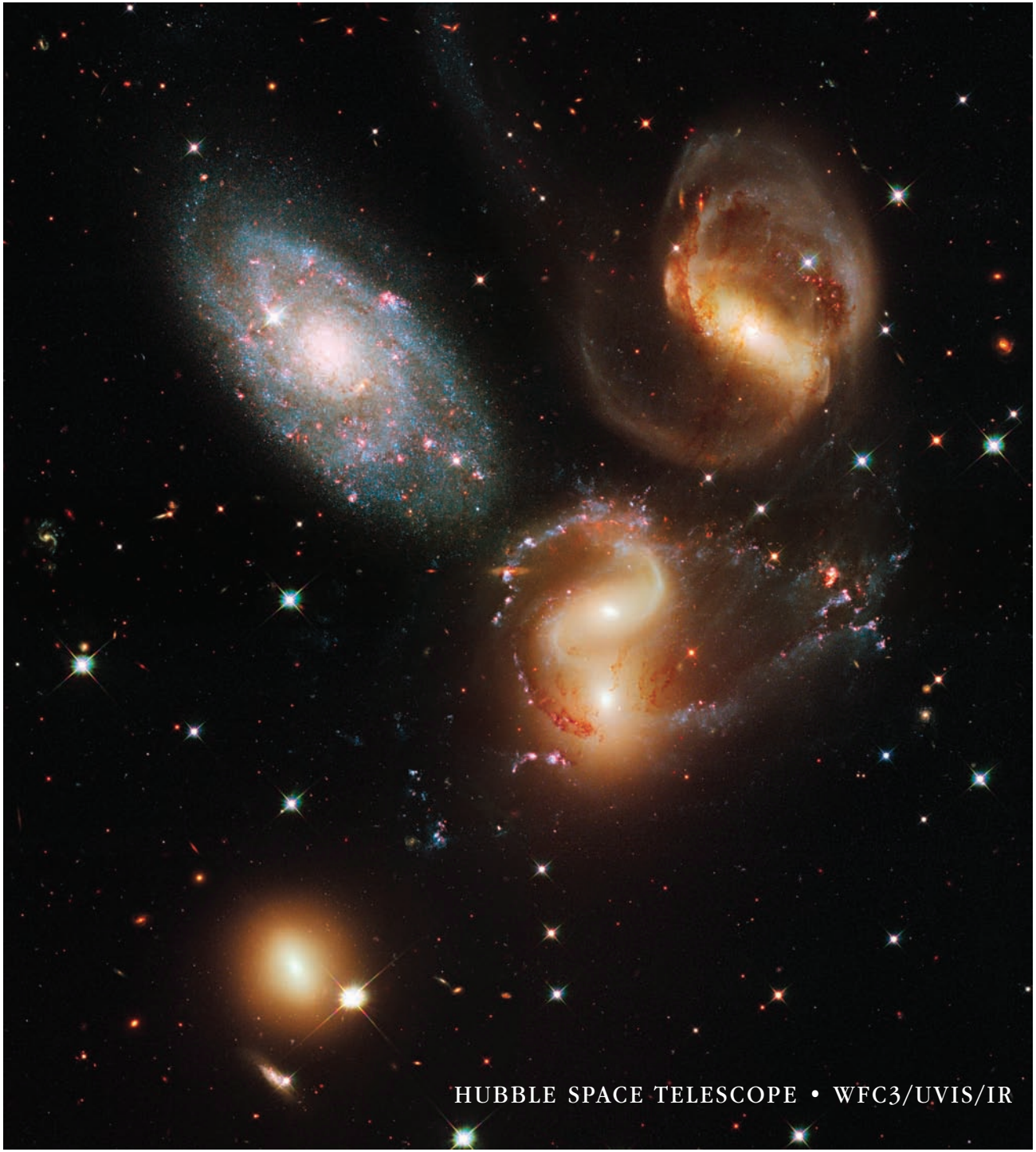
These farther members are markedly redder than the foreground galaxy, suggesting that older stars reside in their cores. The stars' light also may be further reddened by dust stirred up in the encounters.

Spied by Edouard M. Stephan in 1877, Stephan's Quintet is the first compact group ever discovered.

WFC3 observed the quintet in July and August 2009. The composite image was made by using filters that isolate light from the blue, green, and infrared portions of the spectrum, as well as emission from ionized hydrogen.

These Hubble observations are part of the Hubble Servicing Mission 4 Early Release Observations. NASA astronauts installed the WFC3 camera during a servicing mission in May to upgrade and repair the 19-year-old Hubble telescope.

CREDIT: NASA, ESA, AND THE HUBBLE SM4 ERO TEAM



HUBBLE SPACE TELESCOPE • WFC3/UVIS/IR

Stars bursting to life in the chaotic Carina Nebula

These two images of a huge pillar of star birth demonstrate how observations taken in visible and in infrared light by NASA's Hubble Space Telescope reveal dramatically different and complementary views of an object.

The pictures demonstrate one example of the broad wavelength range of the new Wide Field Camera 3 (WFC3) aboard the Hubble telescope, extending from ultraviolet to visible to infrared light.

Composed of gas and dust, the pillar resides in a tempestuous stellar nursery called the Carina Nebula, located 7,500 light-years away in the southern constellation Carina.The pair of images shows that astronomers are given a much more complete view of the pillar and its contents when distinct details not seen at visible wavelengths alone are uncovered in near-infrared light.

The top image on the next page, taken in visible light, shows the tip of the 3-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.

Nestled inside this dense structure are fledgling stars. They cannot be seen in this image because they are hidden by a wall of gas and dust. Although the stars themselves are invisible, one of them is providing evidence of its existence. Thin puffs of material can be seen traveling to the left and to the right of a dark notch in the center of the pillar. The matter is part of a jet produced by a young star. Farther away, on the left, the jet is visible as a grouping of small, wispy clouds. A few small clouds are visible at a similar distance on the right side of the jet. Astronomers estimate that the jet is moving at speeds of up to 850,000 miles an hour. The jet's total length is more than 15 light-years.

