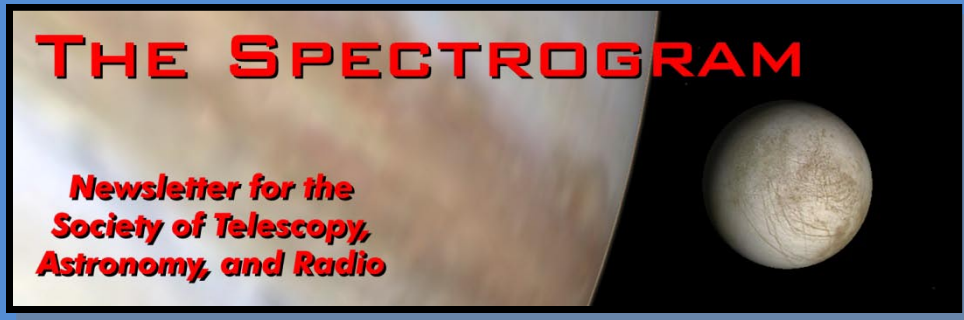


November 2010

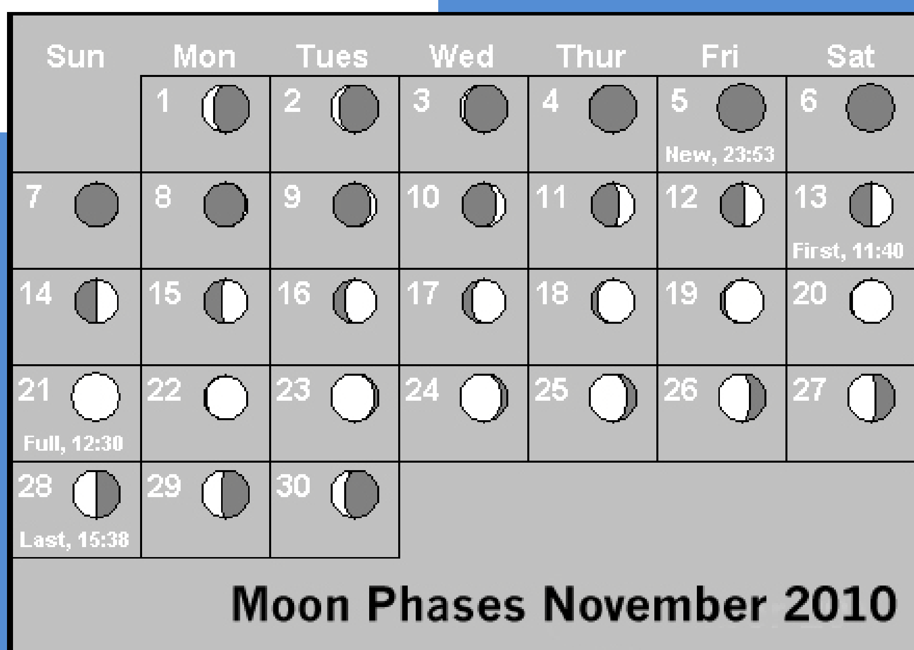
Inside this Issue:

November Meeting

The next meeting of S*T*A*R will be on Thursday, November 4th, 2010 and will feature Telescope manufacturer and former STAR club secretary, Rob Teeter, has built several dozen custom made Truss Dobsonians since opening "Teeter's Telescopes, LLC" in 2002: each scope unique, and each one with a story. Listen as Rob recounts his most interesting telescope making adventures, capped off by one true story sure to make everyone in the room shake their heads.

Calendar

- Nov 4, 2010 - "Teeter and His Telescopes: 8 years, 72 Scopes, and a Thousand Stories" presented by Rob Teeter
- Dec 2, 2010 - S*T*A*R Club's own Arturo Cisneros will give a talk on the origins of the elements.



Sun	Mon	Tues	Wed	Thur	Fri	Sat
	1	2	3	4	5 New, 23:53	6
7	8	9	10	11	12	13 First, 11:40
14	15	16	17	18	19	20
21 Full, 12:30	22	23	24	25	26	27
28 Last, 15:38	29	30				

Moon Phases November 2010

December Issue

Please submit articles and contributions for the next *Spectrogram* by November 27. Please email to fowler@verizon.net.

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 Monmouth Museum on the Brookdale Community College campus. Meetings generally consist of lectures and discussions 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________

Phone____

Email____

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

Upcoming Star Parties!

