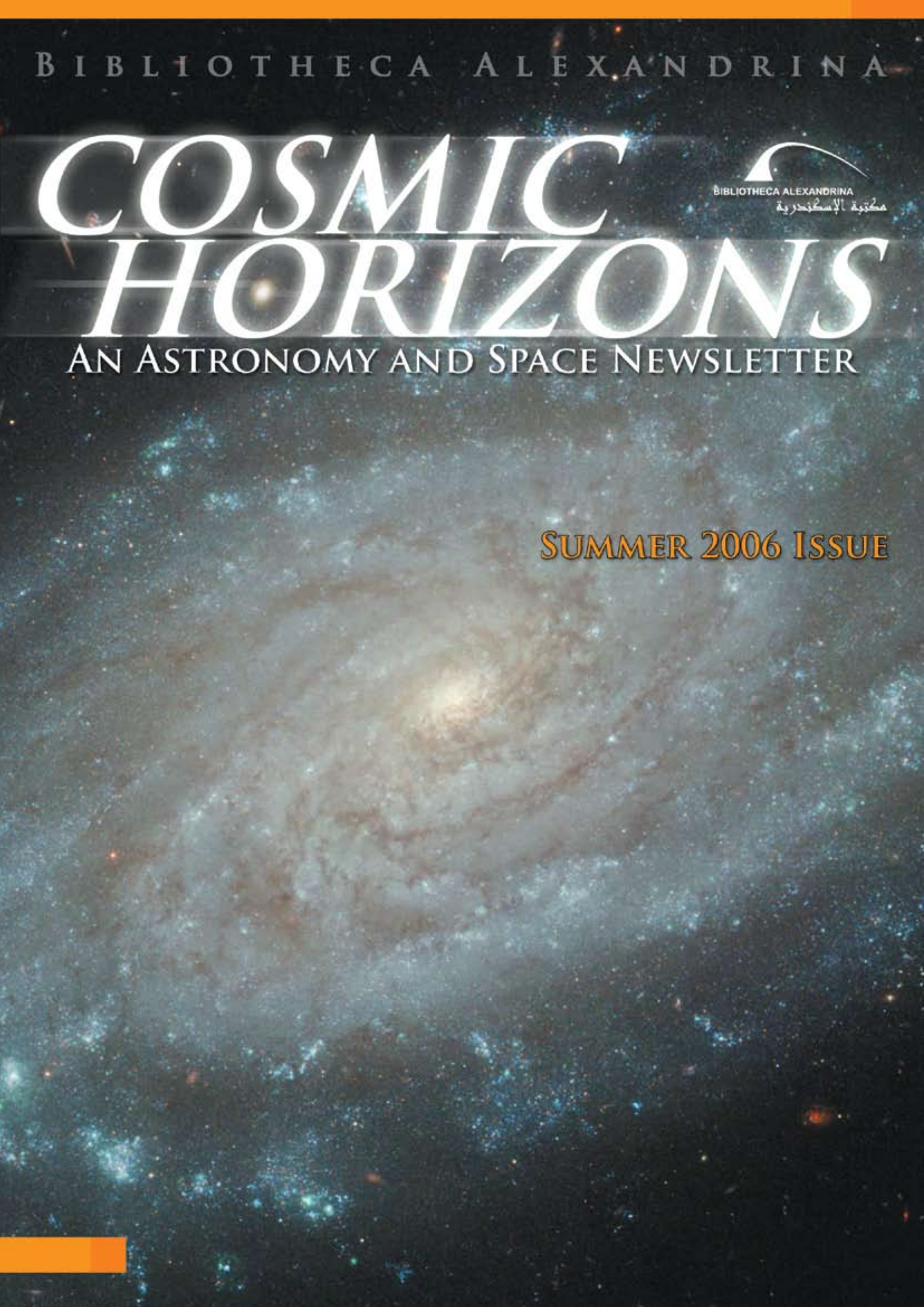
BIBLIOTHECA ALEXANDRINA

COSMIC HORIZONS

BIBLIOTHECA ALEXANDRINA
مكتبة الإسكندرية

AN ASTRONOMY AND SPACE NEWSLETTER



SUMMER 2006 ISSUE


DARKSTAR
ADVENTURE
Now showing at the BA Planetarium Science Center
Tel.: + (203) 4839999 Ext.: 1451 Fax: + (203) 4820464
e-mail: planetarium@bibalex.org
website: www.bibalex.org
Planetarium
Science Center
BIBLIOTHECA ALEXANDRINA
مكتبة الإسكندرية
Design by: M. Gomaa

Content

on the cover

NGC 3370, a dust-laden spiral galaxy. This galaxy shows intricate spiral arms, with hot areas of new star formation.

The galaxy lies 98 million light years away, in the direction of the constellation Leo.

In 1994, a massive star exploded in NGC 3370, outshining all other stars of the galaxy.

Supervisor

Hoda Elmikaty

Director

Planetarium Science Center

Editors

Aymen Ibrahem

PSC Senior Astronomy Specialist

Maissa Azab

PSC Publications Specialist

Planetarium Science Center
Bibliotheca Alexandrina
P. O. Box: 138, Chatby,
Alexandria 21526, Egypt.

Tel.: +203 4839999
Ext. 1451
Fax: +203 4820464
planetaruim@bibalex.org
www.bibalex.org

Contents

The New Solar System

Fig (1)
The new Solar System
Credit: NASA

On Thursday, 24 August 2006, the International Astronomical Union (IAU) approved a new definition of the term "Planet".

During the historic meeting of the IAU's General Assembly in Prague, hundreds of astronomers, from all around the world, voted to adopt the new definition.

The IAU is the authority responsible for naming and classifying all the celestial objects. The IAU defines a planet as an object that orbits the Sun; its mass is large enough to attain a spherical or nearly round shape; and has cleared its orbit of other objects.

According to this definition, Pluto, formerly the ninth and smallest planet, lost its planet status, because its elliptical, highly inclined orbit overlaps with that of giant Neptune, and was thus demoted to the newly devised class of "Dwarf Planet", including two other minor planets. A "Dwarf Planet" is defined as an object that orbits the Sun and whose mass is large enough to attain a nearly round shape. Other than Pluto, the two other dwarf planets are Ceres (about 1,000 km across) and Eris (about 2,400 km across).

As a result, the number of the planets in the Solar System, shrunk to eight, starting with Mercury and ending with Neptune. It is expected that the eight planets will be termed the "classical planets".

For years, the status of Pluto has been debated. Since 1992, astronomers have discovered hundreds of icy objects orbiting the Sun in a belt beyond the orbit of Neptune. The existence of these trans-Neptunian objects was predicted by the great Dutch-American astronomer Gerard Kuiper, through his studies of the orbits of the short-period comets. These objects are known as the Kuiper Belt Objects (KBOs).

The KBOs appear to be similar to Pluto in composition (ice and rock), and some of them have been found to be comparable to Pluto in size. Also, by planetary standards, Pluto (about 2,300 km across) is a very small object. It is even smaller than our Moon (3,476 km across). So, some astronomers regarded Pluto as a giant KBO.

