ASTRONOMICAL RESEARCH CENTER (A. R. C.)

Issue 8

Safar 11, 1428
Esfand 10, 1385
March 01, 2007

And has made the moon a light therein, and made the sun a lamp?

Holy Qur'an 71:16

A. R. C. NEWS

Latest Astronomical News on the Internet

Inside This Issue :

New research shows that there are galaxies out there which are almost completely comprised of dark matter.

A Baby Picture of the Sun

Obviously there's no way to see what our Sun looked like when it was still forming billions of years ago, but you can do the next best thing. Find a newly forming star with very similar mass and chemical constituents, and see how it's starting out.

Astronomers have identified a newly forming star in the nearby Eagle nebula (that's the nebula where the famous Pillars of Creation can be found) located about 7,000 light years from Earth. The object - dubbed E42 - is at the earliest stage of formation for a sunlike star that astronomers have ever found.

Our Sun was thought to form in a nebula very similar to the Eagle Nebula. The cloud of gas and dust collapsed about 5 billion years ago through ultraviolet pressure from nearby stars, as well as passing shockwaves from nearby supernova explosions.

So let's sit back, and watch this baby star for another 5 billions years or so. They grow up so fast.

February 26, 2007
www.colorado.edu

Some Galaxies Are Made Almost Entirely of Dark Matter

When we think of a galaxy, we think of our own Milky Way or perhaps Andromeda; a majestic spiral containing hundreds of billions of stars. Or maybe we think of an irregular galaxy, not so majestic-looking, but still made of regular stuff, like stars, planets… people.

But new research shows that there are galaxies out there which are almost completely comprised of dark matter. They're called dwarf spheroidals, and they only contain a few stars and almost no gas. Instead, they've got an overwhelming amount of dark matter, whose gravity compacts what few stars it has into a roughly spherical shape. And because they don't have many stars, they're hard to see, even when they're nearby.

An international team of researchers has developed a simulation to explain how galaxies like could form. They used supercomputers to calculate how galaxies interact. When a smaller galaxy collides with a much larger galaxy, friction causes the gas to slow down and be stripped out a galaxy, while the stars and dark matter continue on.

Without this gas, the galaxy can't continue making stars. It's only got the stars that had formed before the collision. A massive galaxy can also strip away stars and material through a process called "tidal shocking". Between these two effects, you can end up with a galaxy devoid of regular matter - all that's left is dark matter.

February 26, 2007
www.stanford.edu

Star's Magnetic Field Slams its Solar Winds Back Together

AB Aurigae contains 2.7 times the mass of our Sun, and it's one of the largest stars in the Taurus-Auriga star-forming cloud. It's classified as a Herbig star, named after the astronomer who first discovered them.

ESA's XMM-Newton X-Ray observatory has helped astronomers puzzle through a mystery that's haunted them for a long time. For more than 20 years, observatories have detected X-rays streaming from something in the AB Aurigae system. But nothing in the system should be able to generate this quantity of X-rays.

AB Aurigae contains 2.7 times the mass of our Sun, and it's one of the largest stars in the Taurus-Auriga star-forming cloud. It's classified as a Herbig star, named after the astronomer who first discovered them. When the region was viewed in the X-ray spectrum, AB Aurgae stood out like a sore thumb.

But what could be releasing so many X-rays? Some astronomers suggested a companion star, but the temperature of the gas producing the X-rays was too low to be a newborn star.

The data from XMM-Newton showed that the X-rays are actually coming from a region just above the star. It appears that material cast off by the star by its two hemispheres are being collided together by its magnetic field. It's where the solar wind is colliding that the X-rays are being generated.