Red Bank Schools Star Party Friday, Nov. 12th

Swimming River Discoveries Project is hosting a Red Bank School Family Night on Friday, Nov. 12th at the Red Bank Primary School, 222 River St.They are requesting the Club have some members set up scopes for the students. Students from the primary, middle and high school with their families are expected to attend. Set up time is 6pm with observing session from 6:30 till 8:30 pm. Please respond if able to attend, either on the board or contact Rich Gaynor at richg870@aol.com

Star Party Mill Lake School, Monroe Twp Thursday, Nov.18th

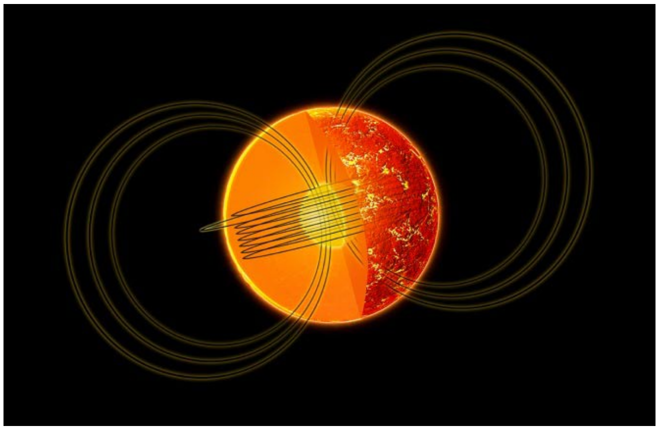
Mill Lake Elementary School in Monroe Township is holding their annual Astronomy Night on Novemeber 18th. They have asked if we could set up several telescopes for the students and parents. The school is located at 115 Monmouth Road, Monroe Township, NJ 08831.
We can arrive and set up in the rear of the school at 5:30. In the past there was pizza, subs and soda for the astronomers. The students will start to arrive at 6:00 and it should end about 9:00.

This event goes on rain or cloud. There are indoor stations where the students are engaged in hands-on activities supervised by the teachers. There will be a Starlab Planetarium also. There are about 180 students plus parents and siblings but they will come out to observe in class sized groups.

Last year we were able to observe but the two previous years the skies were overcast and the astronomers did the observations through breaks in the clouds or came inside the gym and showed the students how their telescopes worked and viewed pictures of galaxies across the room.
Please post if you can help. or reply richg870@aol.com

Chandra: What Lies Beneath? Magnetar Enigma Deepens

CAMBRIDGE, Mass. -- Observations with NASA's Chandra, Swift and Rossi X-ray observatories, Fermi Gamma-ray Space Telescope and ESA's XMM-Newton have revealed that a slowly rotating neutron star with an ordinary surface magnetic field is giving off bursts of X-rays and gamma rays. This discovery may indicate the presence of an internal magnetic field much more intense than the surface magnetic field, with implications for how the most powerful magnets in the cosmos evolve.



An artist's rendering of SGR 0418+5729, a slowly rotating neutron star with a very weak magnetic field at its surface. Observations from several telescopes, including NASA's Chandra X-ray Observatory, have revealed that the star is giving off bursts of X-rays and gamma rays. This discovery may indicate the presence of an internal magnetic field much more intense than the surface magnetic field, with implications for how the most powerful magnets in the cosmos evolve. Credits: CXC/M. Weiss

The neutron star, SGR 0418+5729, was discovered on June 5, 2009, when the Fermi Gamma-ray Space Telescope detected bursts of gamma-rays from this object. Follow-up observations four days later with the Rossi X-Ray Timing Explorer (RXTE) showed that, in addition to sporadic X-ray bursts, the neutron star exhibits persistent X-ray emission with regular pulsations that indicate that the star has a rotational period of 9.1 seconds. RXTE was able to monitor this activity for about 100 days. This behavior is similar to a class of neutron stars called magnetars, which have strong to extreme magnetic fields 20 to 1000 times above the average of the galactic radio pulsars.

As neutron stars rotate, the radiation of low frequency electromagnetic waves -- or winds of high-energy particles -- carry energy away from the star, causing the rotation rate of the star to gradually decrease. Careful monitoring of SGR 0418 was possible because Chandra and XMM-Newton were able to measure its pulsation period even though it faded by a factor of 10 after the initial detection. What sets SGR 0418 apart from other magnetars is that careful monitoring over a span of 490 days has revealed no detectable decrease in its rotation rate.

The lack of rotational slowing implies that the radiation of low frequency waves must be weak, and hence the surface magnetic field must be much weaker than normal. But this raises another question: Where does the energy come from to power bursts and the persistent X-ray emission from the source?

The generally accepted answer for magnetars is that the energy to power the X-ray and gamma-ray emission comes from an internal magnetic field that has been twisted and amplified in the turbulent interior of the neutron star. Theoretical studies indicate that if the internal field becomes about ten or more times stronger than the surface field, the decay or untwisting of the field can lead to the production of steady and bursting X-ray emission through the heating of the neutron star crust or the acceleration of particles.

