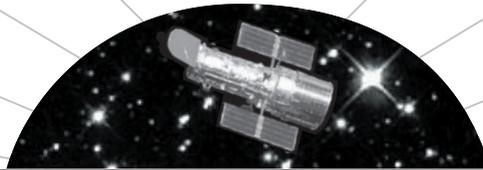




THE STAR★WITNESS



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Special Feature

Hubble Celebrates a Stellar Anniversary

By NASA's Amazing Space reporters
April 2010

WHEN THE EARTH-orbiting Hubble Space Telescope opened its sharp "eye" on the universe 20 years ago, planets circling other stars were just a dream and no one had heard of "dark energy."

Astronomers have used Hubble to hunt for planets around other stars in the hub of our Milky Way Galaxy and to study the bright light from faraway exploding stars to collect evidence for a mysterious dark energy, which makes up most of the energy in our universe.

Hubble has helped expand our view of the cosmos, allowing us to better understand our universe and our place in it. From its lofty perch 350 miles above Earth, Hubble sees farther and sharper than any previous telescope. The observatory has imaged more than 30,000 celestial objects, snapping more than 570,000 pictures.

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

Hubble Captures View of 'Mystic Mountain'

This giant pillar of gas lies within a tempestuous stellar nursery called the Carina Nebula, located 7,500 light-years away in the southern constellation Carina. The image celebrates the 20th anniversary of Hubble's launch and deployment into an orbit around the Earth. Hubble's Wide Field Camera 3 observed the pillar on Feb. 1-2, 2010.

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It's not just the scientific discoveries that have made Hubble an American icon. The telescope's breathtaking images of such cosmic beauties as Saturn and its rings, the pillars in the Eagle Nebula, and a pair of interacting galaxies called The Mice have inspired astronomers and the public.

Hubble's anniversary gift to the public

To mark the 20th anniversary of Hubble's launch and deployment into Earth orbit, NASA and the Space Telescope Science Institute (STScI) are issuing another stunning image. The new photograph of a craggy fantasy mountaintop surrounded by wispy clouds captures the chaotic activity atop a three-light-year-tall pillar of gas and dust that is being eaten away by the brilliant light from nearby colossal stars. Infant stars buried inside the pillar also are firing off jets of gas that can be seen streaming from towering peaks. This turbulent cosmic pillar lies within a tempestuous stellar nursery called the Carina Nebula, located 7,500 light-years away in the southern constellation Carina.

An amazing machine

Hubble can take these crystal-clear views of the cosmos because it is orbiting above Earth's atmosphere, an ocean of air that smears and scatters starlight. Scientists such as Lyman Spitzer, Jr., proposed the idea of a space telescope in the 1940s. It took, however, nearly 50 years of research and planning to get a space telescope off the ground.

NASA launched Hubble on April 24, 1990 aboard the space shuttle Discovery. The observatory is named after U.S. astronomer Edwin P. Hubble who, early last century,

discovered galaxies beyond our Milky Way and determined that space is expanding.

The telescope is a behemoth — the size of a school bus (43.5 feet or 13.3 meters long) and weighing more than 12 tons (11,000 kilograms). Its primary mirror is 94.5 inches wide (2.4 meters). The tubular-shaped spacecraft looks like it has wings. These wings, however, are not used to fly. They are made up of solar panels, which collect light from the Sun to help power the spacecraft's instruments.

Astronauts visit an old friend

Five heroic astronaut servicing missions to Hubble have made it the longest-operating space observatory ever built. Thanks to routine maintenance and upgrades Hubble is 100 times more powerful than when it was launched.

The last astronaut journey to Hubble was May 2009. During this visit, called Servicing Mission 4 (SM4), astronauts boosted Hubble's scientific power and made sure the telescope would continue to work for years

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Hubble Space Telescope (HST), May 2009, after SM4

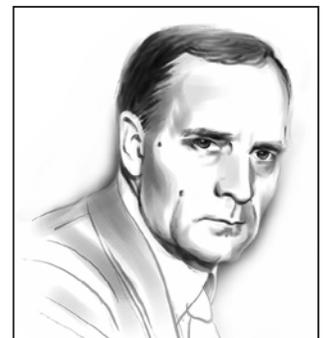


IMAGE: NASA

Above: This image was captured by a crew member aboard the space shuttle Atlantis just after release.

