February 2011

The Spectrogram

Newsletter for the Society of Telescopy, Astronomy, and Radio

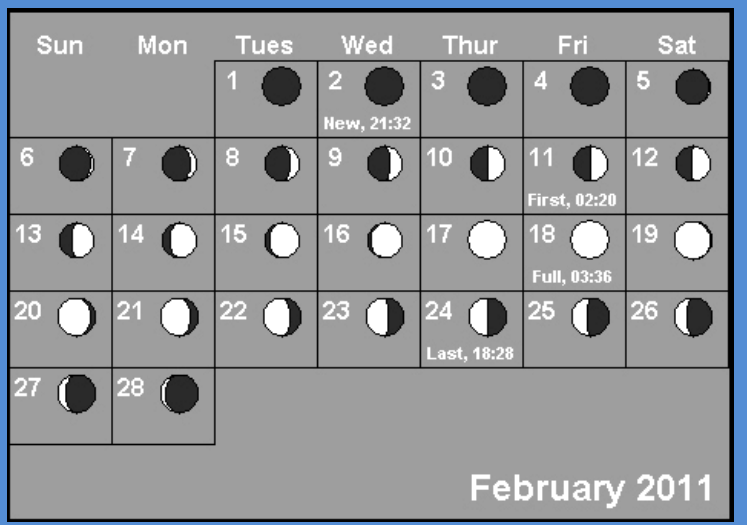
Inside this Issue:

February Meeting

The next meeting of S*T*A*R will be on Thursday, February 3rd 2011. Star Club member and former president Edward Collett will describe the major telescope parameters that allow an observer to optimize his or her observing experience at a telescope. The telescope parameters will be derived from a simple geometrical diagram. After the parameters are determined they will be used to characterize several different telescopes and binoculars. In addition, these parameters are also very useful for selecting or purchasing a telescope.

Calendar

- February 3rd, 2011 Telescope Optics with Edward Collett



March Issue

Please submit articles and contributions for the next *Spectrogram* by February 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

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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!

Campbell Elementary School Star Party (rescheduled form January)
10 February (Thursday)
Cloud date 11 February

The event runs from 7 to 9PM, expect folks to arrive about 6:45. Located on the athletic field, immediately west of the school. Address: 8 Talmadge Avenue, Metchuen NJ
POC: Dave N

Sayreville School Star Party
Friday, March 25th
Rain date: Friday, April 1st

This event is scheduled to start around 7:30 and go until 9:30. 100 students plus one parent each...200 total.
Eisenhower School in Parlin, NJ
POC : KenL

Even though the weather here in New Jersey has not been “stellar” this past month, we can take some solace knowing that Ernie Rossi has had good skies, as his recent shot of the Horsehead Nebula shows… Great work Ernie!

Runaway Star Plows Through Space

A massive star flung away from its former companion is plowing through space dust. The result is a brilliant bow shock, seen here as a yellow arc in a new image from NASA's Wide-field Infrared Survey Explorer, or WISE.

The star, named Zeta Ophiuchi, is huge, with a mass of about 20 times that of our sun. In this image, in which infrared light has been translated into visible colors we see with our eyes, the star appears as the blue dot inside the bow shock.

Zeta Ophiuchi once orbited around an even heftier star. But when that star exploded in a supernova, Zeta Ophiuchi shot away like a bullet. It's traveling at a whopping 54,000 miles per hour (or 24 kilometers per second), and heading toward the upper left area of the picture.

As the star tears through space, its powerful winds push gas and dust out of its way and into what is called a bow shock. The material in the bow shock is so compressed that it glows with infrared light that WISE can see. The effect is similar to what happens when a boat speeds through water, pushing a wave in front of it.

This bow shock is completely hidden in visible light. Infrared images like this one from WISE are therefore important for shedding new light on the region.

JPL manages and operates WISE for NASA's Science Mission Directorate, Washington. The principal investigator, Edward Wright, is at UCLA. The mission was competitively selected under NASA's Explorers Program managed by NASA's Goddard Space Flight Center, Greenbelt, Md. The science instrument was built by the Space Dynamics Laboratory, Logan, Utah, and the spacecraft was built by Ball Aerospace & Technologies Corp., Boulder, Colo. Science operations and data processing take place at the Infrared Processing and Analysis Center at the California Institute of Technology in Pasadena. Caltech manages JPL for NASA.