A crucial question is how large an imbalance can be maintained between the surface and interior fields. SGR 0418 represents an important test case. The observations already imply an imbalance of between 50 and 100. If further observations by Chandra push the surface magnetic field limit lower, then theorists may have to dig deeper for an explanation of this enigmatic object.

This discovery is the result of an international teamwork from CSIC-IEEC, INAF, University of Padua, MSSL-UCL, CEA-Saclay, Sabanci University and NASA's Marshall Space Flight Center in Huntsville, Ala. These results appear in the Oct. 14 issue of Science Express, which provides electronic publication of selected science papers in advance of print.

The Marshall Center manages the Chandra program for NASA's Science Mission Directorate in Washington. The Smithsonian Astrophysical Observatory controls Chandra's science and flight operations from Cambridge, Mass.

More information, including images and other multimedia, can be found at:

http://chandra.harvard.edu
and
http://chandra.nasa.gov

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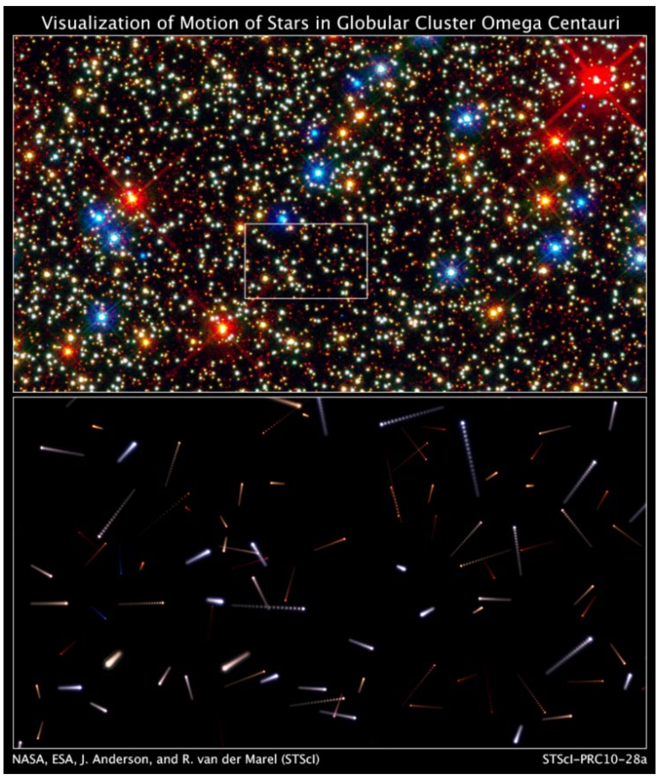
Hubble Data Used to Look 10,000 Years into the Future

The globular star cluster Omega Centauri has caught the attention of sky watchers ever since the ancient astronomer Ptolemy first catalogued it 2,000 years ago. Ptolemy, however, thought Omega Centauri was a single star. He didn't know that the "star" was actually a beehive swarm of nearly 10 million stars, all orbiting a common center of gravity.

The stars are so tightly crammed together that astronomers had to wait for the powerful vision of NASA's Hubble Space Telescope to peer deep into the core of the "beehive" and resolve individual stars. Hubble's vision is so sharp it can even measure the motion of many of these stars, and over a relatively short span of time.



This image juxtaposes an image of the Omega Centauri cluster taken by Hubble's WFC3, with an analysis of stellar motion shown within that cluster. Credit: NASA/ESA/G. Bacon (STScI)

A precise measurement of star motions in giant clusters can yield insights into how stellar groupings formed in the early universe, and whether an "intermediate mass" black hole, one roughly 10,000 times as massive as our Sun, might be lurking among the stars.

Analyzing archived images taken over a four-year period by Hubble's Advanced Camera for Surveys, astronomers have made the most accurate measurements yet of the motions of more than 100,000 cluster inhabitants, the largest survey to date to study the movement of stars in any cluster.

"It takes high-speed, sophisticated computer programs to measure the tiny shifts in the positions of the stars that occur in only four years' time," says astronomer Jay Anderson of the Space Telescope Science Institute in Baltimore, Md., who conducted the study with fellow Institute astronomer Roeland van der Marel. "Ultimately, though, it is Hubble's razor-sharp vision that is the key to our ability to measure stellar motions in this cluster."

Adds van der Marel: "With Hubble, you can wait three or four years and detect the motions of the stars more accurately than if you had waited 50 years on a ground-based telescope."