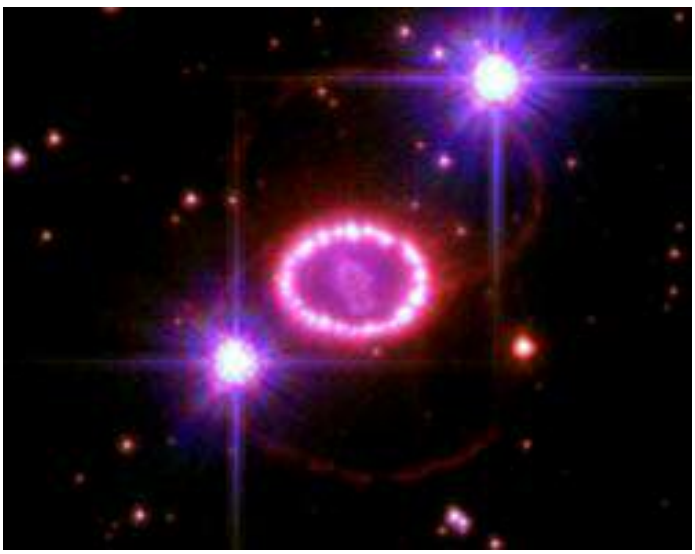
February 22, 2007
www.esa.int

20th Anniversary of the Brightest Supernova in Recent History

What we now call Supernova 1987A detonated in the Large Magellenic Cloud providing a wealth of data for astronomers. Okay, it actually detonated 163,000 years ago, but that's how long it took the light to reach us.

Only 20 years ago, astronomers were treated to one of the most powerful nearby explosions - a sight not seen in 400 years, before the advent of modern telescopes.

What we now call Supernova 1987A detonated in the Large Magellenic Cloud providing a wealth of data for astronomers. Okay, it actually detonated 163,000 years ago, but that's how long it took the light to reach us.



Once it was in orbit, and its optics repaired, SN 1987A was one of the first targets for the Hubble Space Telescope. Hubble revealed how a supernova is much more complicated than astronomers ever expected, and helped rewrite the textbooks on exploding stars.

The attached image shows the amazing glowing ring of material surrounding the supernova. The ring has been there for years, but the supernova is illuminating it as the light echo moves through the material energizing the gas. As this ring of light continues to expand, it'll reveal more details about what the star went through before it exploded.

This image was taken in December 2006, using Hubble's Advanced Camera for Surveys.

February 22, 2007
www.hubblesite.org

Powerful Solar Winds Colliding Head On

Off to one corner of NGC 346, a star cluster in the Small Magellanic Cloud, there's an amazing collision between two stars. Well, not the stars themselves, but the powerful winds they're ejecting.

The two stars are collectively known as HD 5980. They're a binary system of stars separated by only 90 million kilometres; this is roughly half the distance from the Earth to the Sun. One star has 50 times the mass of the Sun, while the other weighs in at 30 times the mass of the Sun. And both are radiating more than a million times the energy of the Sun. It's good to know they're a whole galaxy away from us.

And both stars are producing terrifyingly strong solar winds, each dumping the mass of the Earth into space every month, and then accelerating this mass away with the pressure from all the photons they're emitting. Since the stars are so close to each other, their solar winds interact. And where those solar winds collide… look out.

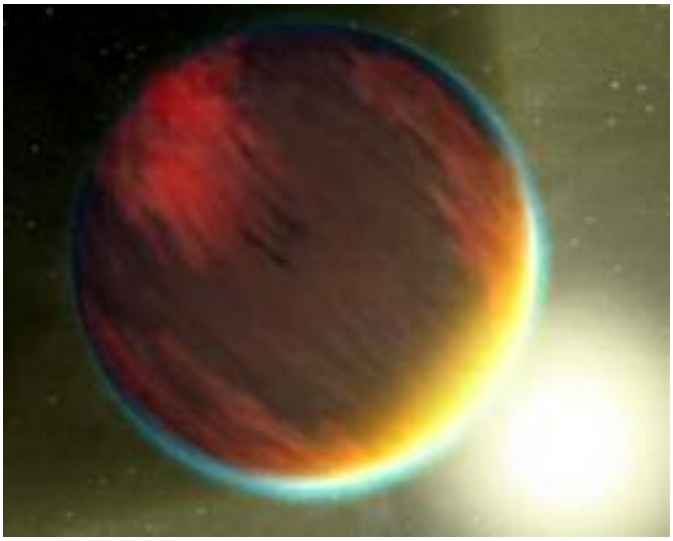
New images from ESA's XMM-Newton Observatory measured the X-ray output from this collision zone, and found that the energy from only X-rays is 10 times the amount of energy output by our own Sun. By studying the interaction between the winds, astronomers will be able to calculate how they change over time.