In the bottom image on the next page, taken in near-infrared light, the dense column and the surrounding greenish-colored gas all but disappear. Only a faint outline of the pillar remains. By penetrating the wall of gas and dust, the infrared vision of WFC3 reveals the infant star that is probably blasting the jet. Part of the jet nearest the star is more prominent in this view. These features can be seen because infrared light, unlike visible light, can pass through the dust.

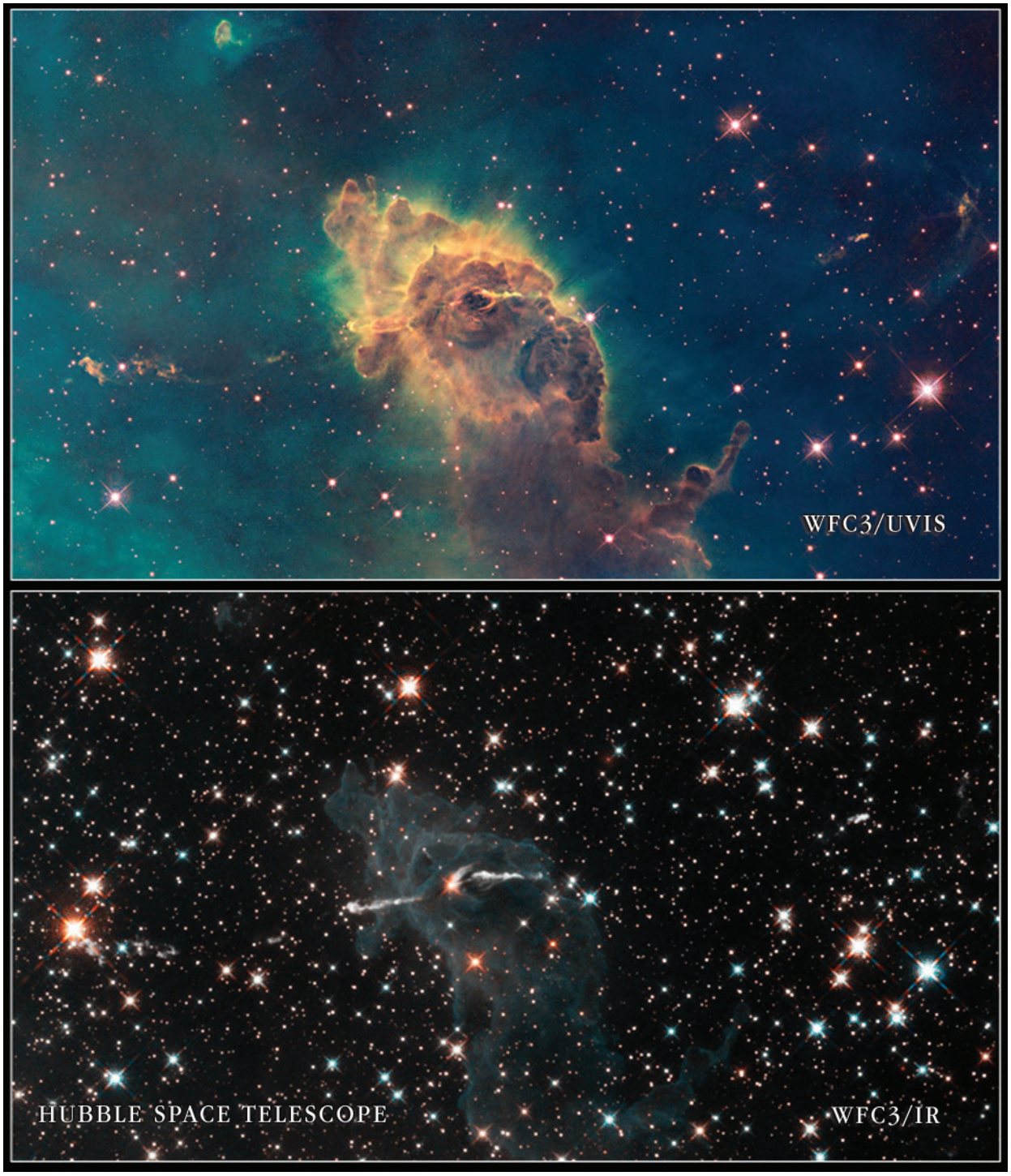
Other infant stars inside the pillar also appear to emerge. Three examples are the bright star almost directly below the jet-producing star, a fainter one to its right, and a pair of stars at the top of the pillar. Winds and radiation from some of the stars are blowing away gas from their neighborhoods, carving out large cavities that appear as faint dark holes.

Surrounding the stellar nursery is a treasure chest full of stars, most of which cannot be seen in the visible-light image because dense gas clouds veil their light. Many of them are background stars.

Hubble's Wide Field Camera 3 observed the Carina Nebula on July 24-30, 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 sulfur.