The astronomers used the Hubble images, which were taken in 2002 and 2006, to make a movie simulation of the frenzied motion of the cluster's stars. The movie shows the stars' projected migration over the next 10,000 years. Identified as a globular star cluster in 1867, Omega Centauri is one of roughly 150 such clusters in our Milky Way Galaxy. The behemoth stellar grouping is the biggest and brightest globular cluster in the Milky Way, and one of the few that can be seen by the unaided eye. Located in the constellation Centaurus, Omega Centauri is viewable in the southern skies.

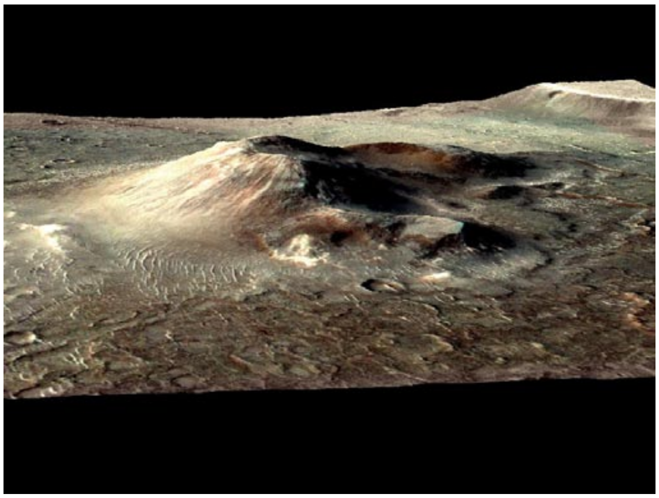
Silica on a Mars Volcano Tells of Wet and Cozy Past

Light-colored mounds of a mineral deposited on a volcanic cone more than three billion years ago may preserve evidence of one of the most recent habitable microenvironments on Mars.

Observations by NASA's Mars Reconnaissance Orbiter enabled researchers to identify the mineral as hydrated silica and to see its volcanic context. The mounds' composition and their location on the flanks of a volcanic cone provide the best evidence yet found on Mars for an intact deposit from a hydrothermal environment -- a steam fumarole, or hot spring. Such environments may have provided habitats for some of Earth's earliest life forms.

"The heat and water required to create this deposit probably made this a habitable zone," said J.R. Skok of Brown University, Providence, R.I., lead author of a paper about these findings published online today by Nature Geoscience. "If life did exist there, this would be a promising type of deposit to entomb evidence of it -- a microbial mortuary."

No studies have yet determined whether Mars has ever supported life. The new results add to accumulating evidence that, at some times and in some places, Mars has had favorable environments for microbial life. This specific place would have been habitable when most of Mars was already dry and cold. Concentrations of hydrated silica have been identified on Mars previously, including a nearly pure patch found by NASA's Mars Exploration Rover Spirit in 2007. However, none of those earlier findings were in such an intact setting as this one, and the setting adds evidence about the origin.



This volcanic cone in the Nili Patera caldera on Mars has hydrothermal mineral deposits on the southern flanks and nearby terrains. Light-toned patches on the closest flank of the cone, and the entire field of light-toned material on the left of the cone (see annotated image) are hydrothermal deposits. The cone is about 5 kilometers (3 miles) in diameter at the base. The deposits are evidence for a past local environment that was warm and wet or steamy, possibly hospitable to microbial life, as reported in a November 2010 Nature Geoscience paper by J.R. Skok, of Brown University, Providence, R.I., and co-author . This image is in false color derived from observation in infrared wavebands with the Compact Reconnaissance Imaging Spectrometer for Mars (CRISM) on NASA's Mars Reconnaissance Orbiter. The CRISM spectral data is overlaid on imagery from the Context Camera on that orbiter. A stereo pair of Context Camera images provided topographic information for a digital terrain model produced with NASA Ames Stereo Pipeline software. The image uses no vertical exaggeration. Image Credit: NASA/JPL-Caltech/MSSS/JHU-APL/Brown Univ.

Skok said, "You have spectacular context for this deposit. It's right on the flank of a volcano. The setting remains essentially the same as it was when the silica was deposited."

The small cone rises about 100 meters (100 yards) from the floor of a shallow bowl named Nili Patera. The patera, which is the floor of a volcanic caldera, spans about 50 kilometers (30 miles) in the Syrtis Major volcanic region of equatorial Mars. Before the cone formed, free-flowing lava blanketed nearby plains. The collapse of an underground magma chamber from which lava had emanated created the bowl. Subsequent lava flows, still with a runny texture, coated the floor of Nili Patera. The cone grew from even later flows, apparently after evolution of the underground magma had thickened its texture so that the erupted lava would mound up.

"We can read a series of chapters in this history book and know that the cone grew from the last gasp of a giant volcanic system," said John Mustard, Skok's thesis advisor at Brown and a co-author of the paper. "The cooling and solidification of most of the magma concentrated its silica and water content."