February 21, 2007
www.esa.int

New images from ESA's XMM-Newton Observatory measured the X-ray output from this collision zone, and found that the energy from only X-rays is 10 times the amount of energy output by our own Sun.

Exoplanet is Hot and Dry

Astronomers working with the Spitzer Space Telescope announced a tremendous new advance today, when they used the great observatory to successfully analyze the atmosphere of two distant planets. This is an enormously important discovery, and we'll deal with the implications of this in a second.



First, though, let's talk about what they turned up.

The planets are known as HD 209458b and HD 189733b. These are your typical hot Jupiters, orbiting their parent stars at extremely close distances. Astronomers originally estimated that these planets should have large quantities of water in their atmospheres. Surprisingly, though, the Spitzer data showed that they're drier and cloudier than expected. The discoverers think the water is there, it's just hidden beneath the clouds. It's also possible that the planets have large quantities of silicate dust, which obscures the view to water.

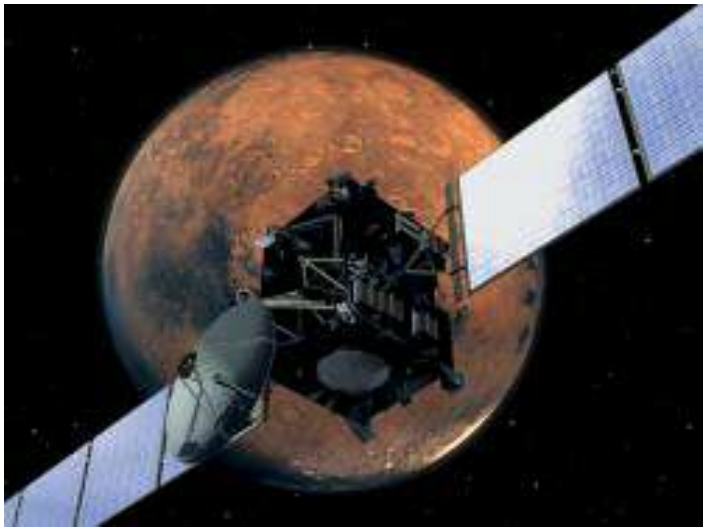
Now, let's talk about the impact of this. Think for a second. Astronomers have used a space telescope to study the atmosphere of a planet orbiting another star. Obviously, a hot jupiter, with temperatures in the thousands of degrees isn't a good place to look for life. But think of it as a dress rehearsal; an opportunity to fine tune techniques and instruments.

This technique will come in handy in the coming years when more powerful telescopes are launched, capable of finding rocky planets orbiting other stars. Once one of those telescopes turns up large quantities of oxygen in the atmosphere of another star, you've got a good candidate for life. I can hardly wait.

February 21, 2007
spitzer.caltech.edu

Astronomers originally estimated that these planets should have large quantities of water in their atmospheres. Surprisingly, though, the Spitzer data showed that they're drier and cloudier than expected. The discoverers think the water is there, it's just hidden beneath the clouds. It's also possible that the planets have large quantities of silicate dust, which obscures the view to water.

Rosetta Approaches its Mars Flyby



If you're waiting for the Rosetta mission to really pay off, you're going to need a lot of patience.

The ESA spacecraft isn't due to meet up with its target, Comet 67P Churyumov Gerasimenko, until 2014. But there's a little science coming on February 25th, when the spacecraft swings by Mars.

Rosetta will make its closest approach to the Red Planet at 0153 GMT, February 25th, passing only 250 km above the surface. The primary objective of this flyby is to give the spacecraft a speed boost, using Mars' gravity to increase its velocity.

