April 2008

Inside this Issue

S*T*A*R
P.O. Box 863
Red Bank, NJ 07701
On the web at:
http://www.starastronomy.org

Edited by: Ahmad & Hanna Jrad

April's Meeting

The next meeting of S*T*A*R will be on Thursday, April 5. Our program will be ***"Adventures at Palomar"*** by Alan Midkiff. All are welcome. The meeting will begin promptly at 8:00pm at the Monmouth Museum on the campus of Brookdale Community College. This is not our usual location so take care to come to the right place.

Editor's Corner

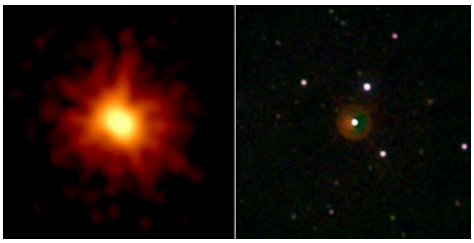
Thanks to Gavin Warnes, Steve Fedor, Ernie Rossi & Randy Walton for sending articles to this month's Spectrogram.

Reminder to pay membership dues $25/individual, $35/family. Donations are appreciated. Make payments to Paul Nadolny at the April meeting or mail a check payable to S*T*A*R Astronomy Society Inc to:

S*T*A*R Astronomy Society
P.O. Box 863
Red Bank, NJ 07701

January Issue

Please send articles and contributions for the next *Spectrogram* by Wednesday, April 23. Please email to stargaze07@verizon.net.



The light from an exploding star 7.5 billion light years away set a record in March for the most distant object ever seen with the naked eye. It's also the brightest gamma-ray burst afterglow ever seen, captured here on an X-ray telescope, left, and an optical-ultraviolet telescope, right.

Calendar

Sep 6, 2007 – "***NASA's Deep Impact Mission***" by Elizabeth Warner, University of Maryland

Oct 4, 2007 – ***" Webcam Astrophotography"*** by Clif Ashcraft

Nov 1, 2007 – ***"The Interstellar Medium"*** by Dr Hector Arce, American Museum of Natural History

Dec 6, 2007 – ***"Adventures at Palomar"*** by Alan Midkiff

Jan 3, 2008 - ***"NASA's Dawn Mission"*** by Dennis O'Leary, S*T*A*R Astronomy

Feb 7, 2008 - ***"Moons of the Solar System"*** by David Britz, S*T*A*R Astronomy

Mar 6, 2008 - ***"Remote Control CCD Imaging "*** by Steve Walters, S*T*A*R

Apr 5, 2008 – ***"Our Changing Sun"*** by Ken Legal, S*T*A*R

May 4, 2008 – "***The Near Side Lunar Megabasin***" by Charlie Byrne, S*T*A*R

Jun 1, 2008 – AGM

Announcements:

4/26-27 - NEAF 2008 Northeast Astronomy Forum & Telescope Show.
http://www.rocklandastronomy.com/neaf.htm
5/29-6/1 - Cherry Springs Star Party Cherry Springs Park, PA.
http://www.astrohbg.org/s4/index.php
5/30-6/1 - AOS Starfest at the Stone Tavern Farm in Delaware Co. NY.
http://www.aosny.org/Starfest2008.htm
7/31-8/3 - Stellafane Springfield, VT.
http://www.stellafane.com

President's Corner

By Gavin Warnes

I'm writing this month's letter on a train to London, England. Despite the UK's notoriously cloudy weather (I found three books on 'cloud watching' on a trip to a book shop earlier this week – no kidding) it is surprising how dark the sky is in semi-rural areas. I stood in my sister's backyard and easily spotted all of the stars in the Little Dipper. Next time I'll take a telescope with me.

This month we will be meeting at the Monmouth Museum – please make every effort to attend. Not only can you hear Ken Legal's talk on 'Our Changing Sun' but you can also gauge how suitable a meeting place it is. We'll have a vote on whether we should move at the AGM in June. For the second half of the meeting we will have free range of the 'Visions of Planetary Landscapes' exhibit.

We have a number of outreach opportunities in the coming months. Last fall we held a successful star party at the Bayonet Farm park in Holmdel which attracted several new members. We've bee invited back to their Earth Day event on April 27 (the Sunday of NEAF weekend). If the weather is fine, hundreds of people will attend this event. We can do solar observing, planet walks, etc. If you'd like to help out please contact me at gwarnes1@comcast.net. On the night of May 17, Vonage is holding a 'Relay for Life' event to raise money for cancer research at their facility on route 520 in Holmdel. They've asked if we can bring telescopes. Please contact Steve Lewis at stevelewis@creativerecords.com if you can help out.