More information is online at http://www.nasa.gov/wise, http://wise.astro.ucla.edu and http://www.jpl.nasa.gov/wise .

NASA Comet Hunter Spots Its Valentine

NASA's Stardust spacecraft has downlinked its first images of comet Tempel 1, the target of a flyby planned for Valentine's Day, Feb. 14. The images were taken on Jan. 18 and 19 from a distance of 26.3 million kilometers (16.3 million miles), and 25.4 million kilometers (15.8 million miles) respectively. On Feb. 14, Stardust will fly within about 200 kilometers (124 miles) of the comet's nucleus.

"This is the first of many images to come of comet Tempel 1," said Joe Veverka, principal investigator of NASA's Stardust-NExT mission from Cornell University, Ithaca, N.Y. "Encountering something as small and fast as a comet in the vastness of space is always a challenge, but we are very pleased with how things are setting up for our Valentine's Day flyby."

The first image of comet Tempel 1 taken by NASA's Stardust spacecraft is a composite made from observations on Jan. 18 and 19, 2011. Image credit: NASA/JPL-Caltech

The composite image is a combination of several images taken by Stardust's navigation camera. Future images will be used to help mission navigators refine Stardust's trajectory, or flight path, as it closes the distance between comet and spacecraft at a rate of about 950,000 kilometers (590,000 miles) a day. On the night of encounter, the navigation camera will be used to acquire 72 high-resolution images of the comet's surface features. Stardust-NExT mission scientists will use these images to see how surface features

on comet Tempel 1 have changed over the past five-and-a-half years. (Tempel 1 had previously been visited and imaged in July of 2005 by NASA's Deep Impact mission).

Launched on Feb. 7, 1999, Stardust became the first spacecraft in history to collect samples from a comet (comet Wild 2), and return them to Earth for study. While its sample return capsule parachuted to Earth in January 2006, mission controllers were placing the still-viable spacecraft on a path that would allow NASA the opportunity to re-use the already-proven flight system if a target of opportunity presented itself. In January 2007, NASA re-christened the mission "Stardust-NExT" (New Exploration of Tempel), and the Stardust team began a four-and-a-half year journey for the spacecraft to comet Tempel 1. This will be the second exploration of Tempel 1 by a spacecraft (Deep Impact).

Along with the high-resolution images of the comet's surface, Stardust-NExT will also measure the composition, size distribution and flux of dust emitted into the coma, and provide important new information on how Jupiter-family comets evolve and how they formed 4.6 billion years ago.

Stardust-NExT is a low-cost mission that will expand the investigation of comet Tempel 1 initiated by NASA's Deep Impact spacecraft. JPL, a division of the California Institute of Technology in Pasadena, manages Stardust-NExT for the NASA Science Mission Directorate, Washington, D.C. Joe Veverka of Cornell University, Ithaca, N.Y., is the mission's principal investigator. Lockheed Martin Space Systems, Denver, built the spacecraft and manages day-to-day mission operations.

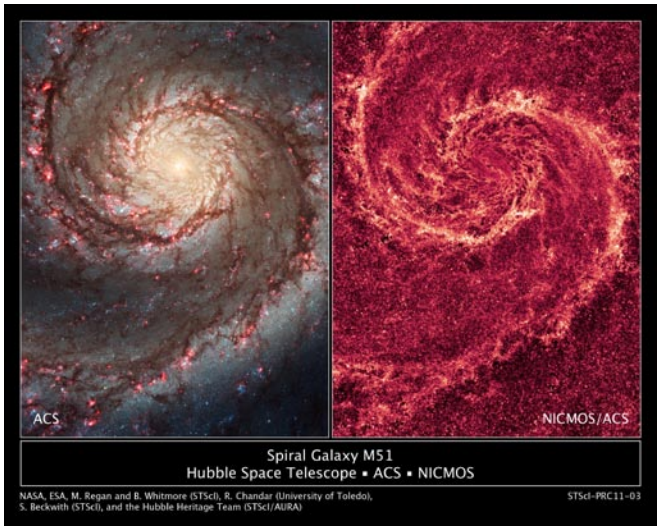
For more information about Stardust-NExT, please visit: http://stardustnext.jpl.nasa.gov/.