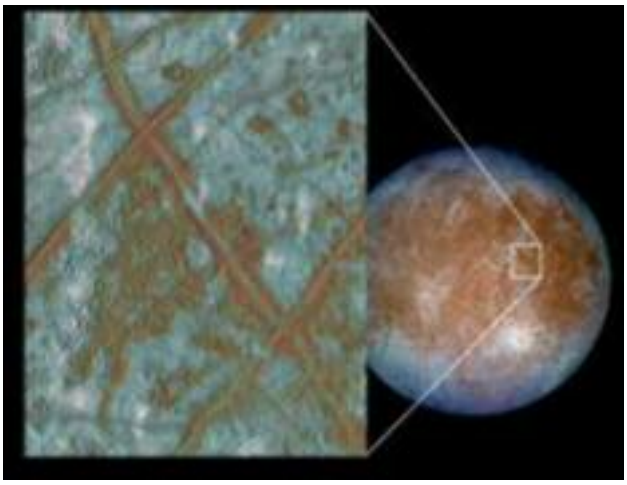
Rosetta already made a flyby past Earth in 2005, and will perform another in November 2009.

As part of its Martian flyby, Rosetta will be operating all of its instruments for two days before and after the closest encounter. It'll be gathering data about the surface of Mars, the atmosphere and its interaction with the solar wind and take photos of its two satellites, Phobos and Deimos.

February 20, 2007
pparc.ac.uk

As part of its Martian flyby, Rosetta will be operating all of its instruments for two days before and after the closest encounter.

Life on Europa



Arizona State University professor Ronald Greeley thinks that NASA's next flagship mission to the outer planets should be sent to Europa, to help determine if the Jovian moon is a good place to search for life. Greeley presented his rationale at the annual meeting of the American Association for the Advancement of Science in San Francisco.

According to Greeley, Europa has all the basic ingredients for life: a source of energy, organic chemistry, and hopefully… liquid water. When NASA's Galileo spacecraft visited Europa, it discovered that the moon's surface seems to be covered in a thick layer of ice. Scientists were intrigued at the possibility that under all that ice there's an ocean of liquid water. And where there's water, there could be life.

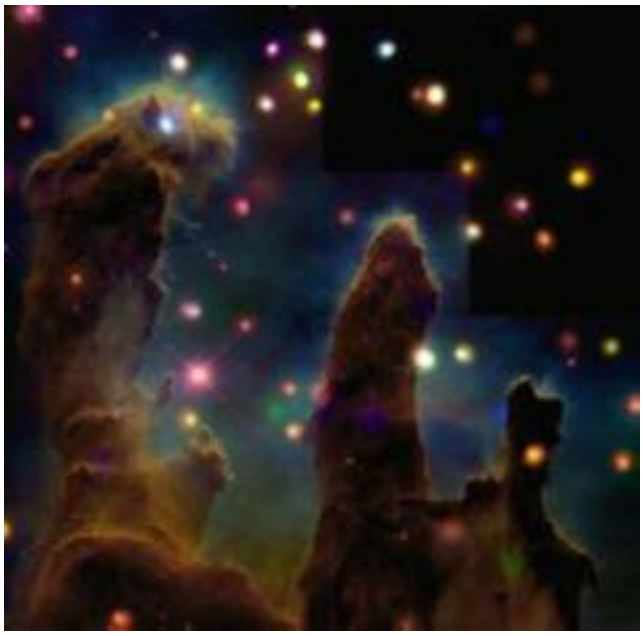
As Europa orbits Jupiter, it experiences tides. An ocean underneath the ice will rise and fall each day, and a spacecraft in orbit equipped with a high-precision altimeter should be able to measure these tides. If it's ice all the way down, the ice should only flex a little bit, but if the ice shell is thin, the ice could rise and fall more than 40 metres (130 feet) each day.

A new mission to Europa should be able to give scientists an answer, and help them determine if the ice shell is thin enough to allow a probe to drill through the ice and search for life in the ocean.