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

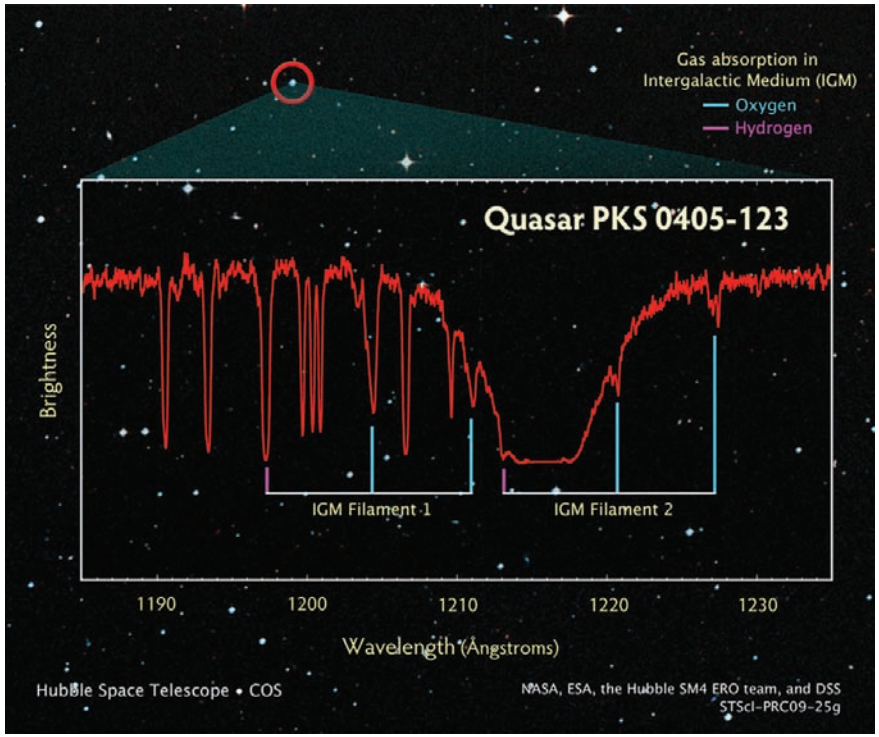


Stellar jet in the Carina Nebula

Fingerprinting the distant universe using the light from Quasar PKS 0405-123

Using a distant quasar as a cosmic flashlight, a new instrument aboard NASA's Hubble Space Telescope has begun probing the invisible, skeletal structure of the universe.

Called the cosmic web, it is the diffuse, faint gas located in the space between galaxies. More than half of all normal matter resides outside of galaxies. By observing the cosmic web, astronomers can probe the raw materials from which galaxies form, and determine how this gas was assembled into the complex structures of the present-day universe.



Using the light from the quasar PKS 0405-123, located 7–8 billion light-years away, the newly installed Cosmic Origins Spectrograph (COS) on Hubble probed a string of gas clouds residing along the light path at different distances. Quasars are the bright cores of active galaxies and are powered by supermassive black holes. Thousands of quasars have been observed, all at extreme distances from our Milky Way galaxy. The most luminous quasars radiate at a rate equivalent to a trillion suns.

The COS spectrum shown here reveals the absorption lines of elements that make up the intervening gas clouds traversed by the quasar's light. COS detected three to five times more lower-density filaments of hydrogen in the cosmic web than were seen in previous observations along this line of sight. The instrument also detected evidence of glowing oxygen and nitrogen that predominantly trace strong shocks in the filamentary cosmic web. These shocks are produced by gravitational interactions between intergalactic clouds of gas falling onto filaments in the web and by the fast outflow of material from star-forming galaxies.

COS produced this spectrum and detected many previously unseen filaments in only a quarter of the time it took to produce spectra in previous studies of this object (using earlier instruments). The spectrum is also of higher quality (with a better signal-to-noise ratio) than those spectra produced by the best previous observations.

With COS, astronomers have access to thousands of quasars where only a handful could be observed before in the ultraviolet. Each quasar sightline passes through multiple filaments of the cosmic web, providing a picture of how intergalactic spaces evolve over time, as light passes from the quasar to us.

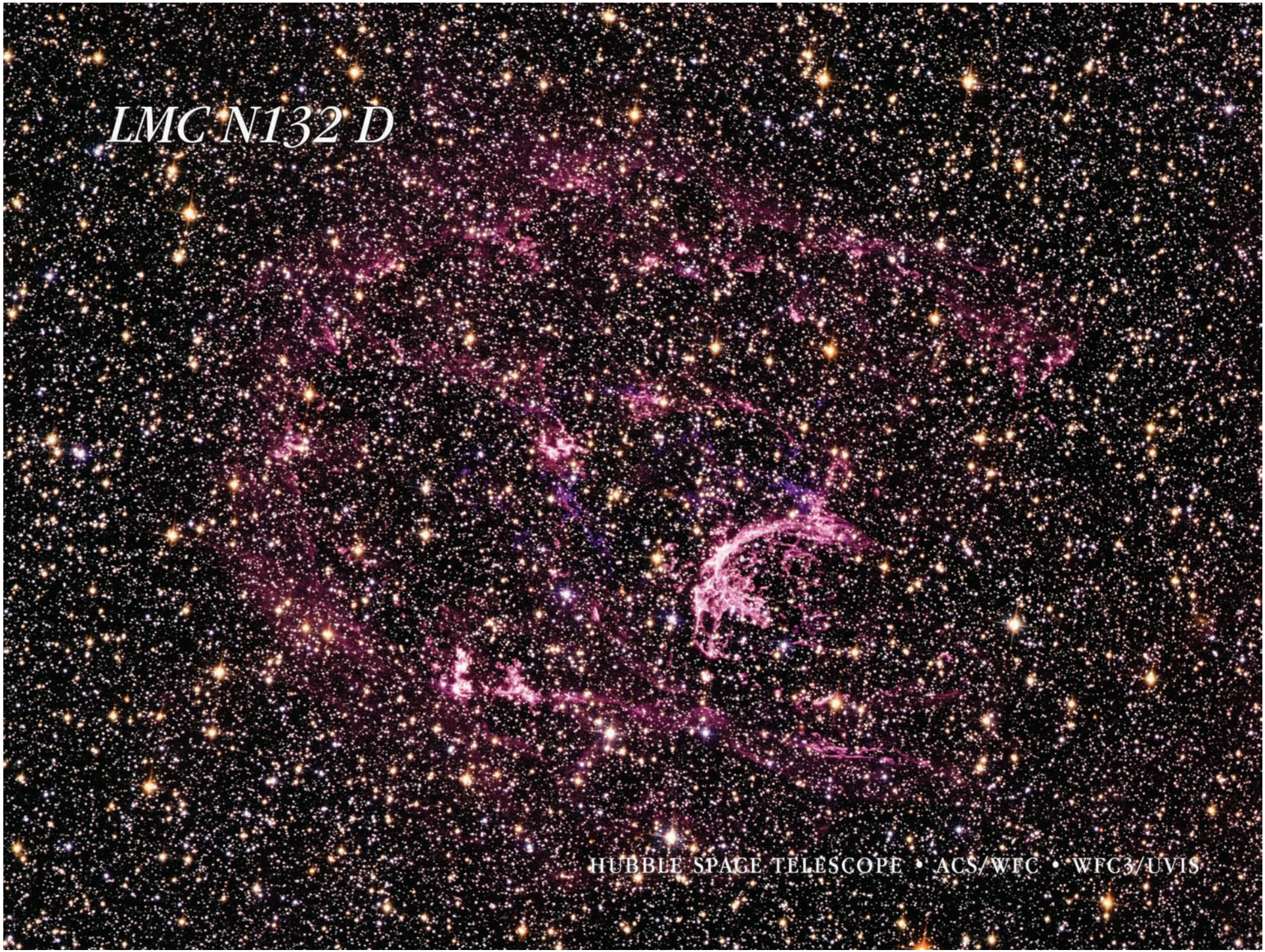
These data are the first in a series of large observation programs that will map out the cosmic web. The studies will trace the complex cycles of how material flows between galaxies and intergalactic space.