The Two-faced Whirlpool Galaxy

These images by NASA's Hubble Space Telescope show off two dramatically different face-on views of the spiral galaxy M51, dubbed the Whirlpool Galaxy.

The image at left, taken in visible light, highlights the attributes of a typical spiral galaxy, including graceful, curving arms, pink star-forming regions, and brilliant blue strands of star clusters.

In the image at right, most of the starlight has been removed, revealing the Whirlpool's skeletal dust structure, as seen in near-infrared light. This new image is the sharpest view of the dense dust in M51. The narrow lanes of dust revealed by Hubble reflect the galaxy's moniker, the Whirlpool Galaxy, as if they were swirling toward the galaxy's core.



To map the galaxy's dust structure, researchers collected the galaxy's starlight by combining images taken in visible and near-infrared light. The visible-light image captured only some of the light; the rest was obscured by dust. The near-infrared view, however, revealed more starlight because near-infrared light penetrates dust. The researchers then subtracted the total amount of starlight from both images to see the galaxy's dust structure.

The red color in the near-infrared image traces the dust, which is punctuated by hundreds of tiny clumps of stars, each about 65 light-years wide. These stars have never been seen before. The star clusters cannot be seen in visible light because dense dust enshrouds them. The image reveals details as small as 35 light-years across.

Astronomers expected to see large dust clouds, ranging from about 100 light-years to more than 300 light-years wide. Instead, most of the dust is tied up in smooth and diffuse dust lanes. An encounter with another galaxy may have prevented giant clouds from forming.

Probing a galaxy's dust structure serves as an important diagnostic tool for astronomers, providing invaluable information on how the gas and dust collapse to form stars. Although Hubble is providing incisive views of the internal structure of galaxies such as M51, the planned James Webb Space Telescope (JWST) is expected to produce even crisper images.

Researchers constructed the image by combining visible-light exposures from Jan. 18 to 22, 2005, with the Advanced Camera for Surveys (ACS), and near-infrared light pictures taken in December 2005 with the Near Infrared Camera and Multi-Object Spectrometer (NICMOS).

Credit for the NICMOS image: NASA, ESA, M. Regan and B. Whitmore (STScI), and R. Chandar (University of Toledo)

Credit for the ACS image: NASA, ESA, S. Beckwith (STScI), and the Hubble Heritage Team (STScI/AURA)

Image files and more information about M51 are available on:

http://hubblesite.org/news/2011/03
http://www.nasa.gov/hubble

The Hubble Space Telescope is a project of international cooperation between NASA and the European Space Agency. NASA's Goddard Space Flight Center manages the telescope. The Space Telescope Science Institute (STScI) conducts Hubble science operations. STScI is operated for NASA by the Association of Universities for Research in Astronomy, Inc., in Washington, D.C.

An Astronomer's Field of Dreams

An innovative new radio telescope array under construction in central New Mexico will eventually harness the power of more than 13,000 antennas and provide a fresh eye to the sky. The antennas, which resemble droopy ceiling fans, form the Long Wavelength Array, designed to survey the sky from horizon to horizon over a wide range of frequencies.

Multiple antennas of the LWA-1 station of the Long Wavelength Array in central New Mexico, photographed at sunset. Each antenna stands about 1.5 meters (5 feet) high and about 2.7 meters (9 feet) across the base. Image credit: LWA Project (at UNM)

The University of New Mexico leads the project, and NASA's Jet Propulsion Laboratory, Pasadena, Calif., provides the advanced digital electronic systems, which represent a major component of the observatory.

The first station in the Long Wavelength Array, with 256 antennas, is scheduled to start surveying the sky by this summer. When complete, the Long Wavelength Array will consist of 53 stations, with a total of 13,000 antennas strategically placed in an area nearly 400 kilometers (248 miles) in diameter. The antennas will provide sensitive, high-resolution images of a region of the sky hundreds of times larger than the full moon. These images could reveal radio waves coming from planets outside our solar system, and thus would turn out to be a new way to detect these worlds. In addition to planets, the telescope will pick up a host of other cosmic phenomena.