February 20, 2007
www.asu.edu

According to Greeley, Europa has all the basic ingredients for life: a source of energy, organic chemistry, and hopefully… liquid water.

Chandra Gives Another Look at the Pillars of Creation



Probably the most famous photograph every taken by the Hubble Space Telescope is of the "Pillars of Creation"; a star forming region inside the Eagle Nebula (aka M16). Astronomers have wanted to know just how much star formation is actually going on inside the nebula.

One of Hubble's co-Great Observatories, the Chandra X-Ray Observatory, has observed the region too, and is helping answer that question. The attached photograph is a composite between the original Hubble photograph overlaid with data from Chandra. The bright multicoloured spots in the photograph are sources of X-rays, such as stars.

If you'll notice, there are plenty of X-ray sources around the photograph, but almost none inside the pillars themselves. What's going on? It's possible that there aren't any stars in there at all, but infrared observations have found infant stellar objects, including 4 large enough to form stars. Another possibility is that the stars inside the pillars are so young, they haven't gotten to the point that they're generating X-rays yet.

February 15, 2007
chandra.harvard.edu

One of Hubble's co-Great Observatories, the Chandra X-Ray Observatory, has observed the region too, and is helping answer that question. The attached photograph is a composite between the original Hubble photograph overlaid with data from Chandra.

Comets Colliding Inside the Helix Nebula

The latest photograph taken by the Spitzer Space Telescope shows a bizarre false color view of the Helix Nebula. Located around 700 light years from Earth, in the constellation of Aquarius, this beautiful nebula used to be a star similar to our own Sun. As it died, it sloughed off its outer layers, creating the view we see today.

It's a beautiful and haunting photograph, but there's some important science in there. The dusty dead star at the heart of the nebula is all that remains, but amazingly, its surrounded by dusty disc of icy material. Where's all this dust coming from? Astronomers think that the death of the star has churned up the region of comets surrounding the star, and we see their collisions.

Enjoy the view while you can. Astronomers think that it'll disappear within 10,000 years or so. The colorful clouds will fade, and all we'll see is tiny white dwarf ember slowly cooling to the ambient temperature of the Universe. A fate that our Sun will eventually share.

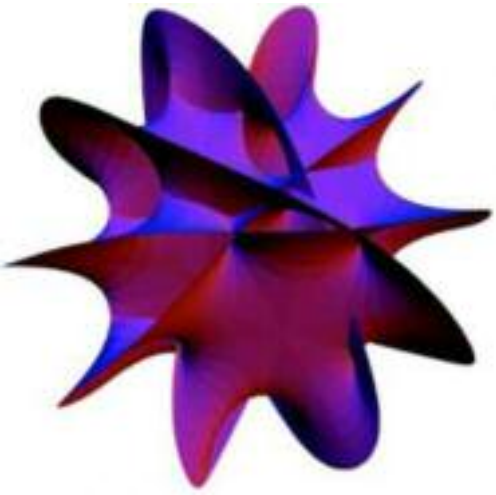
February 12, 2007
spitzer.caltech.edu

It's a beautiful and haunting photograph, but there's some important science in there. The dusty dead star at the heart of the nebula is all that remains, but amazingly, its surrounded by dusty disc of icy material.

Universe with more than 3 dimensions

String theory's mathematics work best when you invoke extra dimensions, beyond the 3 (plus time) that we can detect. Mathematicians propose that these extra dimensions are there, they're just really small, and curled up inside the dimensions we can detect.

One of the great outstanding questions in science is known as the "theory of everything". What underlying laws of physics explain the forces we see in nature? Are gravity and electromagnetism the same force? One popular theory is known as string theory, and proposes that everything in the Universe is made up of tiny, vibrating strings.



String theory's mathematics work best when you invoke extra dimensions, beyond the 3 (plus time) that we can detect. Mathematicians propose that these extra dimensions are there, they're just really small, and curled up inside the dimensions we can detect.