COS observed the quasar in far-ultraviolet light in August 2009. The instrument was installed by NASA astronauts in May 2009, during the servicing mission to upgrade and repair the 19-year-old Hubble telescope.

These Hubble observations of the quasar PKS 0405-123 are part of the Hubble Servicing Mission 4 Early Release Observations.

CREDIT: NASA, ESA, THE HUBBLE SM4 ERO TEAM, AND DSS


Quasar
DIGITIZED SKY SURVEY (DSS) • UK SCHMIDT TELESCOPE
ANGLO-AUSTRALIAN OBSERVATORY (AAO)


LMC N132 D
HUBBLE SPACE TELESCOPE • ACS/WFC • WFC3/UVIS

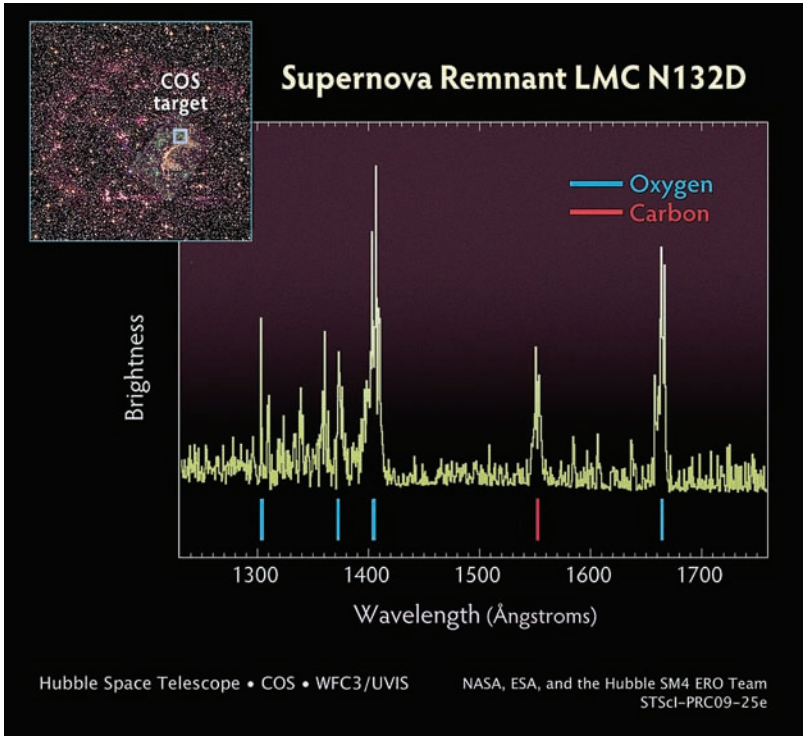
Probing the tattered remains of supernova remnant N132D

The wispy, glowing, magenta structures in this NASA Hubble Space Telescope image are the remains of a star 10 to 15 times the mass of the Sun that we would have seen exploding as a supernova 3,000 years ago. The remnant's fast-moving gas is plowing into the surrounding gas of the galaxy, creating a supersonic shock wave in the surrounding medium and making the material glow.

The Hubble visible-light image reveals, deep within the remnant, a crescent-shaped cloud of pink emission from hydrogen gas and soft purple wisps that correspond to regions of glowing oxygen. A dense background of colorful stars is also visible.

Probing this tattered gaseous relic, the newly installed Cosmic Origins Spectrograph (COS) aboard NASA's Hubble Space Telescope detected pristine gas ejected by the doomed star that has not yet mixed with the gas in the interstellar medium. The supernova remnant, called N132D, resides in the Large Magellanic Cloud, a small companion galaxy of the Milky Way located 170,000 light-years away. The resulting spectrum, taken in ultraviolet light, shows glowing oxygen and carbon in the remnant.

These results allow astronomers to better understand why some stars form an abundance of certain elements, like oxygen, but not others.



Ultraviolet light is blocked by Earth's atmosphere, so the observation of N132D in the ultraviolet requires the use of the space-borne Hubble telescope. The broadest range of spectral signatures of the glowing gas appear in the ultraviolet, allowing astronomers to determine the quantities, or abundances, of key elements such as oxygen, as well as elements whose abundances cannot be traced from visible-light images, including carbon, magnesium, and silicon. Previous ultraviolet instruments on Hubble were not sensitive enough to distinguish between the unmixed ejecta and the "shocked" gas of the surrounding interstellar medium.

Supernova remnants provide a rare opportunity to search for the material hidden deep inside a star. This in turn yields information on how stars evolve and how they manufacture chemicals in their interiors. Supernova explosions also enrich the interstellar medium with new chemical elements, which are incorporated into future generations of stars.

The COS observations were made on Aug. 10, 2009. COS was installed by NASA astronauts in May 2009, during the servicing mission to upgrade and repair the 19-year-old Hubble telescope.

The visible-light image was taken on August 2, 2009 with Hubble's new Wide Field Camera 3 (WFC3). A filter that isolates emission from sulfur was combined with archival data from the Advanced Camera for Surveys (ACS). The ACS data include color filters that sample starlight in the blue, green, and red portions of the spectrum, as well as the pink emission from glowing hydrogen gas.

These Hubble observations of the N132D are part of the Hubble Servicing Mission 4 Early Release Observations.