In June, we hold elections for members of the board for the next year. A couple of members act as a nominating committee to seek out candidates. If you would like to serve on this year's nominating committee, please contact me.

Clear skies,

Gavin

March Meeting Minutes

By Rob for Steve Fedor

The March 2008 meeting of S*T*A*R Astronomy Club began at 8:04 p.m. on 3/6/2008. The meeting was attended by about 50 people, including six first-time attendees. President Gavin Warnes chaired the meeting and began by greeting the first-time attendees. Two of the new attendees heard about the club from club members, and several learned of the club from the club web site.
The program for the night was a demonstration of Steve Walters' imaging system, which is at Steve's house in Pennsylvania. Steve spoke to us from his home, and we watched a projection of the computer monitor screen, delivered via the internet, showing the imaging control system. The planned program included operation of the telescope and capture of images, but those steps had to be left out due to weather conditions.

Steve began by describing his telescope, the image-capture devices, and associated equipment. The telescope is an f8 Ritchey-Chretien. The image-capture devices include a field flattener, an image rotator, an adaptive optics device that can compensate for wind gusts, a guider, and a CCD camera. Associated equipment includes a battery, a cooler for the CCD, and a box for connecting cables. He then explained the software applications that control an imaging session, some of which Steve developed. They include a planning program that determines a sequence for a night's image captures, a controller for fans, focus, and guiding, a program that precisely determines the orientation of the telescope, and software for storing and stacking images.

The gee-wiz moment then arrived as Gavin took over control of the system to demonstrate how to capture images. He selected objects, and then we saw a simulation of the telescope slewing and capturing images, which were then displayed on the screen. The images, which were retrieved from a database, included several that Steve had captured the previous night. Gavin then adjusted brightness and contrast of the images to bring out detail, such as the arms of M81. The talk ended at 8:25.

Nancy McGuire then presented objects of the month. For the beginner objects, she gave a brief history of the Messier objects, and showed a composite image of the objects. The challenge objects were NGC 3394, and colliding galaxies NGC 3395 and NGC 3396 in Leo Minor. Break began at 9:35.

The meeting resumed at 9:55 with a presentation of darkness intervals by Doug Berger, who also informed the club of the poor prospects for a Messier Marathon night. Weather forecasts for the few days following the meeting are for mostly cloudy conditions, and by Sunday, the first chance for clear skies, the moon will be up for an hour of observing time.

Gavin then provided an update on a possible new meeting location. Monmouth Museum in Lincroft has a room the club could use, and Gavin described the facility and presented possible advantages and disadvantages of moving to the museum. The cost would be less than that of the church by $25 per meeting, and association with the museum would likely be a benefit. The room is somewhat smaller than the room we now use, and instead of having a key to the building, we would be dependent on someone from the museum to open the building for us. Gavin suggested that club members stop by the museum to inspect the room. Following some discussion of the issue, we decided to investigate the possibility of holding the Annual

General Meeting in June at the museum. At the June meeting the club will vote on the question of moving to the museum.

Announcements of events were next. Gavin described two events. On April 27 Bayonet Farm in Holmdel would like the club to provide solar observing for an event that will be held from noon to 5 p.m. On May 17 Vonage is sponsoring a Relay for Life event for the American Cancer Society at its facility in Holmdel. Gavin suggested the club could provide solar observing for the late afternoon, and night sky observing when darkness arrives. Larry Campbell thanked the 13 club members who helped with telescope night at Village School in Holmdel. Randy Walton informed the club that ASTRA will have a display of books and equipment on March 14, and will hold Astronomy Day on May 10.
The final item of the night was the 50/50 drawing. The winning ticket was held by President Gavin Warnes. Gavin's win was the third by a board member out of six drawings this season. Gavin donated his winnings to the club. The total added to the treasury was $25.

The meeting was adjourned at 10:35 p.m.