Researchers from the University of Wisconsin-Madison think there's a way we could detect those hidden dimensions, and support string theory with some actual evidence. These additional dimensions might have had an influence right at the beginning of the Universe, during its rapid expansion after the Big Bang. A pattern in the cosmic microwave background radiation, the afterglow of the Big Bang, which we can see in all directions, could have shadows of these other dimensions.

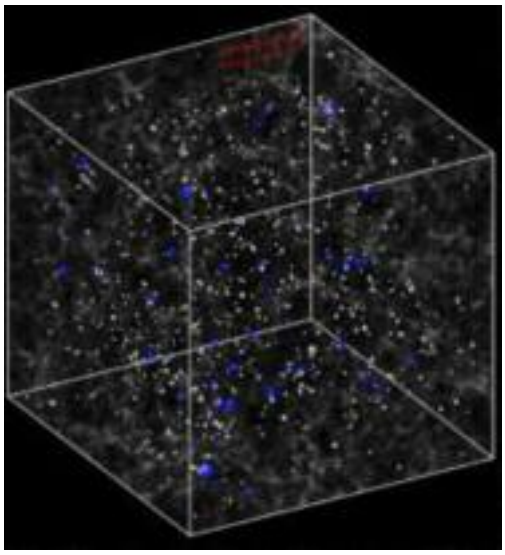
Unfortunately, the current satellites aren't sensitive enough to detect these dimension shadows, but upcoming experiments, like ESA's Planck satellite could have the sensitivity.

February 06, 2007
news.wisc.edu

Distant Quasars Surrounded by Dark Matter Halos

With this latest research, a team of astronomers led by Yue Shen from Princeton University determined the position of 4,000 bright quasars. Quasars are some of the brightest objects in the Universe, and they're thought to be the radiation emitted by actively feeding super massive black holes at the hearts of distant galaxies.

Astronomers have taken 4,000 of the brightest quasars and figured out just how much dark matter surrounds them. As we're starting to learn, wherever there's matter, there's 10x as much dark matter. These quasars back that theory up.



The survey was done using the Sloan Digital Sky Survey (SDSS-II); a detailed data set that will eventually contain more than 25% of the sky. Astronomers are continuously poring through this data, and finding nuggets of information for their theories.

With this latest research, a team of astronomers led by Yue Shen from Princeton University determined the position of 4,000 bright quasars. Quasars are some of the brightest objects in the Universe, and they're thought to be the radiation emitted by actively feeding super massive black holes at the hearts of distant galaxies. They're so bright, they can be seen from billions of light-years away, at a time when the Universe was only a few billion years old.

Since dark matter is invisible, how can astronomers calculate the amount around a quasar? Through gravity. Although astronomers can't see the dark matter, they can detect its influence on surrounding material, in this case, the quasars.

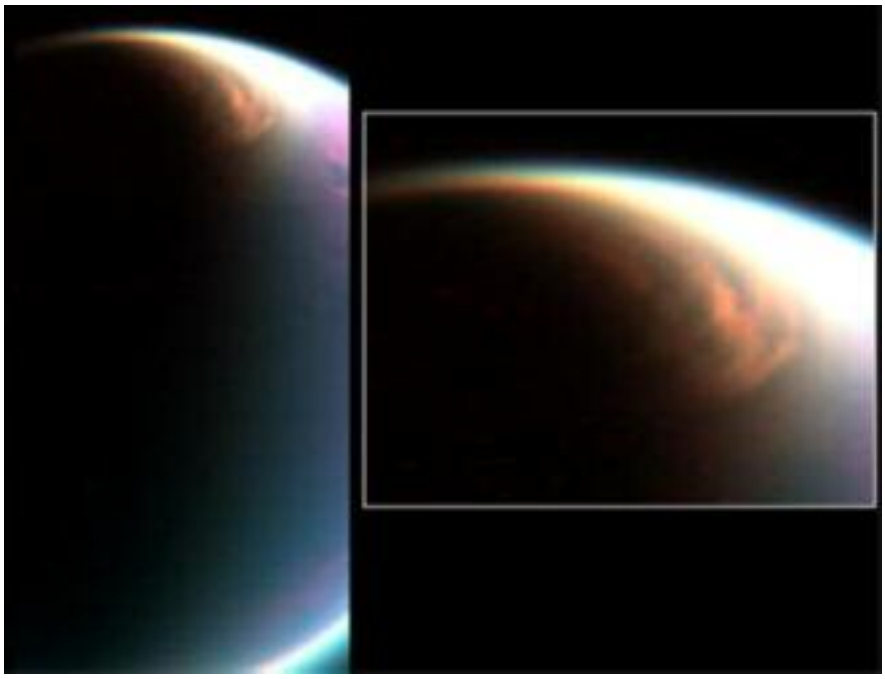
The researchers developed models of how the quasars should cluster depending on the amount of dark matter that surrounds them. And this latest survey matched their models. This clustering of dark matter might have provided the gravity that helped these super massive black holes acquire their material in the first place, and helped them grow with the galaxies that surround them.