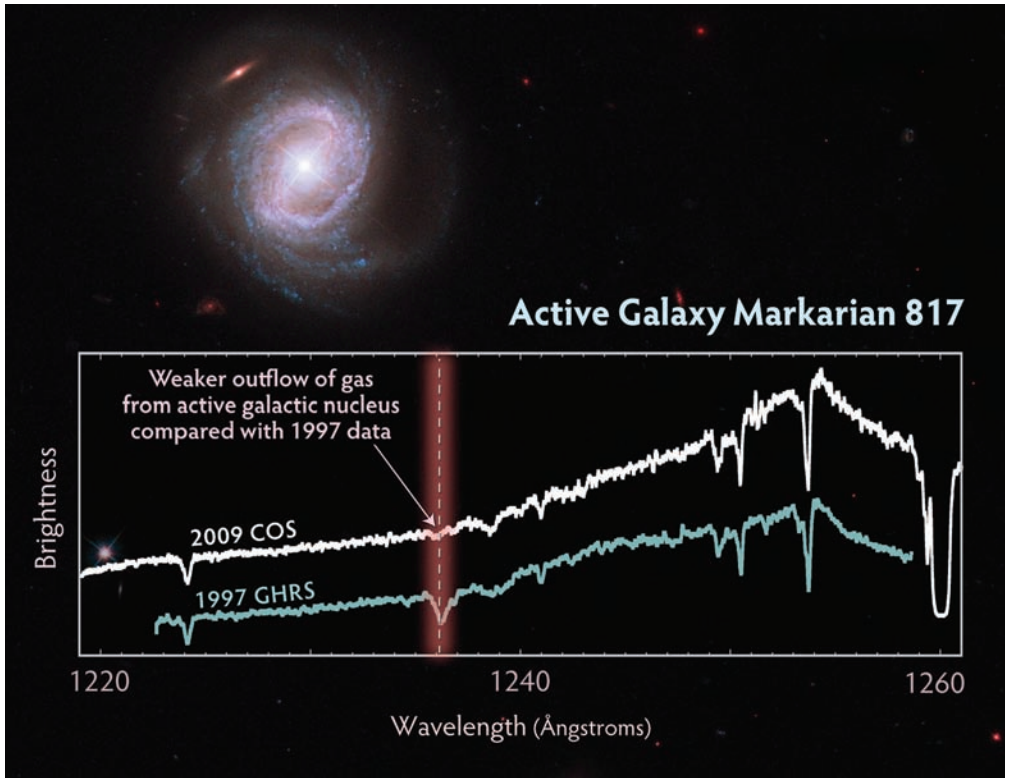
Credit: NASA, ESA, and the Hubble SM4 ERO Team

Capturing the spectacular outflow from Markarian 817

Rings of brilliant blue stars encircle the bright, active core of this spiral galaxy, whose monster black hole is blasting material into space at 9 million miles an hour.

Viewed nearly face-on, the galaxy, called Markarian 817, shows intense star-forming regions and dark bands of interstellar dust along its spiral arms.

Observations by the new Cosmic Origins Spectrograph (COS) aboard NASA's Hubble Space Telescope captured the powerful outflow of material from this galaxy.



The COS spectrum of Markarian 817 highlights the outflow's dynamic nature. A gas cloud containing hydrogen gas that was detected in Hubble data taken in 1997 does not appear in the COS observation because the cloud has apparently been driven out by an outflow of material from the galaxy.

This discharge is being powered by a huge disk of matter encircling the supermassive black hole, which is 40 million times more massive than our Sun. The disk is driving the material out of the galaxy through powerful winds, produced by streams of charged particles. Some of the outflow rains back onto the galaxy. The rest settles into the intergalactic gas.

Astronomers want to know how much of the outflow lands in the galaxy and how much escapes into intergalactic space. To achieve this, astronomers need high-quality spectroscopic observations to detect the signatures of the outflowing material, which includes carbon, nitrogen, and oxygen. This will allow them to determine the composition, location, and dynamics of the winds that distribute the material.

Markarian 817 is 430 million light-years away in the northern constellation Draco. COS observed the galaxy on Aug. 4, 2009, using its far-ultraviolet detector to distinguish the outflow from the galaxy's core. NASA astronauts installed COS during a servicing mission in May to upgrade and repair the 19-year-old Hubble telescope.

The Hubble image was taken with Hubble's Wide Field Camera 3 on August 2, 2009. The composite image was made by using filters that isolate light from the blue, green, and infrared portions of the spectrum, as well as emission from glowing hydrogen.

The Hubble observations are part of the Hubble Servicing Mission 4 Early Release Observations.

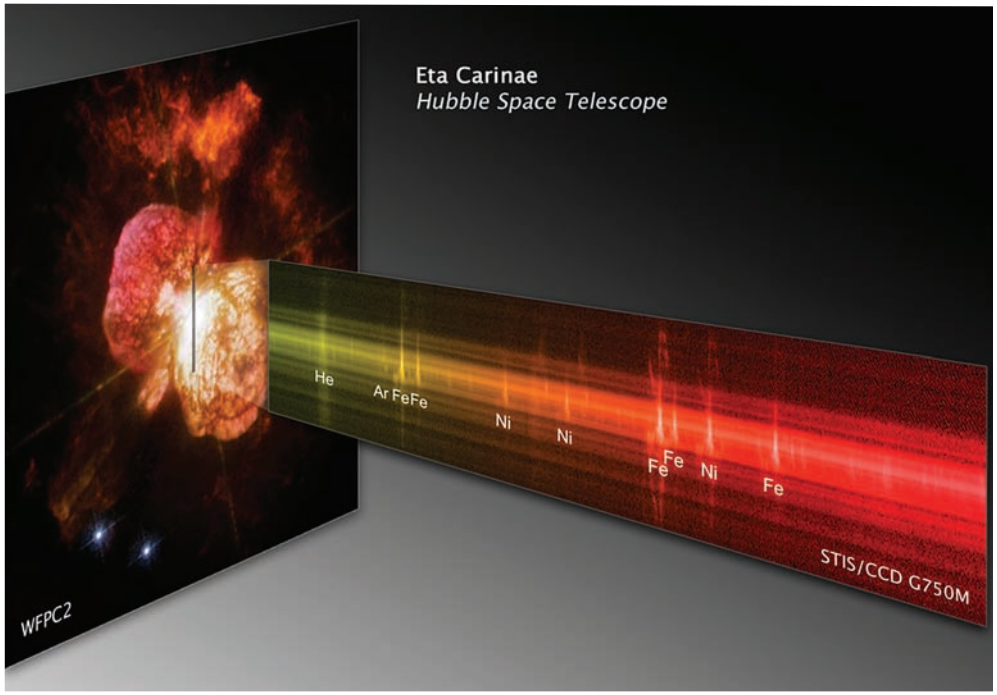
CREDIT: NASA, ESA, AND THE HUBBLE SM4 ERO TEAM


Active Galaxy
Markarian 817
HUBBLE SPACE TELESCOPE • WFC3/UVIS

Probing the last gasps of the doomed star Eta Carinae

The signature balloon-shaped clouds of gas blown from a pair of massive stars called Eta Carinae have tantalized astronomers for decades. Eta Carinae has a volatile temperament, prone to violent outbursts over the past 200 years.