Scientists Observe Neutron Star Explosion In Real-time

Science Daily - Adapted from materials provided by University Of Toronto

A massive and rare explosion on the surface of this neutron star -- pouring out more energy in three hours than the Sun does in 100 years -- illuminated the area and allowed the scientists to spy on details of the region never before revealed. They could see details as fine as the ring of gas swirling around and flowing onto the neutron star as this ring buckled from the explosion and then slowly recovered its original form after approximately 1,000 seconds.
All of this was occurring 25,000 light years from Earth, captured second-by-second in movie-like fashion through a process called spectroscopy with NASA's Rossi X-ray Timing Explorer.

Dr. David Ballantyne of CITA at the University of Toronto and Dr. Tod Strohmayer of NASA's Goddard Space Flight Center in Greenbelt, Md., present this result in an upcoming issue of Astrophysical Journal Letters. The observation provides new insight into the flow of a neutron star's (and perhaps a black hole's) "accretion disk," usually far too minute to resolve with even the most powerful telescopes.

"This is the first time we have been able to watch the inner regions of an accretion disk, in this case literally a few miles from the neutron star's surface, change its structure in real-time," said Ballantyne. "Accretion disks are known to flow around many objects in the Universe, from newly forming stars to the giant black holes in distant quasars. Details of how such a disk flows could only be inferred up to now."

A neutron star is the dense, core remains of an exploded star at least eight times more massive than the Sun. The neutron star contains about a sun's worth of mass packed in a sphere no larger than Toronto. An accretion disk refers to the flow of hot gas (plasma) swirling around neutron stars and black holes, attracted by the strong gravity of the region. This gas is often supplied by a neighboring star.

As matter crashes down on the neutron star it builds up a 10- to 100-meter layer of material comprised mostly of helium. The fusion of the helium into carbon and other heavier elements releases enormous energy and powers a strong burst of X-ray light, far more energetic than visible light. (Nuclear fusion is the same process that powers the Sun.) Such bursts can occur several times a day on a neutron star and last for about 10 seconds.

A detailed rendering of the neutron star surface before the explosion is shown in this image. (Credit: NASA/Dana Berry)

What Ballantyne and Strohmayer observed on this neutron star, named 4U 1820-30, was a "super burst". These are much more rare than ordinary, helium-powered bursts and release a thousand times more energy. Scientists say these super bursts are caused by a buildup of nuclear ash in the form of carbon from the helium fusion. Current thinking suggests that is takes several years for the carbon ash to buildup to such an extent that it begins to fuse.

The super burst was so bright and long that it acted like a spotlight beamed from the neutron star surface and onto the innermost region of the accretion disk. The X-ray light from the burst illuminated iron atoms in the accretion disk, a process called fluorescence. The Rossi Explorer captured the characteristic signature of the iron fluorescence -- that is, its spectrum. This, in turn, provided information about the iron's temperature, velocity and location around the neutron star.
"The Rossi Explorer can get a good measurement of the fluorescence spectrum of the iron atoms every few seconds," Strohmayer said. "Adding up all this information, we get a picture of how this accretion disk is being deformed by the thermonuclear blast. This is the best look we can hope to

get, because the resolution needed to actually see this action as an image, instead of spectra, would be a billion times greater than what the Hubble Space Telescope offers."

The scientists said the bursting neutron stars serve as a laboratory to study accretion disks, which are seen (but in less detail) through the Universe around nearby stellar black holes and exceedingly distant quasar galaxies. Stellar black holes with accretion disks do not produce X-ray bursts.

The Rossi Explorer was launched in December 1995 to observe fast changing, energetic and rapidly spinning objects, such as super massive black holes, active galactic nuclei, neutron stars and millisecond pulsars.

The "Planet" in Planetary Nebulae

Based on an University of Rochester news release
New Studies May Vindicate 300-Year-Old Astronomical 'Mistake'

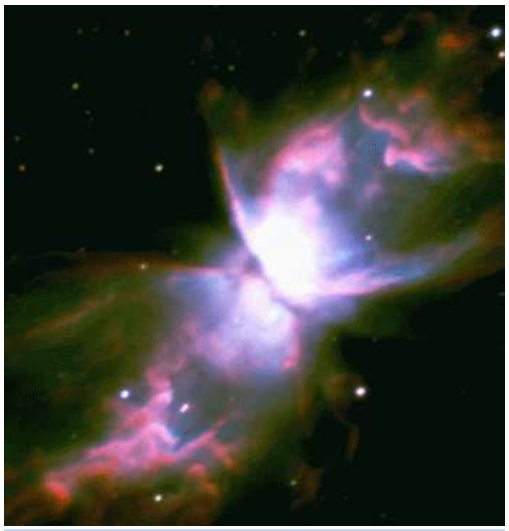
The spherical Abell 39 Nebula
Credit: WIYN/NOAO/NSF

Astronomers at the University of Rochester, home to one of the world's largest groups of planetary nebulae specialists, have announced that low-mass stars and possibly even super-Jupiter-sized planets may be responsible for creating some of the most breathtaking objects in the sky.