February 11, 2007
www.sdss.org

Cassini sees mammoth cloud engulfing Titan's north pole

A giant cloud half the size of the United States has been imaged on Saturn's moon Titan by the Cassini spacecraft. The cloud may be responsible for the material that fills the lakes discovered last year by Cassini's radar instrument.

Cloaked by winter's shadow, this cloud has now come into view as winter turns to spring.



The cloud extends down to 60 degrees north latitude, is roughly 2,400 kilometers (1,490 miles) in diameter and engulfs almost the entire north pole of Titan.

The new image was acquired on Dec. 29, 2006, by Cassini's visual and infrared mapping spectrometer. Scientific models predicted this cloud system, but it had never been imaged in such detail before.

"We knew this cloud had to be there but were amazed at its size and structure," said Dr. Christophe Sotin of the University of Nantes, France, a member of the visual and infrared mapping spectrometer team and distinguished visiting scientist at NASA's Jet Propulsion Laboratory, Pasadena, Calif. "This cloud system may be a key element in the global formation of organics and their interaction with the surface."

The same cloud system seen on Dec. 29, was still there two weeks later during a Jan. 13, 2007, flyby, even though observing conditions were slightly less favorable than in December.

The Cassini radar team reported last year that the lakes at the north pole are partly filled, and some appear to have evaporated, likely contributing to this cloud formation, which is made up of ethane, methane and other organics. These findings reinforce the idea that methane rains down onto the surface to form lakes and then evaporates to form clouds. Scientists compare this methane cycle to the hydrological cycle on Earth, dubbing it "methane-ologic cycle."

Ground-based observations show this Titan cloud system comes and goes with the seasons. A season on Titan lasts approximately seven Earth years. Based on the global circulation models, it seems that such cloud activity can last about 25 Earth years before almost vanishing for four to five years, and then appearing again for 25 years.

Scientists expect this cloud to be around for several years. As the seasons change, scientists expect a shift of these clouds and lakes from the north pole to the south pole. On Titan's south pole, scientists have seen only one kidney-shaped lake with Cassini's imaging cameras.

"With 16 more flybys to come this year, we should have the opportunity to monitor the evolution of this cloud system over time," said Dr. Stephane Le Mouelic, working with the Cassini visual and infrared mapping spectrometer team, and also at the University of Nantes.

The Cassini-Huygens mission is a cooperative project of NASA, the European Space Agency and the Italian Space Agency. JPL, a division of the California Institute of Technology in Pasadena, manages the Cassini-Huygens mission for NASA's Science Mission Directorate, Washington. The Cassini orbiter was designed, developed and assembled at JPL. The visual and infrared mapping spectrometer team is based at the University of Arizona, Tucson.

February 01, 2007
jpl.nasa.gov

A giant cloud half the size of the United States has been imaged on Saturn's moon Titan by the Cassini spacecraft. The cloud may be responsible for the material that fills the lakes discovered last year by Cassini's radar instrument.

Scientists expect this cloud to be around for several years. As the seasons change, scientists expect a shift of these clouds and lakes from the north pole to the south pole.