Earth is over 500 times more massive than Pluto!! Pluto's gravity is only 1/15 (about 7%) that of Earth, i.e., on Pluto, an astronaut's weight

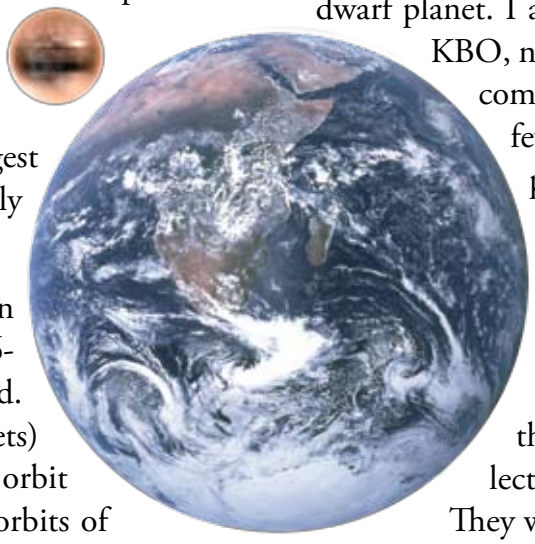
will be only 7% of his/her weight on Earth. Pluto's average distance from the Sun (nearly 6,000 million km) is about 100 times larger than that of Mercury. It lasts 247.68 years to orbit the Sun once. Thus, Mercury that orbits the Sun once every 88 days, is over 1,000 times faster than Pluto!

Pluto is also unique among the planets, as it has a large moon, Charon (about 1,200 km across). Charon is regarded the largest moon in the Solar System, relative to its parent planet. Actually, Pluto and Charon orbit their common center of gravity, lying between the two objects. Therefore, Pluto was regarded by some astronomers as a binary planet. The center of gravity of the Earth-Moon system lies beneath the Earth's surface.

On 5 January 2005, a large trans-Neptunian object was discovered by Dr. Mike Brown (Caltech) and his colleagues, on images obtained in 2003 at Palomar Observatory. The object was technically designated 2003 UB313 and nicknamed Xena by the discoverers. Recently, the IAU officially named this object Eris. Measurements based on Hubble Space Telescope observations showed that Eris is slightly larger than Pluto. The discoverers and some astronomers had called it the "Tenth Planet".

As a result, it was realized that a definition of the term planet was necessary, as astronomers would continue to discover more objects that are comparable to Pluto in size.

Earlier, the IAU discussed a proposal that would have raised the number of planets to 12, including Charon (Pluto's largest moon), Eris (the largest known trans-Neptunian object), and Ceres (the largest asteroid), but it was eventually rejected.



Ceres was discovered in 1801 by Giuseppe Piazzi (1746-1826). It is the largest asteroid. The asteroids (minor planets) are small, rocky objects that orbit the Sun mainly between the orbits of Mars and Jupiter. At the time of its discovery, Ceres was regarded as a planet, but when it was realized that it is one of many similar objects, it was reclassified as a minor planet till 24 August 2006. Ceres orbits the Sun in an elliptical orbit, at an average distance of about 413.7 million km from the Sun. It lasts approximately 4.6 years to orbit the Sun once.

The total estimated number of asteroids is about one million. Several hundred thousand asteroids have been discovered and given provisional designations. Thousands more are discovered every year.

The IAU also adopted a third class of Solar System objects, known as Small Solar System Bodies SSSBs, including all the objects that are not planets or dwarf planets (asteroids, KBOs, comets and meteoroids).

Our new Solar System consists of eight planets, three dwarf planets, and numerous SSSBs.

Some astronomers, colleagues and friends of Clyde Tombaugh, the discoverer of Pluto, protested the IAU's decision to strip Pluto of its planetary status. Dr. Alan Stern, Principal Investigator of the New Horizons spacecraft, which was launched toward Pluto in January 2006, has been particularly involved in the controversy over the new definition of the term "planet". Dr. Stern is a planetary scientist who specializes in Pluto. Online petitions have appeared, urging the IAU to consider reinstating Pluto.

Personally, I agree with classifying Pluto as a dwarf planet. I always believed that it is a large KBO, not a planet, due to its orbit, size, composition and binary nature. A few days after the vote, I gave a public lecture entitled "The New Solar System", explaining the new definition of the term "planet", and describing the new classification of the Solar System objects. Interestingly, the children who attended the lecture were not sad about Pluto! They were only a little bit amazed!

Two Years at Saturn

Saturn, as imaged by Cassini
Credit: NASA/JPL/Space Science Institute

On 1 July 2004, the international Cassini spacecraft arrived at Saturn, beginning a 4-year mission in orbit around the ringed giant.

Cassini is the first spacecraft to orbit Saturn. Now Cassini is halfway through its historic mission. During these two years, Cassini has produced a wealth of stunning images, startling discoveries, topographic maps and myriads of measurements.

Celebrating Cassini's second anniversary, NASA's Jet Propulsion Laboratory (JPL), published an interesting slide show on its website.

View Show

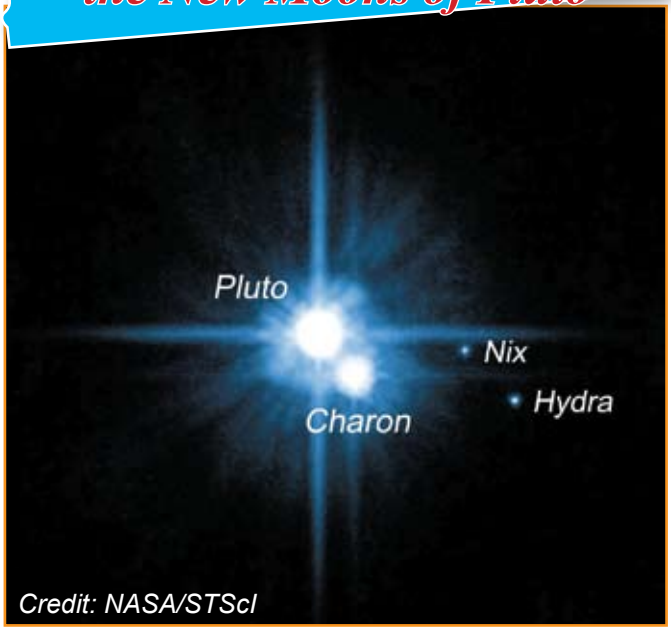
http://www.jpl.nasa.gov/multimedia/cassini-essay-4/

The Cassini-Huygens mission is a joint project of NASA, the European Space Agency and the Italian Space Agency. The Jet Propulsion Laboratory, a division of the California Institute of Technology, California, manages the mission for NASA's Science Mission Directorate, Washington, DC. The Cassini orbiter and its two onboard cameras were designed, developed and assembled at JPL. The imaging operations center is based at the Space Science Institute in Boulder, Colorado.

For additional information, please visit:

http://saturn.jpl.nasa.gov. The Cassini imaging team homepage is at http://ciclops.org.