Observations by cameras on the Mars Reconnaissance Orbiter revealed patches of bright deposits near the summit of the cone, fanning down its flank, and on flatter ground in the vicinity. The Brown researchers partnered with Scott Murchie of Johns Hopkins University Applied Physics Laboratory, Laurel, Md., to analyze the bright exposures with the Compact Reconnaissance Imaging Spectrometer for Mars (CRISM) instrument on the orbiter.

Silica can be dissolved, transported and concentrated by hot water or steam. Hydrated silica identified by the spectrometer in uphill locations -- confirmed by stereo imaging -- indicates that hot springs or fumaroles fed by underground heating created these deposits. Silica deposits around hydrothermal vents in Iceland are among the best parallels on Earth.

Murchie said, "The habitable zone would have been within and alongside the conduits carrying the heated water." The volcanic activity that built the cone in Nili Patera appears to have happened more recently than the 3.7-billion-year or greater age of Mars' potentially habitable early wet environments recorded in clay minerals identified from orbit.

NASA's Jet Propulsion Laboratory, a division of the California Institute of Technology, Pasadena, manages the Mars Reconnaissance Orbiter for NASA. Johns Hopkins University Applied Physics Laboratory provided and operates CRISM, one of six instruments on the orbiter. For more information about the Mars Reconnaissance Orbiter, visit: http://www.nasa.gov/mro.

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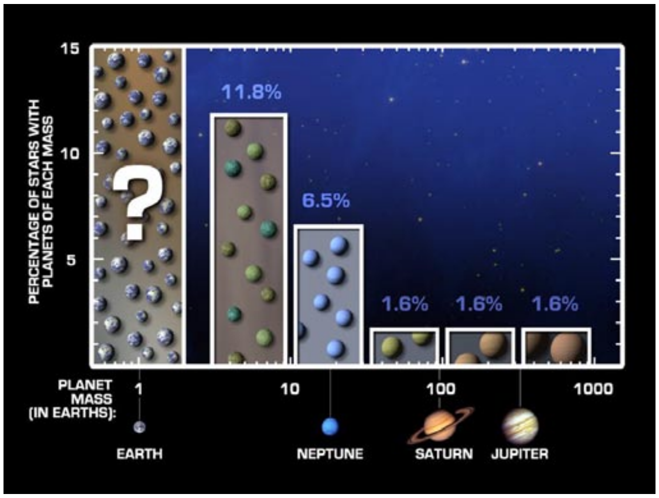
NASA Survey Suggests Earth-Sized Planets Are Common

PASADENA, Calif. -- Nearly one in four stars similar to the sun may host planets as small as Earth, according to a new study funded by NASA and the University of California.

The study is the most extensive and sensitive planetary census of its kind. Astronomers used the W.M. Keck Observatory in Hawaii for five years to search 166 sun-like stars near our solar system for planets of various sizes, ranging from three to 1,000 times the mass of Earth. All of the planets in the study orbit close to their stars. The results show more small planets than large ones, indicating small planets are more prevalent in our Milky Way galaxy.



The data, depicted here in this illustrated bar chart, show a clear trend. Small planets outnumber larger ones. Astronomers extrapolated from these data to estimate the frequency of the Earth-size planets -- nearly one in four sun-like stars, or 23 percent, are thought to host Earth-size planets orbiting close in. Each bar on this chart represents a different group of planets, divided according to their masses. In each of the three highest-mass groups, with masses comparable to Saturn and Jupiter, the frequency of planets around sun-like stars was found to be 1.6 percent. For intermediate-mass planets, with 10 to 30 times the mass of Earth, or roughly the size of Neptune and Uranus, the frequency is 6.5 percent. And the super-Earths, weighing in at only three to 10 times the mass of Earth, had a frequency of 11.8 percent. NASA/JPL-Caltech/UC Berkeley

"We studied planets of many masses -- like counting boulders, rocks and pebbles in a canyon -- and found more rocks than boulders, and more pebbles than rocks. Our ground-based technology can't see the grains of sand, the Earth-size planets, but we can estimate their numbers," said Andrew Howard of the University of California, Berkeley, lead author of the new study. "Earth-size planets in our galaxy are like grains of sand sprinkled on a beach -- they are everywhere."

The study appears in the Oct. 29 issue of the journal Science.

The research provides a tantalizing clue that potentially habitable planets could also be common. These hypothesized Earth-size worlds would orbit farther away from their stars, where conditions could be favorable for life. NASA's Kepler spacecraft is also surveying sun-like stars for planets and is expected to find the first true Earth-like planets in the next few years.