Observations by the newly repaired Space Telescope Imaging Spectrograph (STIS) aboard NASA's Hubble Space Telescope reveal a stream of charged particles from a massive stellar wind and some of the chemical elements that were ejected in the eruption seen in the middle of the nineteenth century.



STIS resolved the chemical information along a narrow section of one of the giant lobes of ejected material. In the resulting spectrum, iron and nickel define the outer material cast off in the nineteenth century from Eta Carinae. STIS also reveals the interior material being carried away by the ongoing wind from Eta Car A, the primary star. The amount of mass being carried away by the wind is the equivalent of one sun every thousand years.

While this rate of "mass loss" may not sound very large, in fact it is an enormous rate among stars of all types. A very faint structure, seen in argon, is evidence of an interaction between winds from Eta Car A and those of Eta Car B, the hotter, less massive, secondary star.

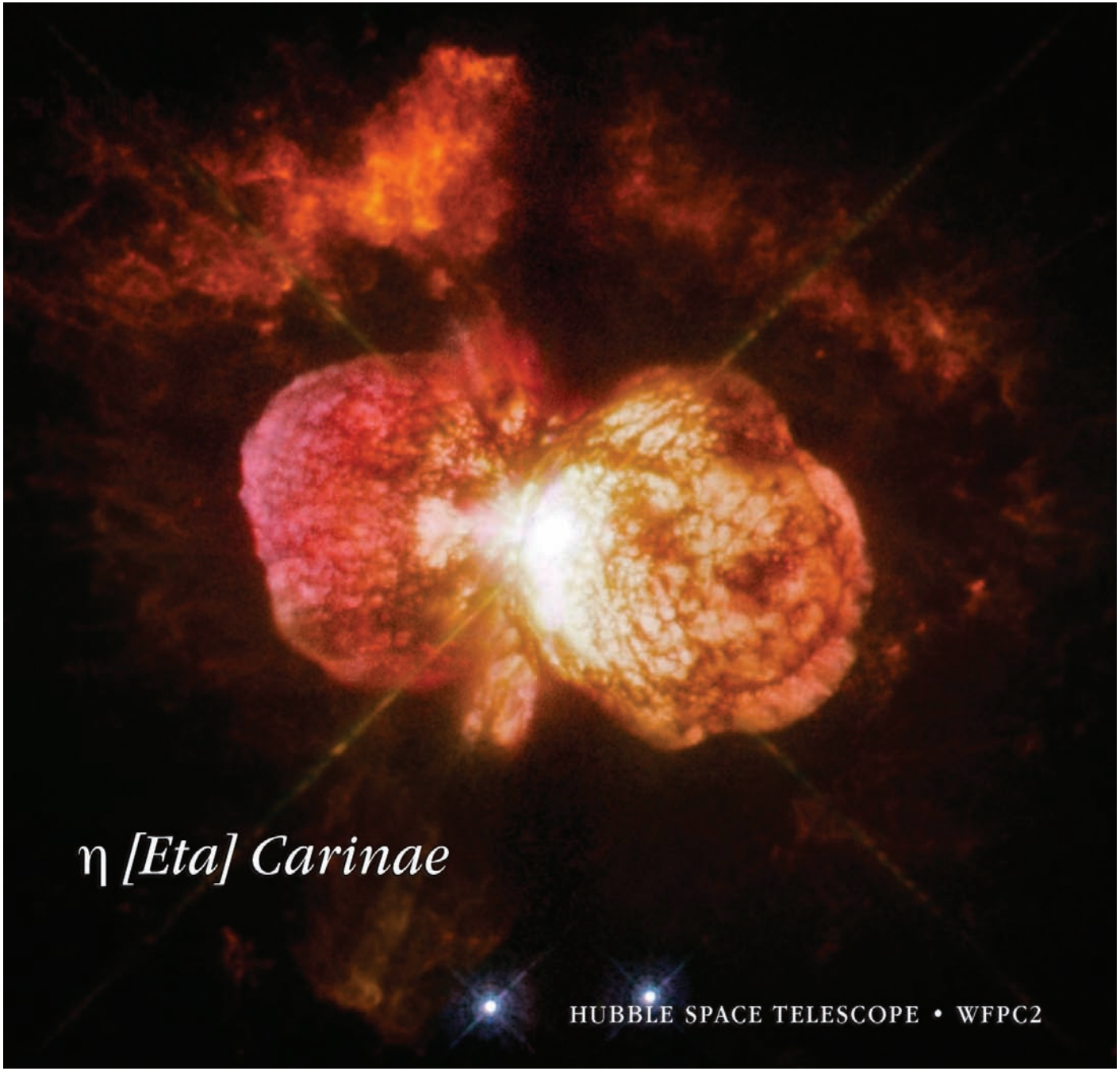
Eta Car A is one of the most massive and most visible stars in the sky. Because of the star's extremely high mass, it is unstable and uses its fuel very quickly, compared with other stars. Such massive stars also have a short lifetime, and astronomers expect that Eta Carinae will explode within a million years.

Eta Carinae was first catalogued by Edmund Halley in 1677. In 1843 Eta Carinae was one of the brightest stars in the sky. It then slowly faded until, in 1868, it became invisible in the sky. Eta Carinae started to brighten again in the 1990s and was again visible to the naked eye. Around 1998 and 1999 its brightness suddenly and unexpectedly doubled.