Naming the New Moons of Pluto



Credit: NASA/STScI

The two small satellites of Pluto, discovered May 2005, were officially named Nix and Hydra. The IAU recently approved the names.

The names are so befitting for Pluto, formerly the darkest and coldest planet. In Roman mythology, Pluto was god of the Underworld. In Greek mythology, Charon, Pluto's largest known moon, was the boatman who ferries the souls of the dead to the Underworld. Nix was the goddess

of Darkness and mother of Charon. Hydra is a horrible beast: a serpent with nine heads.

Astronomers plan to make further observations of Nix and Hydra to study in detail their orbits and physical properties.

NASA's New Horizons spacecraft, will map the two moons when it arrives at Pluto in summer 2015. New Horizons might even discover more moons of Pluto.

Interestingly, as the first two letters of the word Pluto honor Percival Lowell, the astronomer who initiated the search that led to the discovery of Pluto; the first letters of Nix and Hydra honor New Horizons and the Hubble Space Telescope, the telescope that discovered these moons.

Further reading

Pluto

http://www.nineplanets.org/pluto.html

Pluto and Its Moons

http://hubblesite.org/newscenter/newsdesk/archive/releases/2006/29/image/b

NASA's New Horizons Website

http://www.nasa.gov/mission_pages/newhorizons/main/index.html

Wonders of the Universe

Image credit: NASA/ESA/Hubble Heritage Team

The International Astronomical Union (IAU)

http://www.iau.org/

Applying its Advanced Camera for Surveys (ACS), NASA's Hubble Space Telescope (HST) obtained a stunning image of the lens-shaped galaxy NGC 5866.

(NGC stands for the New General Catalogue of deep sky objects; this galaxy is the 5866th entry of the NGC.)

NGC 5866 is a "nearby" galaxy, located at a distance of only 44 million light years. (The farthest objects in the Universe are estimated to be over 13,000 million light years away.) It is 60,000 light years across, i.e., it is two-thirds the size of our Galaxy, but it has a comparable mass.

A striking dust lane divides the galaxy into two halves; it is slightly warped, indicating a past tidal interaction with another galaxy.

The far-sighted HST detected globular clusters (spherical stellar swarms) scattered across the halo of NGC 5866. Each of these clusters contains about a million stars, and is gravitationally bound to the galaxy. These clusters, however, appear as tiny dots in the image.

The image also reveals background galaxies that are farther away.

NGC 5866 is classified as a disk galaxy of type S0, i.e., it is a galaxy that consists of a central bulge of stars, surrounded by a flat disc of gas and dust that shows a slight spiral structure.

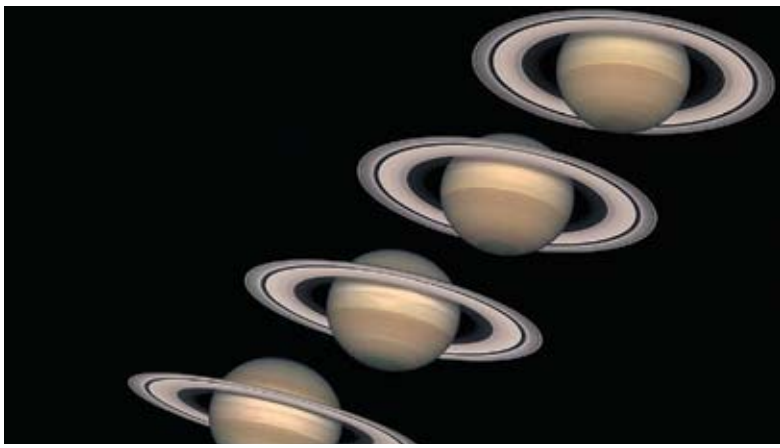
Other galaxy types include the elliptical galaxies, which are round in shape and resemble gigantic spheroids, or ellipsoids of stars.

NGC 5866 is not alone in space. It is a member of a group of galaxies, known as the NGC 5866 Group of Galaxies.

Further reading

Classification of Galaxies

http://hubblesite.org/newscenter/newsdesk/archive/releases/1999/34/image/o



Discovery Lands Safely

On 17 July 2006, under a cloudy sky, Space Shuttle Discovery landed safely in Kennedy Space Center (KSC), Florida, completing a 13-day mission to the International Space Station (ISS).

This is the second shuttle mission since the disaster of the Columbia Space Shuttle in 2003, and the 115th flight in the entire space shuttle program. NASA hopes this great success will rule out fears about the shuttle flights safety. Inspections carried out in space showed no signs of damage to Discovery, clearing the shuttle for re-entering the atmosphere.

As the spacecraft came to a halt on runway 15 at KSC, Shuttle Commander Steven Lindsey said: It was a great mission.

The Discovery crew performed the preparations for landing early on 17 July, a crucial stage in a shuttle flight. Mission controllers were very concerned about the weather in Florida during the landing.

German astronaut Thomas Reiter will remain aboard the ISS for 6 months.

The descent lasted about one hour. Discovery reached a very high speed of nearly 25 times the speed of sound during the atmospheric plunge, generating a great amount of heat.

During this flight, Discovery traversed over 8 million km, and orbited Earth 202 times. Discovery was the shuttle that launched the Hubble Space Telescope in 1990. It is named after one of the ships of the famous explorer James Cook. NASA's three space shuttles will retire in 2010, according to schedule.

Further reading

Discovery soars into space

http://172.16.0.6/Eclipse2006/News_Details.aspx?id=115

Woman Space Tourist flies into Orbit

On 18 September 2006, world's first female space tourist soared into orbit aboard a Soyuz spacecraft, from the Baikonur Cosmodrome, Kazakhstan.

The fourth space tourist is Ms Anousheh Ansari, an American-Iranian businesswoman. Ms Ansari will spend 10 days aboard the International Space Station (ISS). The spacecraft also carries two astronauts, the new crew of the ISS.

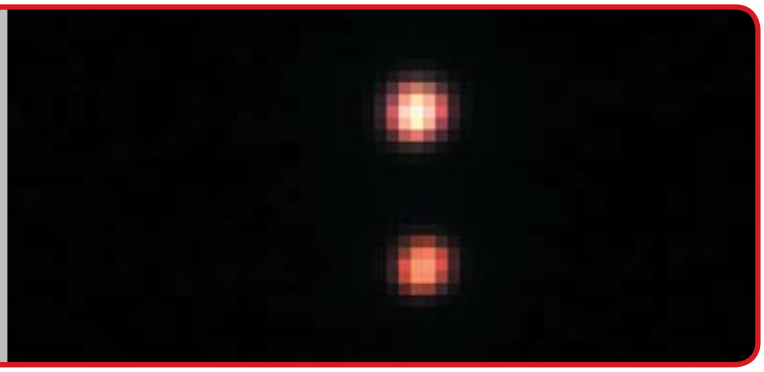
The lift-off occurred at 10:10 GMT, and the space vehicle reached orbit shortly later. A space tourist pays at least $20 million to the Russian space agency for the ticket to fly to the ISS!