Edwin P. Hubble

Right: The Hubble Space Telescope was named after astronomer Edwin Powell Hubble (1889–1953), who made some of the most important discoveries in modern astronomy. In the 1920s, while working at the Mt. Wilson Observatory, Edwin Hubble showed that some of the distant, faint clouds of light in the universe were actually entire galaxies — much like our own Milky Way. The realization that the Milky Way is only one of many galaxies forever changed the way astronomers viewed our place in the universe.



NASA/STScI
Illustration by K. Cordes

Hubble's top science discoveries

Helping astronomers solve many of the universe's mysteries is nothing new for Hubble. Here are some of the telescope's top science discoveries:

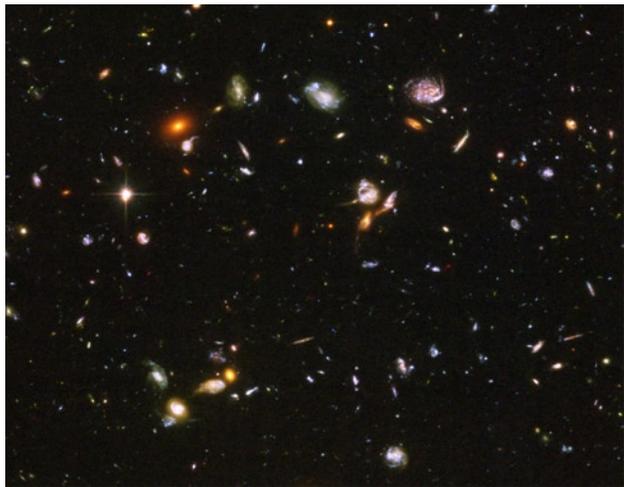


IMAGE: NASA, ESA, S. Beckwith (STScI) and the HUDF Team

The Hubble Ultra Deep Field is the deepest visible-light image of the cosmos.

Galaxies from the ground up

Hubble's surveys of deep space showed that the universe was different long ago, providing evidence that galaxies grew over time through mergers with other galaxies to become the giant galaxies we see today. The deep views also revealed that the early universe was a fertile breeding ground for stars. Observations showed that the universe made a significant portion of its stars in a torrential firestorm of star birth that abruptly lit up the pitch-dark heavens less than a billion years after the Big Bang. Though stars continue to form in galaxies today, the star-birth rate is lower than it was a billion years ago.

An accelerating universe

By witnessing bursts of light from faraway exploding stars, Hubble provided important supporting evidence for the existence of a mysterious "dark energy" that makes up most of the energy in the universe. This dark energy causes a repulsive force that works against gravity. Hubble observations showed that dark energy shoves galaxies away from each other at ever-increasing speeds, making the universe expand at an accelerating pace.

How old is the universe?

Hubble observations allowed astronomers to calculate a precise age for the universe. The method relied on determining the expansion rate of the universe, a value called the Hubble constant, by measuring the distances to tens of galaxies. Using the value of the Hubble constant, astronomers were able to calculate the universe's age, which is about 13.75 billion years.

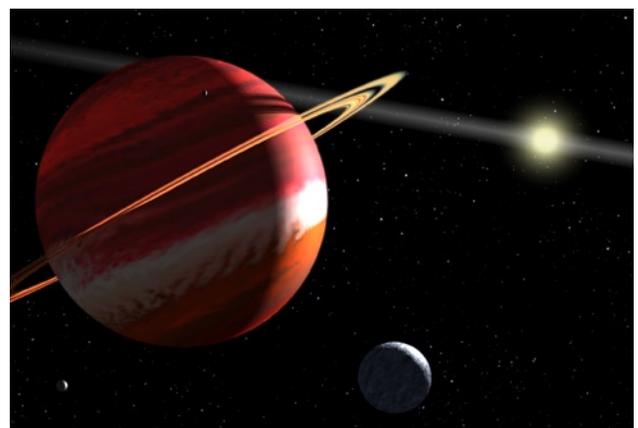
Monster black holes are every where

Hubble probed the dense, central regions of galaxies and provided decisive evidence that supermassive black holes reside in the centers of almost all large galaxies. Although black holes cannot be observed directly, Hubble helped prove their existence by measuring the speed of stars and gas whirling around the core of galaxies. The telescope also showed that the black hole's mass is dependent on the mass of its host galaxy's central bulge of stars. The bigger the bulge of stars, the more massive the black hole. This close relationship means that black holes may have evolved with their host galaxies.