Eta Carinae is 7,500 light-years away in the constellation Carina.

The Hubble observations are part of the Hubble Servicing Mission 4 Early Release Observations. NASA astronauts repaired STIS during a servicing mission in May to upgrade and repair the 19-year-old Hubble telescope.

CREDIT: NASA, ESA, AND THE HUBBLE SM4 ERO TEAM


η [Eta] Carinae
HUBBLE SPACE TELESCOPE • WFPC2

Gravitational Lensing in Galaxy Cluster Abell 370

Hubble Space Telescope's newly repaired Advanced Camera for Surveys (ACS) has peered nearly 5 billion light-years away to resolve intricate details in the galaxy cluster Abell 370.

Abell 370 is one of the very first galaxy clusters where astronomers observed the phenomenon of gravitational lensing, the warping of space by the cluster's gravitational field distorts the light from galaxies lying far behind it. This is manifested as arcs and streaks in the picture, which are the stretched images of background galaxies.

Gravitational lensing proves a vital tool for astronomers when measuring the dark matter distribution in massive clusters, since the mass distribution can be reconstructed from its gravitational effects.

Ground-based telescopic observations in the mid-1980s of the most prominent arc (near the right-hand side of the picture) allowed astronomers to deduce that the arc was not a structure of some kind within the cluster, but the gravitationally-lensed image of an object two times farther away. Hubble resolves unseen new details in the arc that reveal structure in the lensed background galaxy.

Galaxy clusters are the most massive structures of the universe, located at the crossing of the filaments of the cosmic web of dark matter. The most massive clusters can contain up to 1,000 galaxies and intergalactic hot gas, all held together primarily by the gravity of dark matter.

These observations were taken with Hubble's Advanced Camera for Surveys (ACS) in its Wide Field mode on July 16, 2009. The composite image was made using filters that isolate light from green, red, and infrared wavelengths.

These Hubble data are part of the Hubble Servicing Mission 4 Early Release Observations.

CREDIT: NASA, ESA, THE HUBBLE SM4 ERO TEAM, AND ST-ECF


Galaxy Cluster
Abell 370
HUBBLE SPACE TELESCOPE • ACS/WFC

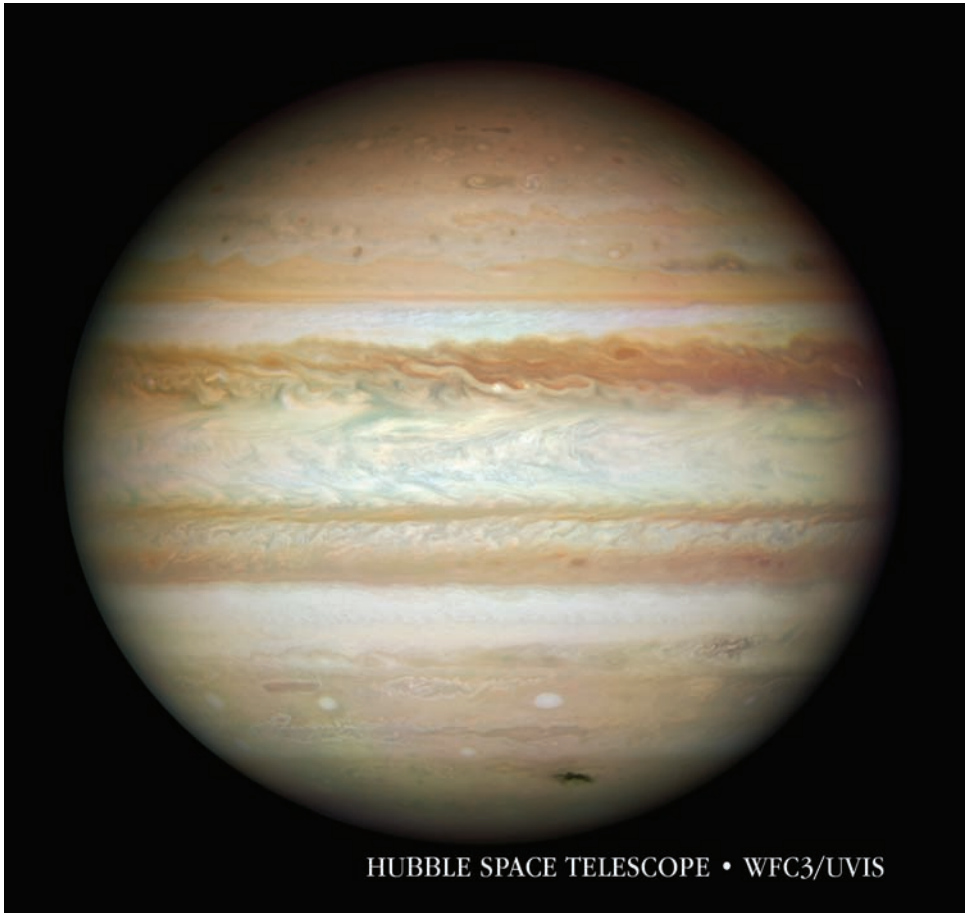
Collision leaves giant Jupiter bruised

This Hubble picture, taken on July 23, is the first full-disk natural-color image of Jupiter made with Hubble's new camera, the Wide Field Camera 3 (WFC3). It is the sharpest visible-light picture of Jupiter since the New Horizons spacecraft flew by that planet in 2007.

Each pixel in this high-resolution image spans about 74 miles (119 km) in Jupiter's atmosphere. Jupiter was more than 370 million miles (600 million km) from Earth when the images were taken.

The dark smudge at bottom right is debris from a comet or asteroid that plunged into Jupiter's atmosphere and disintegrated.

In addition to the fresh impact, the image reveals a spectacular variety of shapes in the swirling atmosphere of Jupiter. The planet is wrapped in bands of yellow, brown, and white clouds. These bands are produced by the atmosphere flowing in different directions at various. When these opposing flows interact, turbulence appears.