The news is ironic because the name "planetary" nebula has always been a misnomer. When these objects were discovered 300 years ago, astronomers couldn't tell what they were and named them for their resemblance to the planet Uranus. But as early as the mid-19th century, astronomers realized these objects are really great clouds of dust emitted by dying stars.
Now, Rochester researchers have found that planets or low-mass stars orbiting these aged stars may indeed be pivotal to the creation of the nebulae's fantastic appearance.

A team of astronomers anchored by Eric Blackman, professor of physics and astronomy at the University of Rochester, has studied the consequences of a dying star that possesses an orbiting companion. "Few researchers have explored how something as small as a very low-mass star, a brown dwarf, or even a massive planet can produce several flavors of nebulae and even change the chemical composition of the dust around these evolved stars," says Blackman. "If the companions can be this small, it's important because low-mass stars and high-mass planets are likely quite common and could go a long way toward explaining the many dusty shapes we see surrounding these evolved stars."

Most medium-sized stars, such as our Sun, will end their lives as planetary nebulae. The stage lasts only several tens of thousands of years—a blink of an eye for stars that typically live ten billion—so it is a relatively rare sight. Of the 200 billion stars in our own galaxy, only about 1,500 have so far been identified in the planetary nebula stage. The new findings are providing scientists with a unique insight into the future of our own star, the Sun, and how it's evolution will affect the planets in our Solar System.



The bipolar Butterfly Nebula NGC 6302
Credit: ESO

As a star begins to deplete its fuel near the end of its life, its core contracts and its envelope expands, eventually throwing off its outermost layers millions of miles into space. One time in five, this envelope keeps its roughly spherical shape as it expands, but much more often this envelope contorts and elongates into new and fantastic shapes.

The Rochester team's work explored the role of low-mass companions in shaping planetary nebulae stars, both when the companion is in a large orbit and interacts with only the very outer edges of the envelope, and when the companion is in a very tight orbit and so close to the evolved star that the companion is fully engulfed by the envelope.

Blackman, along with post-doctoral fellow Richard Edgar, graduate student Jason Nordhaus, and professor of astrophysics Adam Frank, showed that in the case when the planet or companion star is in a very wide orbit, the planet's

gravity begins to drag some of the envelope material around with it. The envelope material—essentially a thin mixture of gas and dust—becomes compressed in spiral waves radiating out from the central star like a twisted wagon wheel, says Blackman. The dust and gas compresses more and more in these spiral waves until they crest, much like waves breaking on a beach. Eventually, a torus of dust forms around the star's mid-section, likely blocking much of the expanding envelope like a belt around an inflating balloon. Over time, such constrained expansion can lead to striking shapes, such as seen in the appropriately named Dumbbell Nebula.

Cat's Eye Nebula
Credit: ESA/Hubble

"Originally, we set out just to model the geometry of the envelope under the influence of a binary companion" says Blackman, "but Richard Edgar discovered that as the spiral waves break, they release their compressed, pent-up energy in a burst of heat, sufficient to melt the dust into liquid globules." The globules cool slowly enough to give the molecules within time to align into crystal lattices.
Blackman says the team's work show's how a waist-cinching torus could originate to produce certain types of planetary nebula patterns, but it also suggests an answer for why astronomers have detected the puzzling signature of crystallized dust around evolved stars before the nebulae is formed.

In the case when the planet orbits so closely to the primary star that it becomes engulfed by the envelope, a new type of model is needed. Nordhaus and Blackman modeled what might happen as the envelope slows the low-mass star or high-mass planet companion, and found that one of three outcomes is likely to occur. First, as the companion plows through the envelope material, it can "spin up" the envelope so quickly that the material is ejected, deforming into a large disk or torus around the star's equator.