Worlds beyond our Sun

At the time of Hubble's launch in 1990, astronomers had not found a single planet outside our solar system. Now there are hundreds of so-called extrasolar planets, most of them discovered by ground-based telescopes. But Hubble has made some unique contributions to the planet hunt. The telescope made the first measurements of the chemical makeup of an extrasolar planet's atmosphere, detecting carbon dioxide, methane, water, and sodium. These measurements are an important step in the search for extraterrestrial life by looking for the chemical signatures for life in a planet's atmosphere.

Hubble also made the first visible-light image of an extrasolar planet circling the star Fomalhaut. In addition, the Earth-orbiting observatory conducted the deepest survey for extrasolar planets in our Milky Way Galaxy's central bulge of stars, finding 16 potential planets.



ARTIST'S CONCEPT: NASA, ESA, G. Bacon (STScI)

Worlds beyond our Sun

In 2006, HST, in collaboration with ground-based observations, provided definitive evidence for the existence of the nearest extrasolar planet to our solar system. The Jupiter-sized world orbits the Sun-like star Epsilon Eridani, which is only 10.5 light-years away.

Hubble's hall-of-fame images

In addition to the top-notch science discoveries, Hubble has taken a photo album's worth of memorable images, including snapshots of a gas shroud around a doomed star, a pair of colliding galaxies, and an aurora on Saturn.

Ten of the public's favorite Hubble images appear here (pgs. 4 and 5).

The Eagle Nebula



NASA, ESA, STScI, J. Hester and P. Scowen
(Arizona State University)

These eerie, dark, pillar-like structures are actually columns of cool hydrogen gas and dust that are incubators for new stars. The pillars part of the Eagle Nebula, a nearby star-forming region 6,500 light-years away in the constellation Serpens.

Galaxy M100



NASA, STScI

M100 is a spiral galaxy, like our Milky Way, and is one of the first spirals to be discovered. The galaxy has two prominent arms of bright blue stars and several fainter arms. The blue stars in the arms are young hot and massive stars. It is one of the brightest galaxies in the Virgo Cluster of Galaxies.

The Orion Nebula



NASA, ESA, M. Robberto (STScI/ESA) and the HST Orion Treasury Project Team

This image is giving astronomers the clearest view yet of a turbulent star-forming region where more than 3,000 stars are being born. The region, called the Orion Nebula, is the closest stellar nursery to Earth.

The Antennae Galaxies



NASA, ESA, and the Hubble Heritage Team (STScI/AURA)-ESA/Hubble Collaboration

This odd-shaped object is actually a pair of galaxies, called the Antennae, caught in the act of merging. Billions of stars are forming from this encounter. The brightest and most compact of the star-birth regions are called super star clusters.

The Cat's Eye Nebula



NASA, ESA, HEIC, and The Hubble Heritage Team (STScI/AURA)

The geometric shapes that make up this object are shrouds of gas surrounding a dying, Sun-like star. Called the Cat's Eye Nebula, it was one of the first planetary nebulas to be discovered. A planetary nebula forms when ordinary stars gently eject their outer gaseous layers, which form amazing and puzzling shapes.

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Hubble's hall-of-fame images, continued

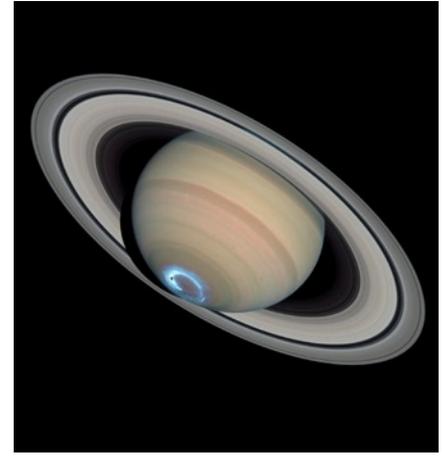
The Sombrero Galaxy



NASA and The Hubble Heritage Team (STScI/AURA)

A nearly edge-on galaxy, called the Sombrero, is shown in this view, revealing dark dust lanes and a glowing central bulge of stars.