All 256 antennas of station LWA-1 of the Long Wavelength Array in Central New Mexico taken on April 1, 2010. The development of the Long Wavelength Array stations will proceed over several years. Construction for the second and third stations will begin in 2011. Eventually, the new telescope array will harness the power of more than 13,000 antennas. Image credit: LWA Project (at UNM)

"We'll be looking for the occasional celestial flash," said Joseph Lazio, a radio astronomer at JPL. "These flashes can be anything from explosions on surfaces of nearby stars, deaths of distant stars, exploding black holes, or even perhaps transmissions by other civilizations." JPL scientists are working with multi-institutional teams to explore this new area of astronomy. Lazio is lead author of an article reporting scientific results from the Long Wavelength Demonstrator Array, a precursor to the new array, in the December 2010 issue of Astronomical Journal.

The new Long Wavelength Array will operate in the radio-frequency range of 20 to 80 megahertz, corresponding to wavelengths of 15 meters to 3.8 meters (49.2 feet to 12.5 feet). These frequencies represent one of the last and most poorly explored regions of the electromagnetic spectrum.

In recent years, a few factors have triggered revived interest in radio astronomy at these frequencies. The cost and technology required to build these low-frequency antennas has improved significantly. Also, advances in computing have made the demands of image processing more attainable. The combination of cost-effective hardware and

technology gives scientists the ability to return to these wavelengths and obtain a much better view of the universe. The predecessor Long Wavelength Demonstrator Array was also in New Mexico. It was successful in identifying radio flashes, but all of them came from non-astronomy targets -- either the sun, or meteors reflecting TV signals high in Earth's atmosphere. Nonetheless, its findings indicate how future searches using the Long Wavelength Array technology might lead to new discoveries.

Radio astronomy was born at frequencies below 100 megahertz and developed from there. The discoveries and innovations at this frequency range helped pave the way for modern astronomy. Perhaps one of the most important contributions made in radio astronomy was by a young graduate student at New Hall (since renamed Murray Edwards College) of the University of Cambridge, U.K. Jocelyn Bell discovered the first hints of radio pulsars in 1967, a finding that was later awarded a Nobel Prize. Pulsars are neutron stars that beam radio waves in a manner similar to a lighthouse beacon.

Long before Bell's discovery, astronomers believed that neutron stars, remnants of certain types of supernova explosions, might exist. At the time, however, the prediction was that these cosmic objects would be far too faint to be detected. When Bell went looking for something else, she stumbled upon neutron stars that were in fact pulsing with radio waves -- the pulsars. Today about 2,000 pulsars are known, but within the past decade, a number of discoveries have hinted that the radio sky might be far more dynamic than suggested by just pulsars.

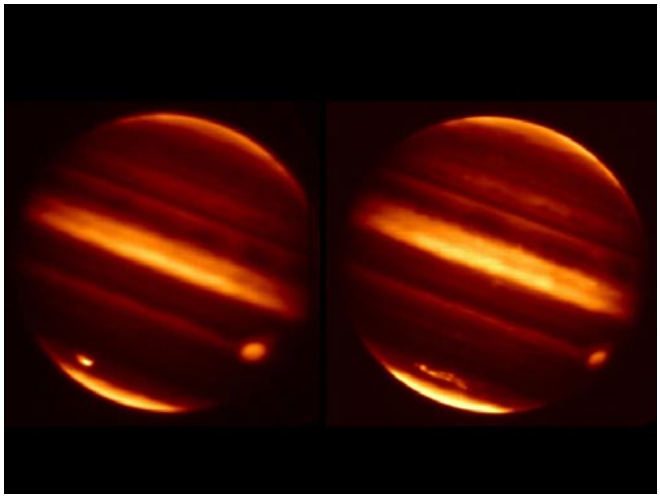
"Because nature is more clever than we are, it's quite possible that we will discover something we haven't thought of," said Lazio.

More information on the Long Wavelength Array is online at: http://lwa.unm.edu .