The W.M. Keck Observatory, atop Mauna Kea in Hawaii, was used to survey 166 sun-like stars for planets of different sizes. Image credit: WMKO

Howard and his planet-hunting team, which includes principal investigator Geoff Marcy, also of the University of California, Berkeley, looked for planets within 80-light-years of Earth, using the radial velocity, or "wobble," technique.

They measured the numbers of planets falling into five groups, ranging from 1,000 times the mass of Earth, or about three times the mass of Jupiter, down to three times the mass of Earth. The search was confined to planets orbiting close to their stars -- within 0.25 astronomical units, or a quarter of the distance between our sun and Earth.

A distinct trend jumped out of the data: smaller planets outnumber larger ones. Only 1.6 percent of stars were found to host giant planets orbiting close in. That includes the three highest-mass planet groups in the study, or planets comparable to Saturn and Jupiter. About 6.5 percent of stars were found to have intermediate-mass planets, with 10 to 30 times the mass of Earth -- planets the size of Neptune and Uranus. And 11.8 percent had the so-called "super-Earths," weighing in at only three to 10 times the mass of Earth.

"During planet formation, small bodies similar to asteroids and comets stick together, eventually growing to Earth-size and beyond. Not all of the planets grow large enough to become giant planets like Saturn and Jupiter," Howard said. "It's natural for lots of these building blocks, the small planets, to be left over in this process."

The astronomers extrapolated from these survey data to estimate that 23 percent of sun-like stars in our galaxy host even smaller planets, the Earth-sized ones, orbiting in the hot zone close to a star. "This is the statistical fruit of years of planet-hunting work," said Marcy. "The data tell us that our galaxy, with its roughly 200 billion stars, has at least 46 billion Earth-size planets, and that's not counting Earth-size planets that orbit farther away from their stars in the habitable zone."

The findings challenge a key prediction of some theories of planet formation. Models predict a planet "desert" in the hot-zone region close to stars, or a drop in the numbers of planets with masses less than 30 times that of Earth. This desert was thought to arise because most planets form in the cool, outer region of solar systems, and only the giant planets were thought to migrate in significant numbers into the hot inner region. The new study finds a surplus of close-in, small planets where theories had predicted a scarcity.

"We are at the cusp of understanding the frequency of Earth-sized planets among planetary systems in the solar neighborhood," said Mario R. Perez, Keck program scientist at NASA Headquarters in Washington. "This work is part of a key NASA science program and will stimulate new theories to explain the significance and impact of these findings."

NASA's Exoplanet Science Institute at the California Institute of Technology, Pasadena, Calif., manages time allocation on the Keck telescope for NASA. NASA's Jet Propulsion Laboratory, also in Pasadena, manages NASA's Exoplanet Exploration program office. More information about exoplanets and NASA's planet-finding program is at http://planetquest.jpl.nasa.gov.

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The Long Voyage of Discovery

It has flown to space more than any other craft, and it has carried more crew members to orbit. It was the first spacecraft to retrieve a satellite and bring it back to Earth. It has visited two space stations. It launched a telescope that has seen deeper in space and in time than ever before. And twice it has demonstrated the United States' will to persevere following devastating tragedy, returning America to orbit following the two worst accidents in space history.

Although all five vehicles that have comprised NASA's space shuttle fleet are unmatched in achievements, space shuttle Discovery is unique among the extraordinary.

Space shuttle Discovery is featured in this image photographed by an Expedition 23 crew member as the shuttle approaches the International Space Station during STS-131 rendezvous and docking operations. Image Credit: NASA.

In 38 trips to space, Discovery has spent 352 days in orbit, almost a full year. Discovery has circled Earth 5,628 times, all the while speeding along at 17,400 miles per hour. It has traveled almost 143 million miles. That equals 288 round trips to the moon or about one and a half trips to the sun.

Discovery has carried more crew members -- 246 -- than any space vehicle. Those have included the first female to ever pilot a spacecraft, the oldest person to fly in space, the first African-American to perform a spacewalk, the first cosmonaut to fly on an American spacecraft and the first sitting member of Congress to fly in space.

Discovery was used for NASA's Return to Flight Mission following the Challenger accident, during which the STS-26 crew delivered the TDRS-C satellite to Earth orbit. Image Credit: NASA.

It took four years to build Discovery, the third shuttle orbiter built. Named for past sailing ships of exploration, it rolled out of its Palmdale, Calif. assembly plant in October 1983 and was delivered via piggyback airplane flight to NASA' s Kennedy Space Center the next month. Discovery's first launch was Aug. 30, 1984 on mission STS-41D. That flight launched three communications satellites and tested an experimental solar array wing. The mission was commanded by astronaut Henry W. Hartsfield.