Also, NASA's Atlantis Space Shuttle, which undocked the ISS the day before, is expected to land on 21 September 2006. During their 12-day mission at the ISS, the Atlantis crew delivered and installed the 17.5-ton P3/P4 truss, with a new set of solar arrays which will double power capabilities and provide data services to the ISS. The crew performed three spacewalks to prepare the truss and its solar arrays for operation.

This is the 116th shuttle flight and the 19th shuttle mission at the ISS.

Hot Topic

Starless Planets



Astronomers working with the European Southern Observatory (ESO) recently discovered a giant extrasolar planet-like object, seven times more massive than Jupiter, the largest planet.

Such planet-like objects are termed planetary mass objects, or planemos. They appear to be starless planets (planets without stars).

The newly discovered planemo does not orbit a star, however. It is a companion of another giant planemo, 14 times the mass of Jupiter, and both objects appear to orbit each other. This planemo pair is known as Oph 162225-240515, or Oph1622 for short.

During the past five years, astronomers have discovered a few dozen of even smaller planemos, in nearby star forming regions. This is, however, the first observed case of a double planemo. They are located in the Ophiuchus star-forming region, approximately 400 light years away.

The discovery places strong constraints on theories of star and planet formation.

Ray Jayawardhana of the University of Toronto (Canada) and Valentin D. Ivanov of ESO report the discovery in the August 3 issue of *Science Express*, the rapid online publication service of the journal *Science*.

"This is a truly remarkable pair of twins - each having only about one percent the mass of our Sun," said Jayawardhana, "Its mere existence is a surprise, and its origin and fate a bit of a mystery."

Recent estimates show that, roughly half of all Sun-like stars are members of binary star systems. A binary star is a system of two stars orbiting their common center of gravity. About a sixth of brown dwarfs, low-mass stars that failed to maintain nuclear fusion in their cores, are also binaries.

A brown dwarf has a mass of about 0.08 solar mass, or 80 times that of Jupiter. The mass of Jupiter is about 320 times that of Earth, and the mass of the Sun is approximately 2×10^{30} kg, or 333,000 times the mass of Earth.

The researchers discovered the companion candidate in an optical image obtained using ESO's 3.5-m New Technology Telescope at La Silla, Chile. The team performed follow-up observations to acquire optical spectra and infrared images of the pair with ESO's 8.2-m Very Large Telescope to confirm their binary nature, i.e., they are gravitationally bound.

These observations showed that the objects are young, too cool to be stars, and at the same distance.

The twin planemos are estimated to be only a million years old, and separated by about six times the distance between the Sun and Pluto. (Our Sun is estimated to be 4.5 billion years old, and is expected to continue to shine for about 5 billion years.)

Planet formation theories show that planets may form in clouds surrounding stars, brown dwarfs, or even planemos.

The researchers believe that these twins probably "formed together out of a contracting gas cloud that fragmented, like a miniature stellar binary". "We are resisting the temptation to call it a 'double planet' because this pair probably did not form the way that planets in our Solar system did," added Ivanov.

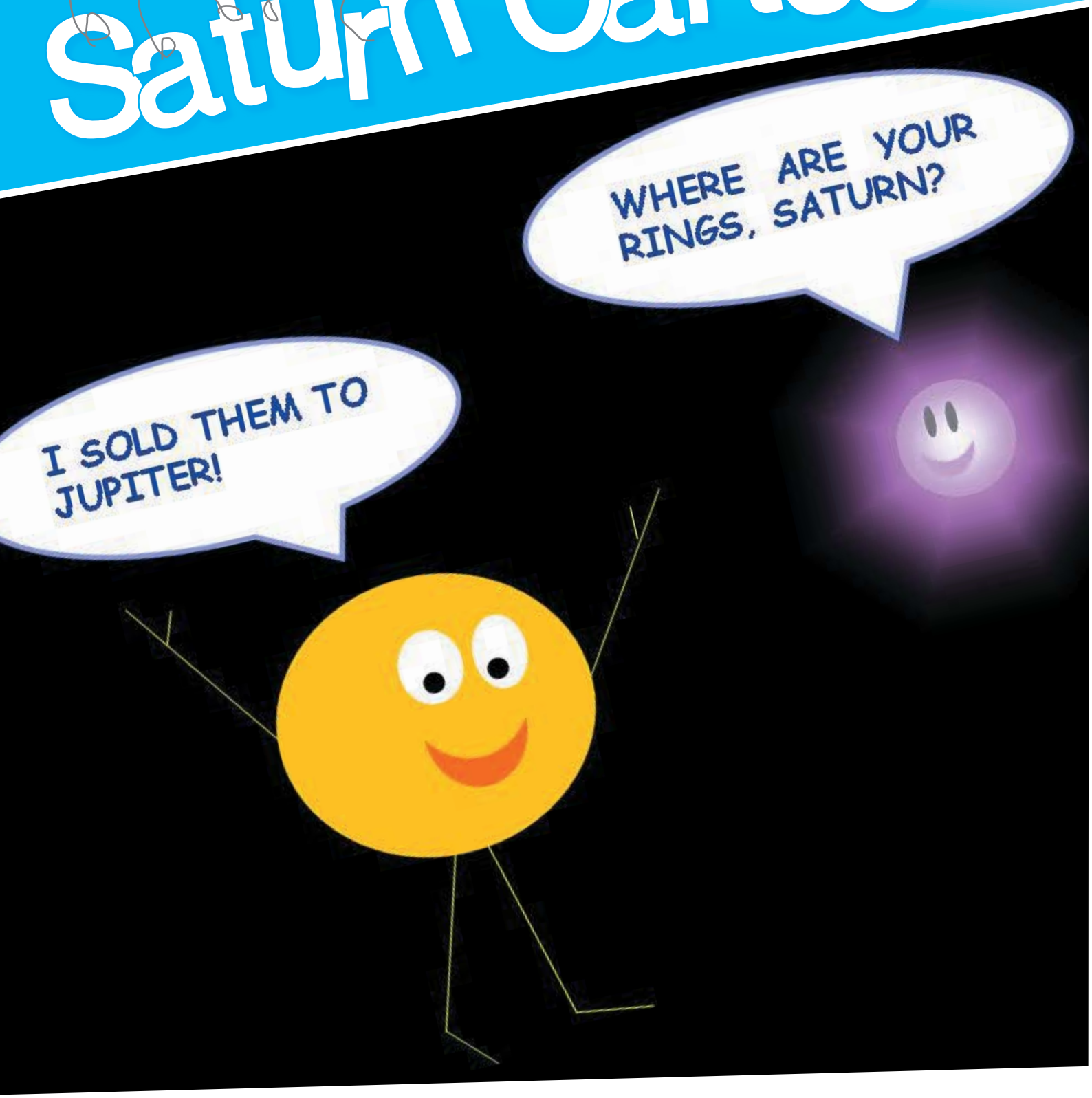
Further reading

The Planemo Twins
http://www.eso.org/outreach/press-rel/pr-2006/pr-29-06.html

Is this a Brown Dwarf or an Exoplanet?
http://www.eso.org/outreach/press-rel/pr-2005/pr-09-05.html

Two Extremely Hot Exoplanets Caught in Transit
http://www.eso.org/outreach/press-rel/pr-2004/pr-11-04.html

Fun Facts
Saturn Cartoon



Saturn orbits the Sun once every 29.47 years. Approximately, every 15 years, the Earth passes in the plane of Saturn's magnificent rings. As the rings are very thin, less than 1 km thick, they become nearly invisible, and Saturn apparently loses its glorious rings!