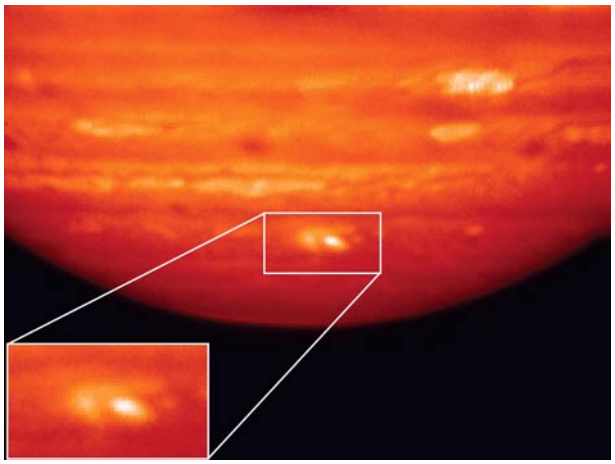
The Long Wavelength Array project is led by the University of New Mexico, Albuquerque, N.M., and includes the Los Alamos National Laboratory, N.M., the United States Naval Research Laboratories, Washington, and NASA's Jet Propulsion Laboratory, Pasadena, Calif. The California Institute of Technology manages JPL for NASA.

Asteroids Ahoy! Jupiter Scar Likely from Rocky Body

A hurtling asteroid about the size of the Titanic caused the scar that appeared in Jupiter's atmosphere on July 19, 2009, according to two papers published recently in the journal Icarus.



These infrared images obtained from NASA's Infrared Telescope Facility in Mauna Kea, Hawaii, show particle debris in Jupiter's atmosphere after an object hurtled into the atmosphere on July 19, 2009. Image credit: NASA/IRTF/JPL-Caltech/University of Oxford



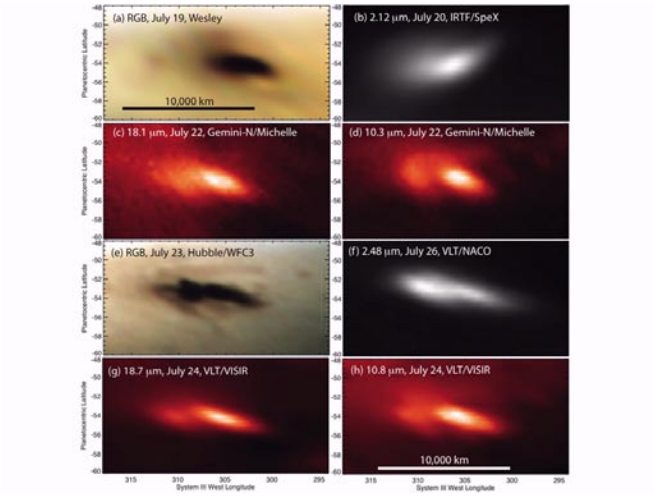
This infrared image, showing thermal radiation at a wavelength of 9.7 microns, was obtained by the Gemini North Telescope in Hawaii. Image credit: Gemini Observatory/AURA/UC Berkeley/SSI/ JPL-Caltech

Data from three infrared telescopes enabled scientists to observe the warm atmospheric temperatures and unique chemical conditions associated with the impact debris. By piecing together signatures of the gases and dark debris produced by the impact shockwaves, an international team of scientists was able to deduce that the object was more likely a rocky asteroid than an icy comet. Among the teams were those led by Glenn Orton, an astronomer at NASA's Jet Propulsion Laboratory, Pasadena, Calif., and Leigh Fletcher, researcher at Oxford University, U.K., who started the work while he was a postdoctoral fellow at JPL.

"Both the fact that the impact itself happened at all and the implication that it may well have been an asteroid rather than a comet shows us that the outer solar system is a complex, violent and dynamic place, and that many surprises

may be out there waiting for us," said Orton. "There is still a lot to sort out in the outer solar system."

The new conclusion is also consistent with evidence from results from NASA's Hubble Space Telescope indicating the impact debris in 2009 was heavier or denser than debris from comet Shoemaker-Levy 9, the last known object to hurl itself into Jupiter's atmosphere in 1994.



These images show eight different looks at the aftermath of a body — probably an asteroid — hitting Jupiter on July 19, 2009. Image credit: NASA/JPL-Caltech/IRTF/STScI/ESO/Gemini Observatory/AURA/A. Wesley

Before this collision, scientists had thought that the only objects that hit Jupiter were icy comets whose unstable orbits took them close enough to Jupiter to be sucked in by the giant planet's gravitational attraction. Those comets are known as Jupiter-family comets. Scientists thought Jupiter had already cleared most other objects, such as asteroids, from its sphere of influence. Besides Shoemaker-Levy, scientists know of only two other impacts in the summer of 2010, which lit up Jupiter's atmosphere.