A second possibility is that the companion spins up the envelope more gently. This causes the inner regions of the envelope to spin around the parent star faster than the outer envelope material. This difference in rotation speeds, combined with the convection of material in the envelope, stretches and amplifies the star's magnetic fields. The stretched magnetic fields can act like a giant spring, ejecting the envelope material out the star's poles as jets.
The third outcome sees the companion itself ejecting out the star's jets, says Blackman. This scenario applies when the companion is an extremely low-mass star or a massive planet that is too small to eject the envelope before it falls to a violent fate. The parent's intense gravity can shred the planet as its orbit shrinks, eventually smearing the planet into a disk of debris around the star. This disk is very turbulent and different parts are orbiting at different speeds, generating a magnetic dynamo that again can throw material out the star's poles at tremendous speeds. Unlike the previous scenario, however, Blackman says that material fired out by these jets would include the remains of the planet or companion star itself.
This research was funded by NASA and the National Science Foundation.

Tracking Wildlife from Space

By Patrick Barry

It's 10 o'clock, do you know where your Oriental Honey Buzzard is?
Tracking the whereabouts of birds and other migrating wildlife across thousands of miles of land, air, and sea is no easy feat. Yet to protect the habitats of endangered species, scientists need to know where these roving animals go during their seasonal travels.
Rather than chasing these animals around the globe, a growing number of scientists are leveraging the bird's-eye view of orbiting satellites to easily monitor animals' movements anywhere in the world.
The system piggybacks on weather satellites called Polar Operational Environmental Satellites, which are operated by the National Oceanic and Atmospheric Administration (NOAA), as well as a European satellite called MetOp. Sensors aboard these satellites pick up signals beamed from portable transmitters on the Earth's surface, 850 kilometers below. NOAA began the project—called Argos—in cooperation with NASA and the French space agency (CNES) in 1974. At that time, scientists placed these transmitters primarily on buoys and balloons to study the oceans and atmosphere. As electronics shrank and new

satellites' sensors became more sensitive, the transmitters became small and light enough by the 1990s that scientists could mount them safely on animals. Yes, even on birds like the Oriental Honey Buzzard.

The ARGOS program tracks the whereabouts of endangered migrating animals via miniature transmitters on the animals and the POES satellites in orbit

"Scientists just never had the capability of doing this before," says Christopher O'Connors, Program Manager for Argos at NOAA.

Today, transmitters weigh as little as 1/20th of a pound and require a fraction of a watt of power. The satellites can detect these feeble signals in part because the transmitters broadcast at frequencies between 401 and 403 MHz, a part of the spectrum reserved for environmental uses. That way there's very little interference from other sources of radio noise.

"Argos is being used more and more for animal tracking," O'Connors says. More than 17,000 transmitters are currently being tracked by Argos, and almost 4,000 of them are on wildlife. "The animal research has been the most interesting area in terms of innovative science."

For example, researchers in Japan used Argos to track endangered Grey-faced Buzzards and Oriental Honey Buzzards for thousands of kilometers along the birds' migrations through Japan and Southeast Asia. Scientists have also mapped the movements of loggerhead sea turtles off the west coast of Africa. Other studies have documented migrations of wood storks, Malaysian elephants, porcupine caribou, right whales, and walruses, to name a few.

Argos data is available online at www.argos-system.org, so every evening, scientists can check the whereabouts of all their herds, schools, and flocks. Kids can learn about some of these endangered species and play a memory game with them at spaceplace.nasa.gov/en/kids/poes_tracking.

This article was provided by the Jet Propulsion Laboratory, California Institute of Technology, under a contract with the National Aeronautics and Space Administration.

Are you a S*T*A*R Member?

S*T*A*R is the proud owner of a monstrous 25" Dobsonian Obsession reflector – which members can gain access to!

Meetings are the first Thursday of each month, except July and August, at 8:00 PM at the King of Kings Lutheran Church, 250 Harmony Rd. in Middletown. Meetings generally consist of lectures and discussion by members or guest speakers on a variety of interesting astronomical topics. S*T*A*R is a member of United Astronomy Clubs of New Jersey (UACNJ), the Astronomical League (AL), and the International Dark Sky Association (IDA).