On its second mission, Discovery became the first spacecraft to retrieve a satellite and bring it home. Through a spectacular series of spacewalks using the free-flying Manned Maneuvering Unit jetpacks, two malfunctioning satellites were retrieved and tucked into Discovery's payload bay for the trip home.

Cosmonaut Valeriy V. Polyakov, who boarded Russia's Mir Space Station on January 8, 1994, looks out Mir's window during rendezvous operations with the Space Shuttle Discovery. Image Credit: NASA.

In 1985, Discovery became the only shuttle orbiter to fly four times in a single year. One of those missions, STS-51D, counted the first sitting member of Congress among its crew, Utah Senator Jake Garn.

After more than a two and a half year hiatus to add safety improvements throughout the shuttle systems following the January 1986 Challenger accident, Discovery took America back to orbit on mission STS-26 in September 1988. Commanded by astronaut Rick Hauck, the mission tested safety improvements and launched a NASA communications satellite. It was Discovery's seventh flight and the nation's first return to flight.

One-time cold war adversaries found common ground above the Earth aboard Discovery in February 1994 on mission STS-60, as Sergei Krikalev of Russia became the first cosmonaut to fly on a U.S. spacecraft. The eight-day research flight was commanded by astronaut Charles F. Bolden, Jr.

Discovery moved the fledgling partnership closer on mission STS-63 one year later as it became the first shuttle to rendezvous with the Russian Mir Space Station. As Discovery flew to within 40 feet of the orbiting complex, the mission broke other barriers as well. Commanded by astronaut James D. Wetherbee, the crew included the first female to pilot a U.S. spacecraft -- astronaut Eileen Collins.

Discovery's only other visit to Mir came on mission STS-91 in June 1998, a docking with the space station that ended the Shuttle-Mir Program. The cooperative effort had seen nine shuttle missions dock to the Russian station since Discovery's trailblazing rendezvous in 1995.

In October 1998, Discovery flew a science mission that again broke barriers on Earth and in space. The crew included the oldest astronaut to fly to space -- astronaut John Glenn, who at age 77 made his second trip to orbit on Discovery's STS-95 mission. In 1962, Glenn became the first American to orbit Earth. In addition to other duties with the STS-95 crew, Glenn was a test subject for a host of experiments that studied aging.

Astronaut Scott E. Parazynski (left), STS-95 mission specialist, prepares to withdraw blood from the arm of U. S. Senator John H. Glenn, Jr. (D.-Ohio), payload specialist, positioned in his sleep station on the space shuttle Discovery's middeck. Image Credit: NASA.

In October 2000, Discovery launched on the 100th mission of the Space Shuttle Program, a flight to the new and growing International Space Station on mission STS-92. The 12-day mission installed a shuttle docking port on the station and the first piece of the station's exterior truss structure, setting the stage for the arrival of its first resident crew only a few weeks later.

In February 2003, the world again mourned as the shuttle Columbia and her crew were lost during reentry. America resolved to continue the shuttle program and again improve the safety of flight, and NASA again turned to Discovery to return the nation to space on mission STS-114 to the International Space Station. The mission, commanded by Eileen Collins, included new procedures to ensure the shuttle heat shield was in good condition for the trip home, among them a first of its kind "back flip" as Discovery approached the station to enable the station crew to capture high resolution imagery of the shuttle's heat shield.

NASA's final mission of 2006 was expected to be one of its most challenging. Discovery's STS-116 mission to the space station called for installation of the port five truss segment and a major overhaul of the station's electrical power system. Problems arose while retracting one of the station's solar arrays, which was to be relocated on a future flight. During the retraction, the array snagged. During two spacewalks, astronauts Bob Curbeam, Suni Williams and Christer Fuglesang assisted in the retraction by hand, successfully troubleshooting the problem and folding the array.

Astronaut Stephen K. Robinson, STS-114 mission specialist, anchored to a foot restraint on the International Space Station's Canadarm2, participates in the mission's third spacewalk. Image Credit: NASA.

Discovery participated in another space milestone in October 2007 as mission STS-120 marked the first time that two female commanders were in space together. Discovery Commander Pam Melroy flew the shuttle to dock with the space station, which was under the command of astronaut Peggy Whitson. The mission installed the Harmony module on the complex and relocated and deployed the solar array that had been folded on STS-116. The crew and ground had to improvise as the array was unfolded, installing straps that mended and stabilized the panel.

On STS-124 in May 2008, Discovery headed back to the station to deliver the centerpiece of the Japan Aerospace Exploration Agency's Kibo experiment laboratory. STS-124 was the second of three shuttle flights that delivered the elements to complete the Japanese lab.