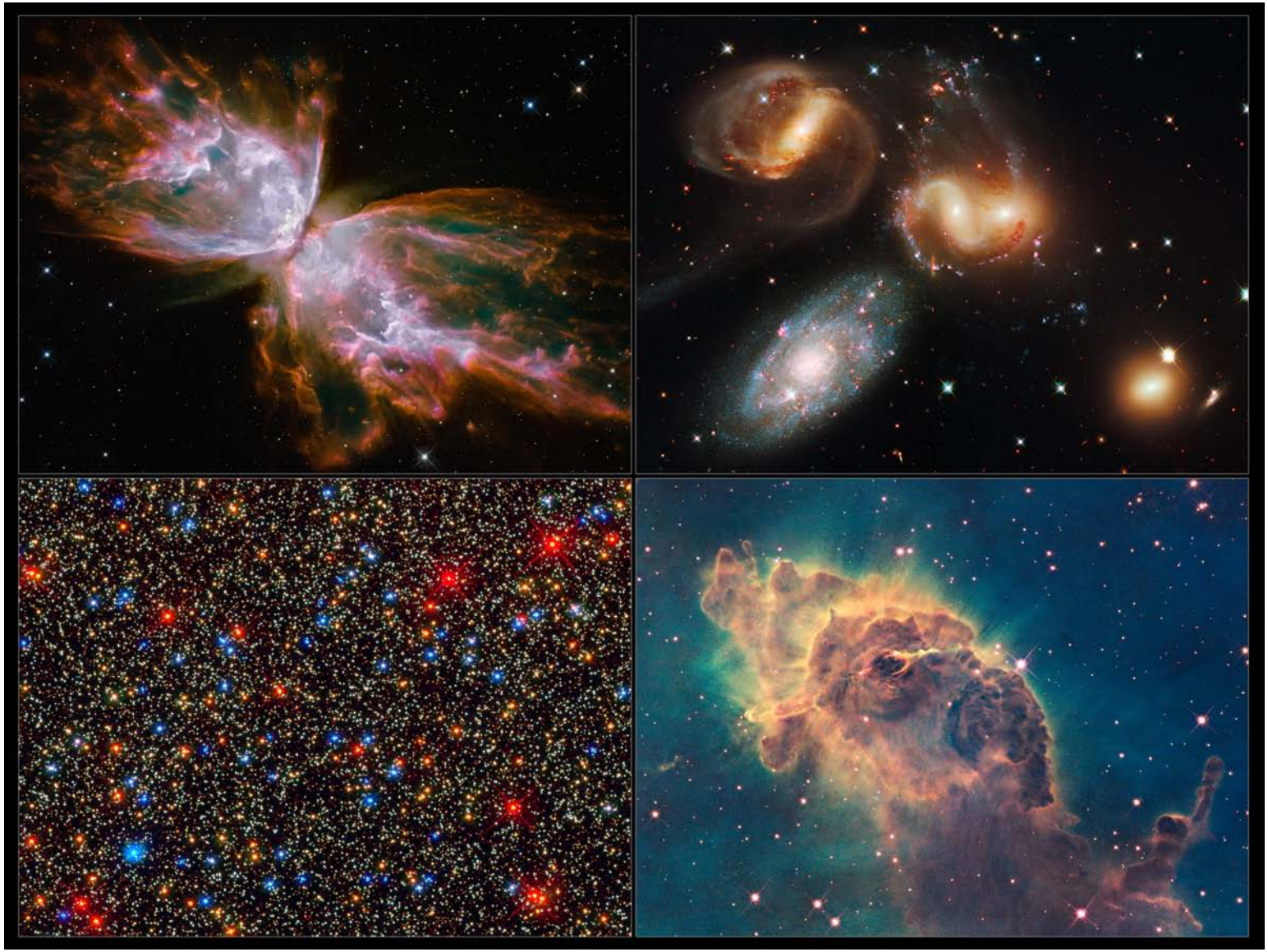
Such data complement the images taken from other telescopes and spacecraft by providing exquisite details of atmospheric phenomena. For example, the image suggests that dark "barges" -- tracked by amateur astronomers on a nightly basis -- may differ both in form and color from barge features identified by the Voyager spacecraft. (The Great Red Spot and the smaller Red Oval are both out of view on the other side of the planet.)

This color image is a composite of three separate color exposures (red, blue, and green) made by WFC3. Additional processing was done to compensate for asynchronous imaging in the color filters and other effects.

The image is a composite of separate exposures made by the Wide Field Camera 3.

Credit: NASA, ESA, Michael Wong (Space Telescope Science Institute, Baltimore, MD), H. B. Hammel (Space Science Institute, Boulder, CO), and the Jupiter Impact Team

Hubble's new views of the universe



These four images are among the first observations made by the new Wide Field Camera 3 aboard the upgraded NASA Hubble Space Telescope.

The image at top left shows NGC 6302, a butterfly-shaped nebula surrounding a dying star. At top right is a picture of a clash among members of a galactic grouping called Stephan's Quintet. The image at bottom left gives viewers a panoramic portrait of a colorful assortment of 100,000 stars residing in the crowded core of Omega Centauri, a giant globular cluster. At bottom right an eerie pillar of star birth in the Carina Nebula rises from a sea of greenish-colored clouds.

NOTES

NOTES

NOTES

NOTES

NOTES

For media inquires, please contact:

J. D. Harrington
Headquarters, Washington
202-358-5241
j.d.harrington@nasa.gov

Susan Hendrix
NASA Goddard Space Flight Center
301-286-7745
susan.m.hendrix@nasa.gov

Ray Villard
Space Telescope Science Institute, Baltimore, Md.
410-338-4514
villard@stsci.edu

For images and more information, visit:

http://www.nasa.gov/hubble
http://hubblesite.org/news/2009/25
http://www.spacetelescope.org/html/heic0910.html

The Hubble Space Telescope is a project of international cooperation between NASA and the European Space Agency (ESA) and is managed by NASA's Goddard Space Flight Center (GSFC) in Greenbelt, Md. The Space Telescope Science Institute (STScI) conducts Hubble science operations. The institute is operated for NASA by the Association of Universities for Research in Astronomy, Inc., Washington, D.C.

STScI is an International Year of Astronomy 2009 (IYA 2009) program partner.