Memberships: ( )Individual....$25 ( ) Family...$35

Name_____

Address_____

City_____State___Zip_____

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Email_____

Make checks payable to: S*T*A*R Astronomy Society, Inc. and mail to P.O. Box 863, Red Bank, NJ 07701

2008 April Celestial Events

Supplied by J. Randolph Walton (Randy)

Day	Date	Time (EDT)	Event
Sat	5	02:35	Mars Sets
		02:50	Jupiter Rises
		02:58	Double shadow transit on Jupiter
		05:10	Saturn Sets
		06:05	Venus Rises
		06:23	Mercury Rises
		06:37	Sunrise
		19:16	Moon Set
		19:29	Sunset
		23:55	**New Moon**
Tue	8	22:00	Moon 1.0 deg. N of Pleiades (M45)
		23:13	Moon Set
Sat	12	02:20	Mars Sets
		02:25	Jupiter Rises
		04:40	Saturn Sets
		05:58	Venus Rises
		06:26	Sunrise
		11:41	Moon Rise
		14:32	**First Quarter Moon**
		19:36	Sunset
Sat	19	02:00	Jupiter Rises
		02:10	Mars Sets
		04:15	Saturn Sets
		05:50	Venus Rises
		06:16	Sunrise
		19:21	Moon Rise
		19:43	Sunset
		20:00	Mercury Sets
Sun	20	05:55	Moon Set
		06:25	**Full Moon**
Tue	22	00:00	Lyrid meteors peak (ZHR 20)
		06:54	Moon Set
Sat	26	01:05	Moon Rise
		01:30	Jupiter Rises
		01:50	Mars Sets
		03:50	Saturn Sets
		05:45	Venus Rises
		06:06	Sunrise
		19:50	Sunset
		20:55	Mercury Sets
Mon	28	02:18	Moon Rise
		10:12	**Last Quarter Moon**

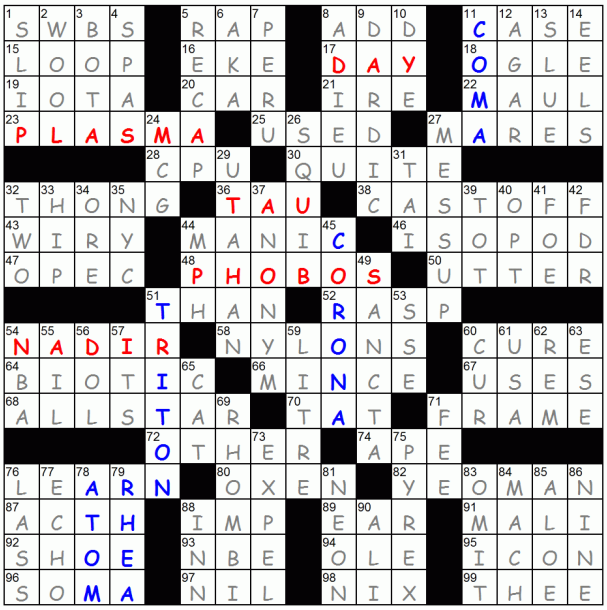
In the Eyepiece

Here is a list of objects for this month. This is reproduced from www.skyhound.com with the kind permission of its creator and author of SkyTools Greg Crinklaw.

Object(s)	Class	Con	RA	Dec	Mag
M 81 & M 82	Galaxies	Ursa Major	09h55m34.1s	+69°03'59"	7.8
NGC 3511	Galaxy	Crater	11h03m23.7s	-23°05'11"	11.5
Spindle	Galaxy	Sextans	10h05m14.1s	-07°43'07"	10.1
Ghost of Jupiter/Eye	Planetary Nebula	Hydra	10h24m46.1s	-18°38'32"	8.6
NGC 2903	Galaxy	Leo	09h32m09.7s	+21°30'03"	9.6
M 95	Galaxy	Leo	10h44m00.0s	+11°41'57"	10.5
M 96	Galaxy	Leo	10h46m48.1s	+11°48'54"	10.1
The Leo I Dwarf	Galaxy	Leo	10h08m30.6s	+12°18'07"	11.2
Markarian 421	Galaxy	Ursa Major	11h04m27.4s	+38°12'34"	14.8
NGC 3395	Galaxy	Leo Minor	10h49m52.4s	+32°58'35"	12.4
NGC 2818/A	Planetary Nebula in Open Cluster	Pyxis	09h16m01.5s	-36°36'37"	13.0
PHL 1811	Quasar	Cap	21h55m01.6s	-09°22'24"	13.8?
Focus On the Twin Quasar	Quasar	Ursa Major	10h01m20.8s	+55°53'54"	17.0
Hickson 44	Galaxy Group	Leo	10h18m00.4s	+21°48'44"	10.0
Abell 33	Planetary Nebula	Hydra	09h39m09.2s	-02°48'35"	13.4
Black Eye	Galaxy	Coma Berenices	12h56m43.9s	+21°41'00"	9.3
Sombrero	Galaxy	Virgo	12h39m59.3s	-11°37'22"	9.1
Siamese Twins	Galaxy Pair	Virgo	12h36m34.4s	+11°14'18"	11.7+12.1
M 106	Galaxy	Canes Venatici	12h18m57.5s	+47°18'14"	9.1
M 108	Galaxy	Ursa Major	11h11m31.3s	+55°40'31"	10.9
M65	Galaxy	Leo	11h18m55.8s	+13°05'32"	10.2
M 66	Galaxy	Leo	11h20m15.1s	+12°59'22"	9.6
Owl	Planetary Nebula	Ursa Major	11h14m46.1s	+55°01'07"	12.0
NGC 4631 - the Whale	Galaxy	Canes Venatici	12h42m07.8s	+32°32'27"	9.7