The July 19, 2009 object likely hit Jupiter between 9 a.m. and 11 a.m. UTC. Amateur astronomer Anthony Wesley from Australia was the first to notice the scar on Jupiter, which appeared as a dark spot in visible wavelengths. The scar appeared at mid-southern latitudes. Wesley tipped off Orton and colleagues, who immediately used existing observing time at NASA's Infrared Telescope Facility in Mauna Kea, Hawaii, the following night and proposed observing time on a host of other ground-based observatories, including the Gemini North Observatory in Hawaii, the Gemini South Telescope in Chile, and the European Southern Observatory's Very Large Telescope in Chile. Data were acquired at regular intervals during the week following the 2009 collision.

The data showed that the impact had warmed Jupiter's lower stratosphere by as much as 3 to 4 Kelvin at about 42 kilometers above its cloudtops. Although 3 to 4 Kelvin does not sound like a lot, it is a significant deposition of energy because it is spread over such an enormous area.

Plunging through Jupiter's atmosphere, the object created a channel of super-heated atmospheric gases and debris. An explosion deep below the clouds – probably releasing at least around 200 trillion trillion ergs of energy, or more than 5 gigatons of TNT -- then launched debris material back along the channel, above the cloud tops, to splash back down into the atmosphere, creating the aerosol particulates and warm temperatures observed in the infrared. The blowback dredged up ammonia gas and other gases from a lower part of the atmosphere known as the troposphere into a higher part of the atmosphere known as the stratosphere.

"Comparisons between the 2009 images and the Shoemaker-Levy 9 results are beginning to show intriguing differences between the kinds of objects that hit Jupiter," Fletcher said. "The dark debris, the heated atmosphere and upwelling of ammonia were similar for this impact and Shoemaker-Levy, but the debris plume in this case didn't reach such high altitudes, didn't heat the high stratosphere, and contained signatures for hydrocarbons, silicates and silicas that weren't seen before. The presence of hydrocarbons, and the absence of carbon monoxide, provide strong evidence for a water-depleted impactor in 2009."

The detection of silica in this mixture of Jovian atmospheric gases, processed bits from the impactor and byproducts of high-energy chemical reactions was significant because abundant silica could only be produced in the impact itself, by a strong rocky body capable of penetrating very deeply into the Jovian atmosphere before exploding, but not by a much weaker comet nucleus. Assuming that the impactor had a rock-like density of around 2.5 grams per cubic centimeter (160 pounds per cubic foot), scientists calculated a likely diameter of 200 to 500 meters (700 to 1,600 feet).

Scientists computed the set of possible orbits that would bring an object into Jupiter in the right range of times and at the right locations. Then they searched the catalog of known asteroids and comets to find the kinds of objects in these orbits. An object named 2005 TS100 – which is probably an asteroid but could be an extinct comet – was one of the closest matches. Although this object was not the actual impactor, it has a very chaotic orbit and made several very close approaches to Jupiter in computer models, demonstrating that an asteroid could have hurtled into Jupiter.

"We weren't expecting to find that an asteroid was the likely culprit in this impact, but we've now learned Jupiter is getting hit by a diversity of objects," said Paul Chodas, a scientist at NASA's Near-Earth Object Program Office at JPL. " Asteroid impacts on Jupiter were thought to be quite rare compared to impacts from the so-called 'Jupiter-family comets,' but now it seems there may be a significant population of asteroids in this category."

Scientists are still working to figure out what that frequency at Jupiter is, but asteroids of this size hit Earth about once every 100,000 years. The next steps in this investigation will be to use detailed simulations of the impact to refine the size and properties of the impactor, and to continue to use imaging at infrared, as well as visible wavelengths, to search for debris from future impacts of this size or smaller.

JPL is managed for NASA by the California Institute of Technology in Pasadena.

NASA Research Team Reveals Moon Has Earth-Like Core

State-of-the-art seismological techniques applied to Apollo-era data suggest our moon has a core similar to Earth's.