An aurora on Saturn



NASA, ESA, J. Clarke (Boston University), and Z. Levay (STScI)

This image shows an aurora on Saturn. Auroras are electrical storms that occur near a planet's magnetic poles. Earth's auroras last for a few hours, but Saturn's auroras can last for days.

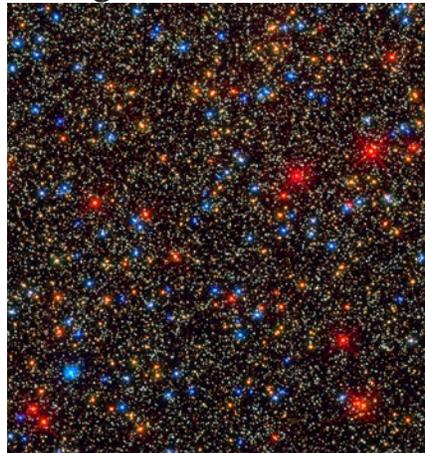
Galaxy NGC 1300



NASA, ESA, and The Hubble Heritage Team (STScI/AURA)

NGC 1300, shown in this snapshot, is a classic example of a barred-spiral galaxy. A barred spiral has a straight bar of stars through its center that extends to the spiral arms.

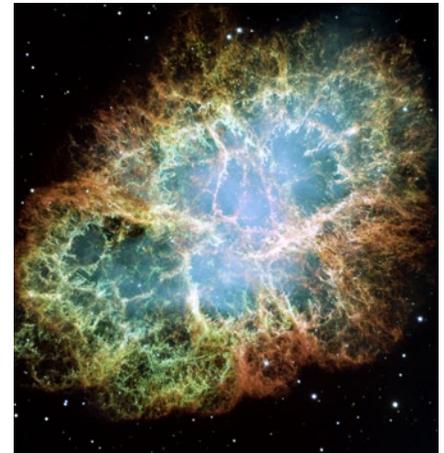
Omega Centauri



NASA, ESA, and the Hubble SM4 ERO Team

The full panoramic view of this image displays a colorful assortment of 100,000 stars residing in the crowded core of the giant globular star cluster Omega Centauri. 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 Crab Nebula



NASA, ESA, J. Hester and A. Loll (Arizona State University)

This photograph captures the gaseous remains of an exploding star. A rapidly spinning neutron star embedded in the center of this object, called the Crab Nebula, is the dynamo powering the eerie interior bluish glow. Japanese and Chinese astronomers recorded the star's explosive death nearly 1,000 years ago in 1054.

to come. Astronauts installed two state-of-the-art science instruments, a wide-field camera and a spectrograph. They also added six batteries, six gyroscopes, a Fine Guidance Sensor, and repaired an aging camera and an aging spectrograph.

Back on Earth

In the two decades since Hubble began changing our view of the cosmos, the world, too, has undergone many changes. Here are a few of them:

During Hubble's reign, the Berlin Wall came crashing down, the Soviet Union broke apart, four men were elected president of the U.S., Hong Kong regained its sovereignty from Great Britain, and Fidel Castro resigned

as the long-time president of Cuba. Jody Williams, Mikhail Gorbachev, Al Gore, and Nelson Mandela were among the Nobel Peace prize winners.

In science news, the oldest human remains, estimated to be about 4.4 million years old, were uncovered in Kenya, Africa. Footprints of a 350,000-year-old upright-walking human were spotted in Italy. The world's first artificial heart was implanted in a human. In a surprising discovery, archaeologists uncovered a 2,100-year-old melon in Japan.

While Hubble has been in space, we saw the dawn of a new millennium and a revolution in digital technology. The introduction of the World Wide Web greatly expanded the public's

use of the Internet, prompting more people to buy computers for home use. Internet usage in the U.S. jumped from just a few percent to more than 70 percent. Internet search engines such as Google and Yahoo were born. Facebook, Wikipedia, and YouTube became popular Web destinations.

Ready to tackle the next cosmic mystery

Advanced technologies, new countries, and alien worlds have been born in the 20 years since Hubble was launched and deployed. With its newly installed camera, spectrograph, batteries, and gyroscopes, the Earth-orbiting observatory will continue to probe the universe's secrets for years to come. ★

SEE MORE Hubble images and read more
Star Witness news stories at Amazing Space,
NASA's award-winning educational Web site for
K-12 students and teachers.