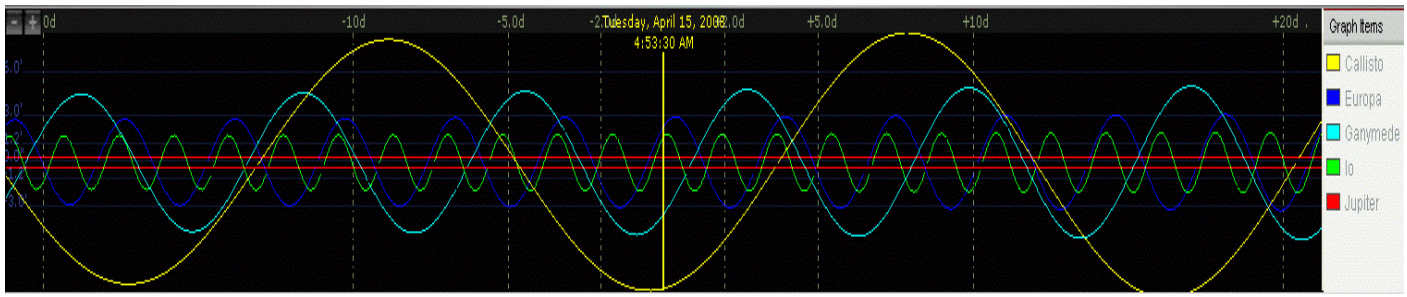
Moon Phases

AstroPuzzle Solution for March 2008



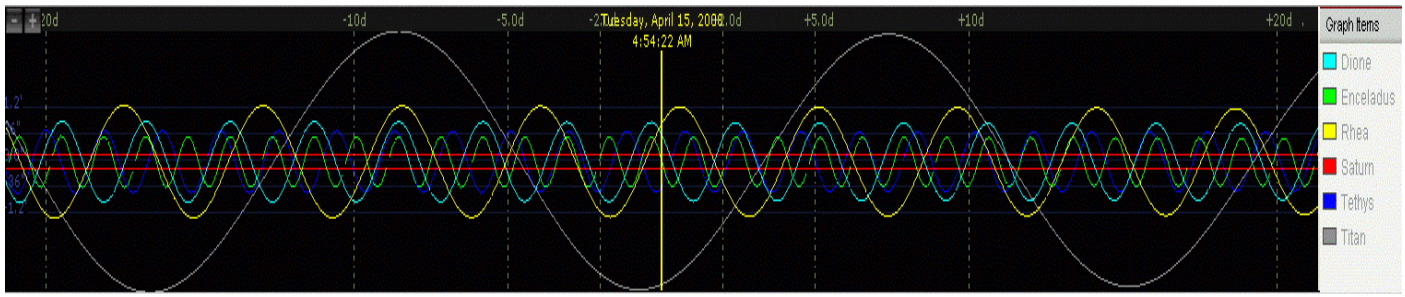
Jupiter Moon Calendar

Here is a graphical depiction of the visible moons of Jupiter for the month of April 2008.