Interestingly, the ancient Arabs named Jupiter "The Buyer", because they titled it "the one who bought all beauty", as it shines in the night sky as a bright white star. Usually, Jupiter is the fourth brightest celestial object after the Sun, Moon and Venus. Sometimes, Mars is brighter than Jupiter, when it is particularly close to Earth.

Picture Gallery

Ringed Crescent

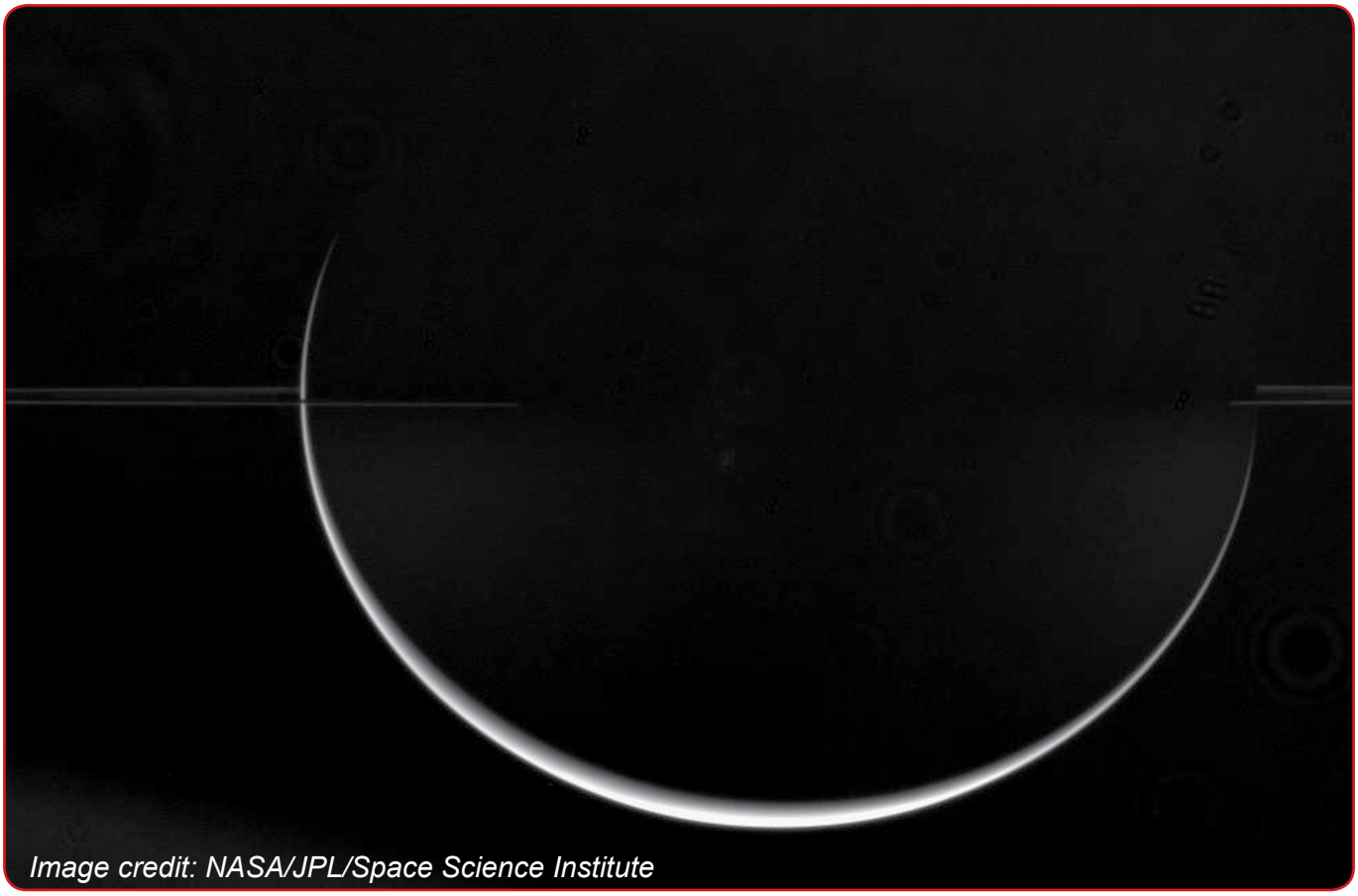


Image credit: NASA/JPL/Space Science Institute

NASA recently published a stunning image of Saturn, obtained by the Saturn-bound Cassini spacecraft.

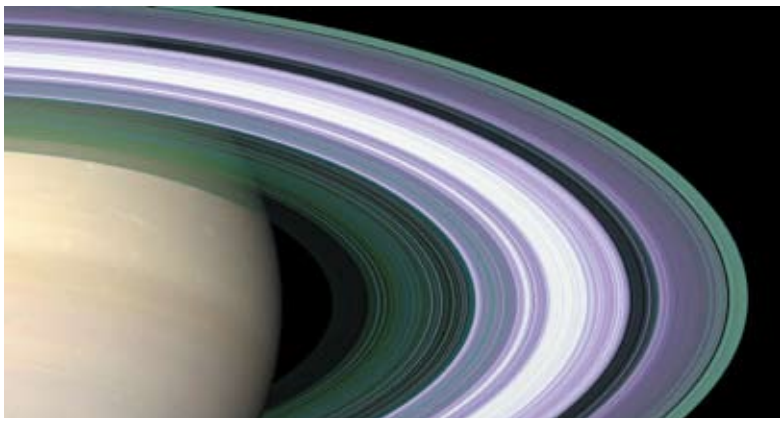
In this image, Saturn appears as a slender crescent, due to the spacecraft's position with respect to the Sun. Compared to the crescent Moon, crescent Saturn seems markedly flattened. This flattening is due to the rapid axial rotation of Saturn whose equatorial and polar diameters differ by nearly 10%.

Saturn's magnificent rings glow faintly across the center of the image.
The image was obtained in visible light with the Cassini spacecraft wide-angle camera on 11 July 2006, at a distance of approximately 2.9 million kilometers from Saturn and at a Sun-Saturn spacecraft, or phase angle of 163 degrees. Image scale is 169 kilometers per pixel.