On its final flight in November 2010, Discovery will deliver a final module to the U.S. segment of the station, the Leonardo Permanent Multipurpose Module, as well as the first humanoid robot to fly in space, Robonaut2. The new module will be a storeroom and provide additional research space. Robonaut2 is a technology demonstration to learn how humanoid robots can assist crews in orbit. Discovery also will carry a host of spare equipment to be stored aboard the complex. Befitting the milestones that have punctuated Discovery's career, its final visit to the station will coincide with the 10-year anniversary of a permanent human presence aboard the outpost.

Pinwheel of Star Birth

Though the universe is chock full of spiral-shaped galaxies, no two look exactly the same. This face-on spiral galaxy, called NGC 3982, is striking for its rich tapestry of star birth, along with its winding arms. The arms are lined with pink star-forming regions of glowing hydrogen, newborn blue star clusters, and obscuring dust lanes that provide the raw material for future generations of stars. The bright nucleus is home to an older population of stars, which grow ever more densely packed toward the center.

NGC 3982 is located about 68 million light-years away in the constellation Ursa Major. The galaxy spans about 30,000 light-years, one-third of the size of our Milky Way galaxy. This color image is composed of exposures taken by the Hubble Space Telescope's Wide Field Planetary Camera 2 (WFPC2), the Advanced Camera for Surveys (ACS), and the Wide Field Camera 3 (WFC3). The observations were taken between March 2000 and August 2009. The rich color range comes from the fact that the galaxy was photographed invisible and near-infrared light. Also used was a filter that isolates hydrogen emission that emanates from bright star-forming regions dotting the spiral arms.

November 2010 Celestial Events

supplied by J. Randolph Walton (Randy)

Day	Date	Time (EDT)	Event
Fri	5	13:00	**S. Taurid slow bright meteors (ZHR=10)**
Sat	6	00:52	**New Moon**
		03:30	Jupiter Sets
		04:50	Saturn Rises
		06:35	Venus Rises
		07:35	Sunrise
		08:10	Moon Rise
		17:52	Sunset
		18:22	Mercury Sets
		19:00	Mars Sets
Sun	7	02:00	**Daylight Saving Time ends**
Fri	12	11:00	**N. Taurid slow bright meteors (ZHR=15)**
Sat	13	02:00	Jupiter Sets
		03:30	Saturn Rises
		04:55	Venus Rises
		06:43	Sunrise
		11:38	**First Quarter Moon**
		12:37	Moon Rise
		16:45	Sunset
		17:25	Mercury Sets
		17:50	Mars Sets
Sun	14	18:00	**Lunar Straight Wall visible**
Wed	17	15:00	**Leonid meteors (ZHR=20)**
Sat	20	01:30	Jupiter Sets
		03:05	Saturn Rises
		04:20	Venus Rises
		06:51	Sunrise
		15:46	Moon Rise
		16:40	Sunset
		17:35	Mercury Sets
		17:43	Mars Sets
Sun	21	12:27	**Full Moon**
		16:29	Moon Rise
Wed	24	19:56	**Jupiter with only one moon visible**
Sat	27	01:05	Jupiter Sets
		02:40	Saturn Rises
		03:55	Venus Rises
		06:58	Sunrise
		16:37	Sunset
		17:35	Mars Sets
		17:45	Mercury Sets
		22:53	Moon Rise
Sun	28	12:07	Moon set
		15:36	**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
Iota Cas	Multiple Star	Cassiopeia	02h29m04.0s	+67°24'09"	4.5
6 Tri	Multiple Star	Triangulum	02h12m22.3s	+30°18'11"	4.9
Almaak	Multiple Star	Andromeda	02h03m53.9s	+42°19'47"	2.1
h and Chi Perseus	Open Clusters	Perseus	02h19m01.8s	+57°08'47"	4.3
NGC 1097	Galaxy	Fornax	02h46m18.9s	-30°16'21"	10.2
M 103	Open Cluster	Cassiopeia	01h33m13.8s	+60°42'23"	6.9
Little Dumbbell (M76)	Planetary Nebula	Perseus	01h42m19.3s	+51°34'30"	12.2
NGC 891	Galaxy	Andromeda	02h22m32.9s	+42°20'46"	10.8
NGC 1023	Galaxy	Perseus	02h40m27.7s	+39°04'04"	10.2
AGC 347	Galaxy Group	Andromeda	02h25m48.0s	+41°52'00"	--
IC 1747	Planetary Nebula	Cassiopeia	01h57m35.8s	+63°19'19"	13.6
NGC 470 & 474	Interacting Galaxy Pair	Pisces	01h19m44.9s	+03°24'35"	12.6
NGC 925	Galaxy	Triangulum	02h27m16.8s	+33°34'45"	10.9
NGC 784	Galaxy	Triangulum	02h01m16.8s	+28°50'14"	12.5