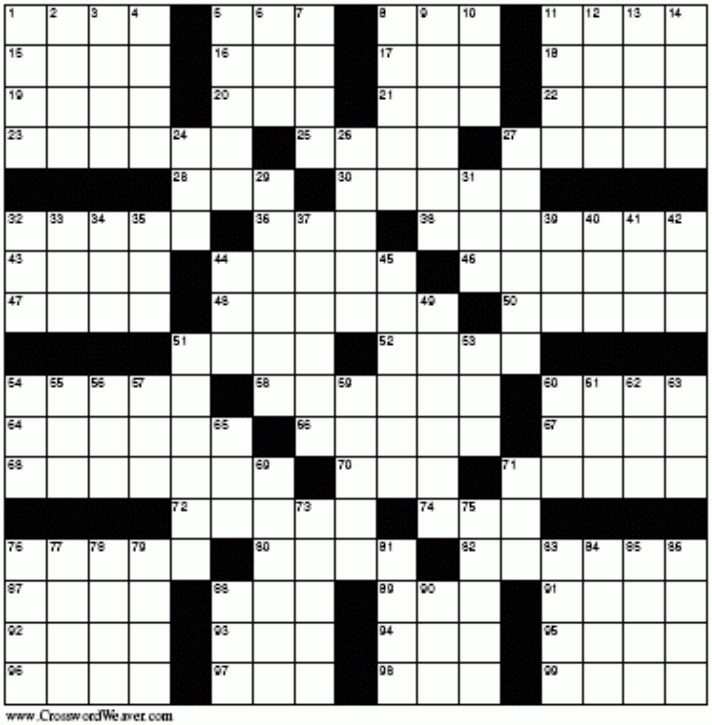


Saturn Moon Calendar

Here is a graphical depiction of the visible moons of Saturn for the month of April 2008.



AstroPuzzle - April 2008



www.CrosswordWeaver.com

ACROSS

1 Asian nation
5 Black-backed gull
8 Tree
11 City in Yemen
15 Seldom
16 Movie 2001's talking computer
17 Pair
18 Deceive
19 Gets older
20 Is
21 Hotel
22 Afresh
23 ***A very distant immensely bright object.***
25 Secondhand
27 Lets out
28 Energy unit
30 Bird
32 Trades
36 ***A negatively charged lepton, similar to an electron or a muon but much more massive and very short-lived.***
38 Endows
43 Indonesian island
44 Insane
46 Furrow
47 Eve's garden
48 ***A moon of an adjascent planet named after the greek God of fear.***
50 African nation
51 Other __
52 Tears
54 ***That point on the celestial sphere directly below the observer.***
58 Women's stockings
60 Helper
64 Subclass including ticks and mites
66 Impressionist painter
67 Churn
68 Hereditary
70 Jigsaw
71 Black and white animal
72 Bad smells
74 Chatter
76 Male admirer
80 Chimney dirt
82 Dictator
87 Jetty
88 Flightless bird
89 American Cancer Society (abbr.)
91 Whim
92 First letter of the Arabic alphabet
93 Billion years
94 Caviar
95 Cavil
96 Drama
97 Acid
98 Hotel
99 Famous cookies

DOWN

1 Asian country
2 Prego's competition
3 Realm
4 Loch __ monster
5 Graph
6 Rowing tool
7 Type of cheese
8 Bye
9 Ice-cream __
10 Honey abr.
11 Jewish calendar month
12 ***Any deposit of sand-sized (1/16 to 2 mm in diameter) windblown material.***
13 Fencing sword
14 Information
24 Abdominal muscles (abbr.)
26 Brief witty speech
27 ***Beautiful eruptions in the outer part of the Sun's atmosphere.***
29 Dweller of the Beehive State
31 Incorporated (abbr.)
32 Compass point
33 Compact bundle
34 Brew
35 Tenpin
37 Alias
39 Grovel
40 Amateur
41 Extra-sensory perception
42 Position
44 Car speed
45 ***The outermost part of the Sun's atmosphere.***
49 Fibrous
51 ***the largest moon of the planet Neptune.***
53 Clock time
54 Badger
55 Whiz
56 Newsman Rather
57 Wrath
59 Loop
60 __ of the covenant
61 Promissory note
62 Obnoxious noises
63 Antlered animal
65 Does
69 ***The universe.***
71 Welkin
73 Inning
75 Afloat (2 wds.)
76 Switch
77 Fence
78 Opera solo
79 Uncertain
81 Sticky black substances
83 Costa __
84 First man
85 Roman emperor
86 Knocks (2 wds.)
88 Elver
90 Lawman