Further reading

Saturn

http://www.nineplanets.org/saturn.html

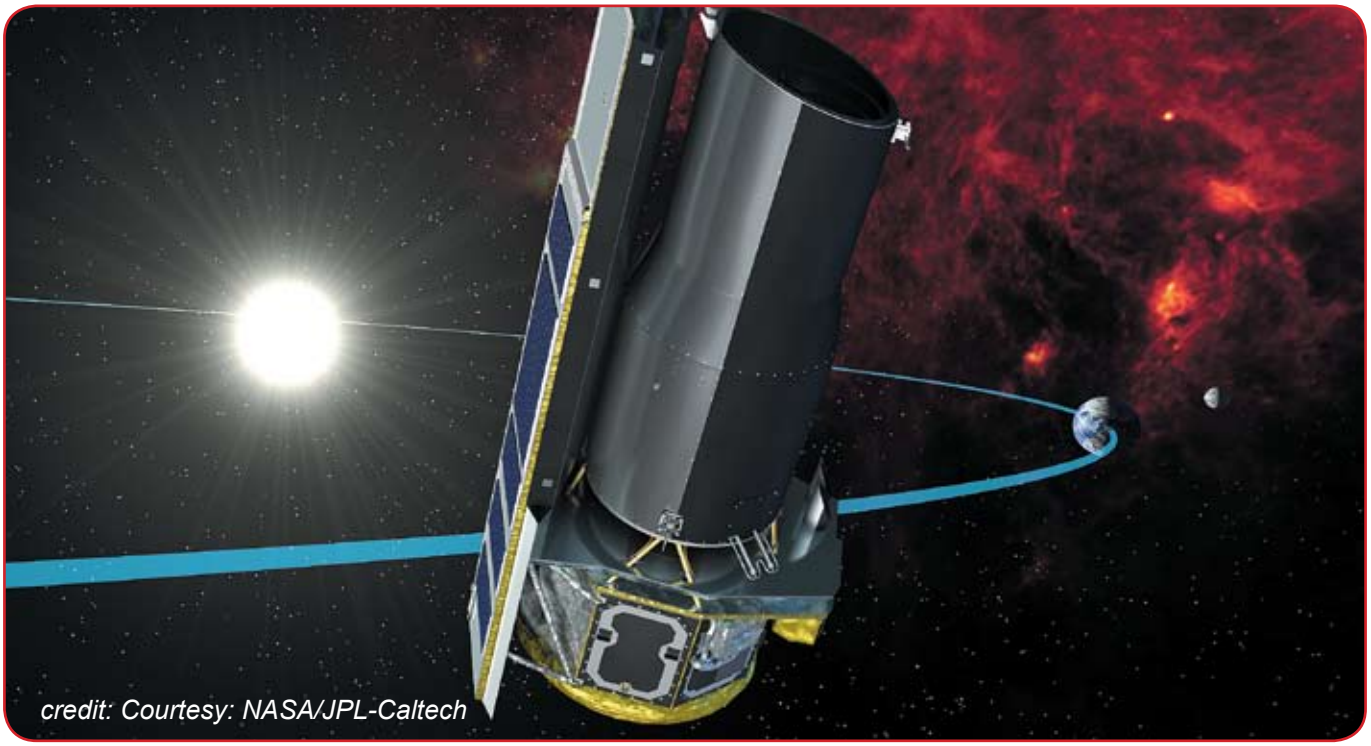


NASA, The Hubble Heritage Team and A. Riess (STScI)

Shining Blue Eyes

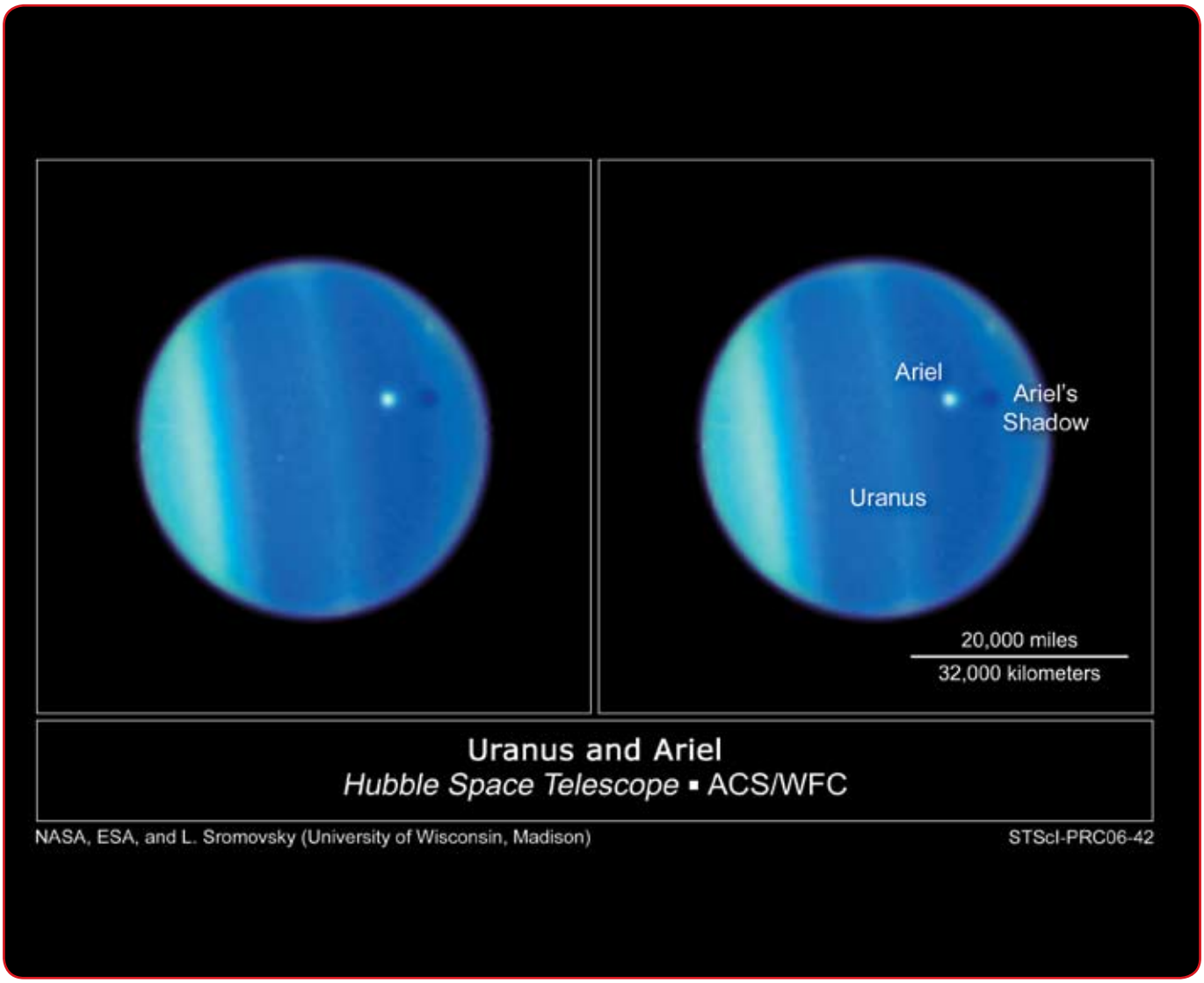
Blue eyes shining through a glowing red mask, in this false-colored image from NASA's Spitzer Space Telescope (SST). The peering blue eyes are actually the cores of two colliding galaxies, known as NGC 2207 and IC 2163. The mask is the galaxies' dusty spiral arms.