Issue 8 Safar 11, 1428 Esfand 10, 1385 March 01, 2007

A. R. C. NEWS
Internal, Scientific, Cultural, latest astronomical news on the Internet

Astronomical Research Center Activities

Some of the activities:

- Educational Facilities
- Research Facilities
- Receive and Transmit Atomic-Clock waves
- Institution of a virtual observatory
- Cosmic radio observation project
- Calculation and distribution of timings of religious duties
- Organizing scientific conferences with invitations to scholars and experts
- Publishing new titles on the field of Astronomy
- Building an observatory and a big planetarium

Astronomical Research Center (A. R. C.)

ADDRESS:

No.81 Amin blvd.
Qom - Iran

Tel: +98 251 2936313-15
Fax: +98 251 2913555

Http://www.nojumi.org
E-mail: info@nojmi.org

SPECIAL REPORT

Integral points to the fastest spinning neutron star

Astronomers using the European Space Agency's gamma-ray observatory, Integral, have detected what appears to be the fastest spinning neutron star yet. This tiny stellar corpse is spinning 1122 times every second. If confirmed, the discovery gives astronomers the chance to glimpse the insides of the dead star.

The neutron star, known by its catalogue number XTE J1739-285, was discovered during one of its active phases on 19 October 1999 by NASA's Rossi X-Ray Timing Explorer (RXTE) satellite. In August 2005, while Integral was monitoring the bulge of the Galaxy, XTE J1739-285 started to come back to life. About a month later Integral discovered the first short bursts of X-rays from the object.

Erik Kuulkers of the ESA Integral Science Operations Centre, Spain, who leads the Galactic bulge monitoring programme, informed Philip Kaaret, University of Iowa, via email that things were still hotting up near the end of October. Kaaret arranged for the RXTE satellite to observe XTE J1739-285 between 31 October and 16 November. Together the two satellites recorded about twenty bursts between September and November.

Just because a star dies, it doesn't mean its life is over. A neutron star is the tiny heart of a collapsed star. Measuring about 10 kilometres across, yet containing something like the mass of the Sun, the interior of a neutron star is the most exotic realm that astronomers can imagine. According to their calculations a thimbleful of neutron star material weighs a hundred million tonnes.

When a neutron star orbits another star, its strong gravitational field can pull gas from the other star. This coats the surface of the neutron star. When the coating reaches a height of between 5-10 metres, the gas ignites in a thermonuclear explosion. This massive release of energy generally lasts from between several seconds to several minutes and a burst of X-rays is released.

Previous observations of other neutron stars have shown that the X-rays emitted during bursts display oscillations that correspond to the rotation rate of the neutron stars. So the team began analysing the XTE J1739-285 bursts for oscillations. What they found was astounding. In the brightest burst, which RXTE recorded on 4 November, there were indeed oscillations but they were nearly twice as fast as any previously observed.

"It was quite a surprise to us," admits Kuulkers. However, after running a series of checks, the team satisfied themselves that the oscillations were indeed taking place 1122 times a second (1122 Hz).

Previously, the fastest neutron stars were known to spin with frequencies between 270-619 Hz. This had led some astronomers to estimate, using statistical arguments, that the fastest a neutron star could spin was 760 Hz. If the new observations are confirmed, XTE J1739-285 smashes this limit.

"Our detection is just above the level where we think there is something real. We definitely need more observations. If we see the signal again, then everyone will believe it," says Kuulkers.

This doesn't mean that neutron stars can spin as fast as they like. If the spin is too fast, even the crushing gravity of the star will be unable to hold matter to the surface and the star will break up. The exact break-up speed depends on the internal conditions of a neutron star and as yet, astronomers do not know these precisely.

"Our putative 1122 Hz detection places a serious constraint on neutron star models. If we can find more stars that spin in this range, it will certainly allow us to exclude some models of their interior structure," says Kuulkers.

So, now it is just a matter of patience. The astronomers will keep watch, not only for XTE J1739-285 to burst again, but also for other fast-spinning X-ray neutron stars.

February 19, 2007
www.esa.int