On the cosmological time scale, NGC 2207 and IC 2163 "recently" approached each other, about 40 million years ago! They began gravitationally tugging at each other. A high rate of star formation was induced due to this galactic encounter. Eventually, the two galaxies will meld into one single, larger galaxy. The interacting duo lies 140 million light-years away in the southern constellation Canis Major (the Greater Dog).



SST Explores the Infrared Universe from Heliocentric Orbit, an Artist's Impression

Solar Eclipses on Uranus

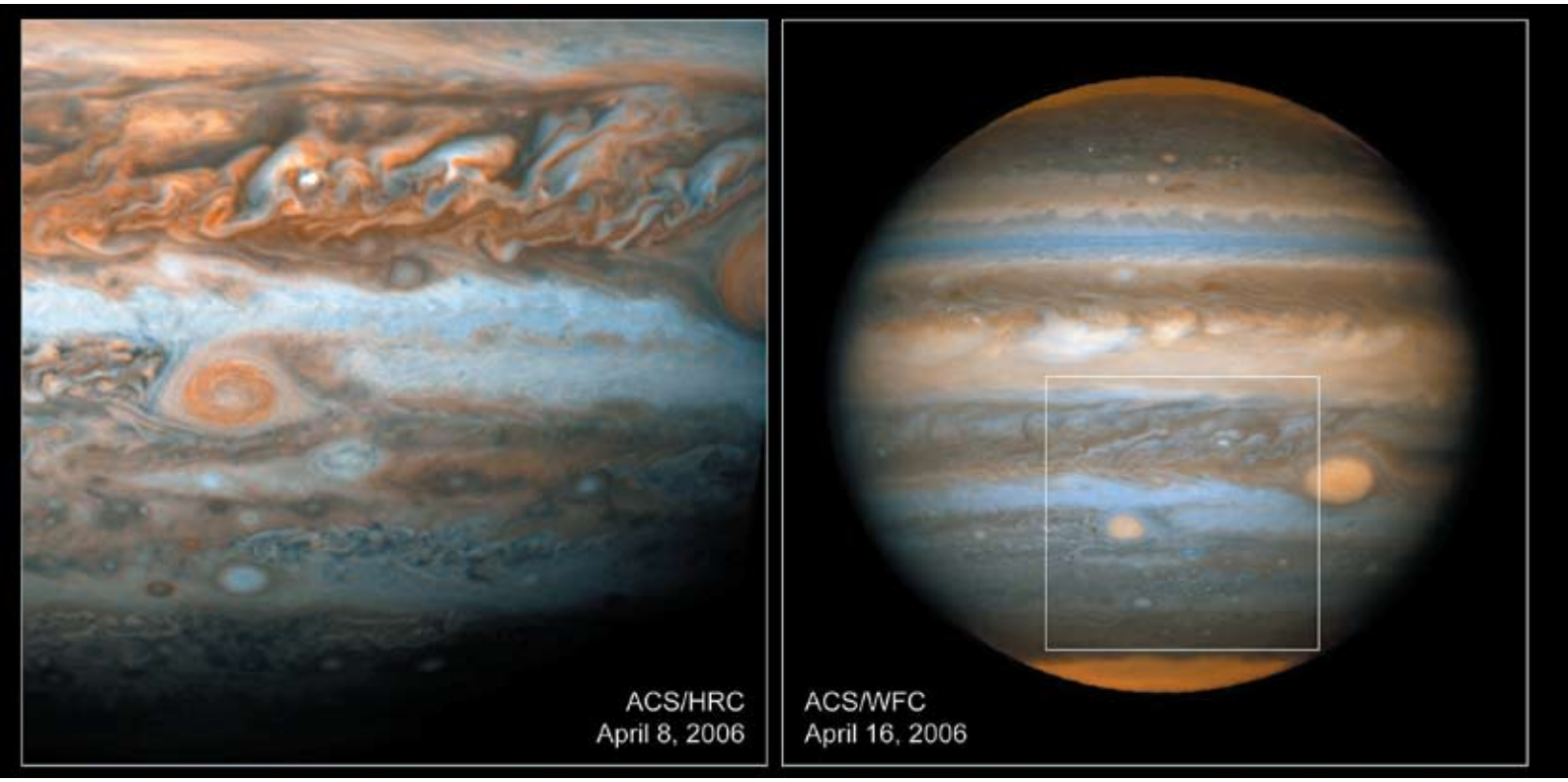


NASA's Hubble Space Telescope recently obtained a stunning image of a rare solar eclipse on Uranus. The image shows Uranus' moon, Ariel, and its shadow transiting the blue orb of the giant planet. This means that a solar eclipse was visible from the spot where Ariel's shadow touched down on Uranus' cloud tops.

Uranus is unique among the planets, as its rotational axis lies nearly in the plane of its orbit. That is, Uranus is tipped over on its side! Uranus orbits the Sun once every 84.01 years. As the orbits of Ariel and the other major Uranian moons lie in the equatorial plane of Uranus, this makes solar eclipses very rare on Uranus. They occur twice along Uranus' orbit, or once every 42 years, when the planet passes or is near one of its equinoxes. During this time, the Sun becomes aligned with Uranus' equator. Ariel is an icy moon, 1,158 km in diameter. It orbits Uranus at a distance of approximately 190,000 km.

Interestingly, the Uranian moons have been named after characters that appeared in works of William Shakespeare and Alexander Pope. Examples are Juliet, the heroine of the Romeo and Juliet tragedy; and Desdemona, wife of Othello in Shakespeare's Othello. Ariel is a fictional spirit that appears in Shakespeare's play The Tempest.

Stormy Jupiter



credit: NASA, ESA, A. Simon-Miller (NASA/GSCF), and I de Pater (University of California Berkeley)

The Great Red Spot (GRS) and Red Jr., the two red, gigantic storms of Jupiter, recently approached and brushed each other.

Fig (1)
The Great Red Spot and Red Jr. brush each other
http://www.gemini.edu/images/stories/press_release/pr2006-7/fig1full.jpg
Credit: Gemini Observatory/AURA

The GRS, the greatest hurricane in the Solar System, has been known since the 17th century. Red Jr. is about half the size of GRS. It was formed due to the collision of three big storms, five years ago. Each of these storms has been observed for decades. It was originally white in color, but, in February 2006, it turned red.

No collision occurred. There were also similar phenomena of storms making close passages of GRS without colliding.

Astronomers working with the Gemini Observatory, Hawaii, captured images of this spectacular encounter in July 2006.

Astronomers do not know precisely why the storms are red. A plausible explanation is that the GRS dredges material from deep beneath Jupiter's cloud tops, and lifts it to higher altitudes. Some chemical compounds then interact with solar ultraviolet radiation becoming red in color.

Further reading
Gemini Captures Close Encounter of Jupiter's Red Spots
http://www.gemini.edu/index.php?option=content&task=view&id=196
Jupiter gains another red spot
http://www.bibalex.org/Eclipse2006/News_Details.aspx?id=80
New maps of Jupiter
http://www.bibalex.org/Eclipse2006/News_

Details.aspx?id=78
Jupiter
http://www.nineplanets.org/jupiter.html

Saturn Movies
NASA recently released interesting movies obtained by the Saturn-bound Cassini spacecraft, demonstrating the graceful orbital motions of several of Saturn's 47 known moons.

The Silent Spheres
In this movie, Rhea (1,528 km across), Saturn's second largest moon, glides past Mimas (397 km across) and Enceladus (505 km across). The three moons appear in the crescent phase, due to the position of the spacecraft with respect to the Sun.

Play Movie:
http://www.nasa.gov/mov/150532main_pia07804.mov

The night sides of Mimas and Enceladus are faintly illuminated by sunlight reflected off Saturn. Our Moon (3,476 km across) shows a similar illumination during the crescent phase, due to sunlight reflected off Earth. This feeble glow is known as the Ashen Light, since it is gray in color; it is also known as Earthshine or the "da Vinci glow", since it was first explained by Leonardo da Vinci (1452-1516).

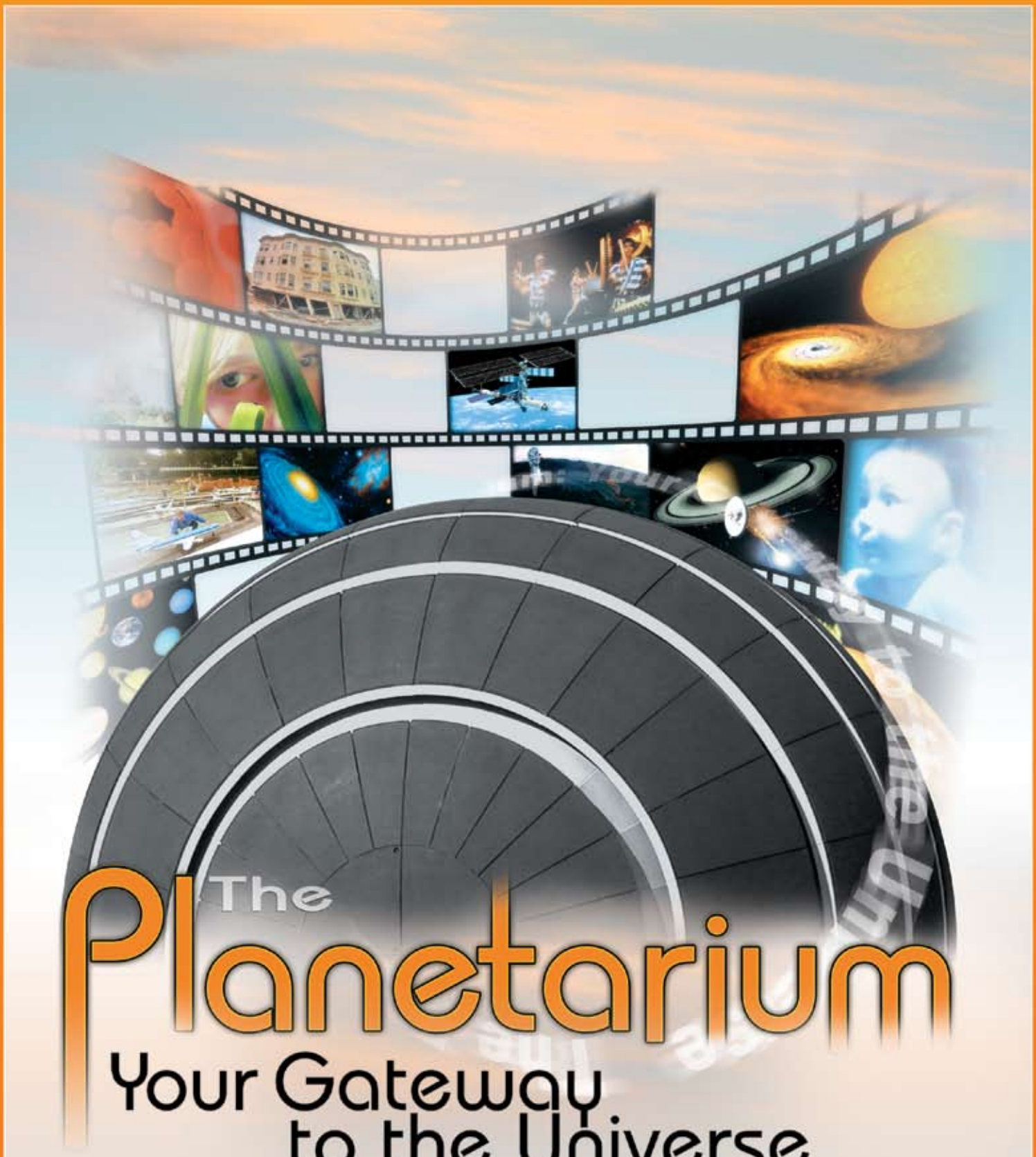
Three Moons Meet
This movie shows a space ballet, performed by three intriguing moons: Janus, Epimetheus and Dione. The movie demonstrates clearly the relative sizes of the trio; evidently, Dione (1,126 km across) is much larger than Epimetheus (116 km across) and Janus (181 km across).

Play Movie:
http://www.nasa.gov/mov/150541main_pia07808.mov

Cruising with Pan
This movie shows Saturn's small, walnut-shaped moon, Pan, cruising through the planet's magnificent rings. Pan is only 26 km across!
Play Movie:
http://www.nasa.gov/mov/150542main_pia08320.mov

The movie begins with Pan and the rings against the night side of Saturn. Cassini focuses on Pan as the moon heads toward the outside edge of the Encke Gap (325 kilometers wide) in which it orbits. (The Encke Gap is a division in the A ring, formed due to the gravity of Pan.)
Saturn's dark shadow is seen stretching across the middle of the ring's plane. Midway through the sequence, the far side of the rings emerges from behind the planet, but eventually is completely darkened by Saturn's shadow.
Further reading

Cassini-Huygens Mission to Saturn
http://saturn.jpl.nasa.gov/home/index.cfm
Rhea
http://saturn.jpl.nasa.gov/science/moons/moonDetails.cfm?pageID=14
Janus
http://saturn.jpl.nasa.gov/science/moons/moonDetails.cfm?pageID=8
Epimetheus
http://saturn.jpl.nasa.gov/science/moons/moonDetails.cfm?pageID=21
Saturn's Moons
http://saturn.jpl.nasa.gov/science/moons/index.cfm



The Planetarium

Your Gateway to the Universe

BIBLIOTHECA ALEXANDRINA
مكتبة الإسكندرية

www.bibalex.org

e-mail: planetarium@bibalex.org

Tel.: +(203) 4839999 Ext.: 1451; Fax: +(203) 4820464

Planetarium Science Center

Design by Mohamed Gomaa