Uncovering details about the lunar core is critical for developing accurate models of the moon's formation. The data sheds light on the evolution of a lunar dynamo -- a natural process by which our moon may have generated and maintained its own strong magnetic field.

The team's findings suggest the moon possesses a solid, iron-rich inner core with a radius of nearly 150 miles and a fluid, primarily liquid-iron outer core with a radius of roughly 205 miles. Where it differs from Earth is a partially molten boundary layer around the core estimated to have a radius of nearly 300 miles. The research indicates the core contains a small percentage of light elements such as sulfur, echoing new seismology research on Earth that suggests the presence of light elements -- such as sulfur and oxygen -- in a layer around our own core.

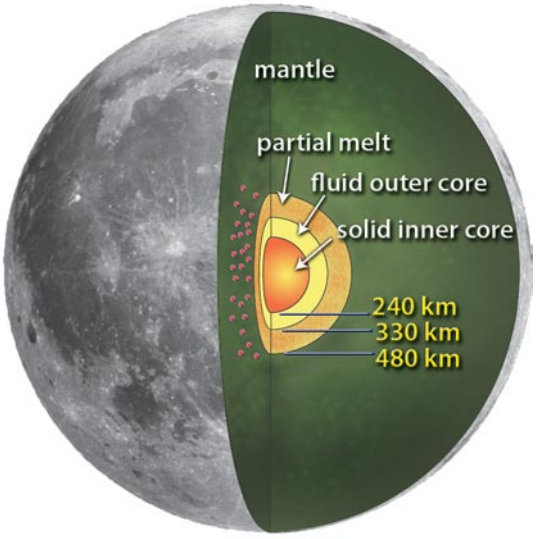
The researchers used extensive data gathered during the Apollo-era moon missions. The Apollo Passive Seismic Experiment consisted of four seismometers deployed between 1969 and 1972, which recorded continuous lunar seismic activity until late-1977.

"We applied tried and true methodologies from terrestrial seismology to this legacy data set to present the first-ever direct detection of the moon's core," said Renee Weber, lead researcher and space scientist at NASA's Marshall Space Flight Center in Huntsville, Ala.

In addition to Weber, the team consisted of scientists from Marshall; Arizona State University; the University of California at Santa Cruz; and the Institut de Physique du Globe de Paris in France. Their findings are published in the online edition of the journal Science.

The team also analyzed Apollo lunar seismograms using array processing, techniques that identify and distinguish signal sources of moonquakes and other seismic activity.

The researchers identified how and where seismic waves passed through or were reflected by elements of the moon's interior, signifying the composition and state of layer interfaces at varying depths.



An artist's rendering of the lunar core as identified in new findings by a NASA-led research team. (NASA/MSFC/Renee Weber)

Although sophisticated satellite imaging missions to the moon made significant contributions to the study of its history and topography, the deep interior of Earth's sole natural satellite remained a subject of speculation and conjecture since the Apollo era. Researchers previously had inferred the existence of a core, based on indirect estimates of the moon's interior properties, but many disagreed about its radius, state and composition.

A close-up view of the Passive Seismic Experiment, a component of the Apollo Lunar Surface Experiments Package (ALSEP) which was deployed on the Moon by the Apollo 14 astronauts during their first extravehicular activity (EVA-1). (NASA/JSC)

A primary limitation to past lunar seismic studies was the wash of "noise" caused by overlapping signals bouncing repeatedly off structures in the moon's fractionated crust. To mitigate this challenge, Weber and the team employed an approach called seismogram stacking, or the digital partitioning of signals. Stacking improved the signal-to-noise ratio and enabled the researchers to more clearly track the path and behavior of each unique signal as it passed through the lunar interior.

"We hope to continue working with the Apollo seismic data to further refine our estimates of core properties and characterize lunar signals as clearly as possible to aid in the interpretation of data returned from future missions," Weber said.

Future NASA missions will help gather more detailed data. The Gravity Recovery and Interior Laboratory, or GRAIL, is a NASA Discovery-class mission set to launch this year. The mission consists of twin spacecraft that will enter tandem orbits around the moon for several months to measure the gravity field in unprecedented detail. The mission also will answer longstanding questions about Earth's moon and provide scientists a better understanding of the satellite from crust to core, revealing subsurface structures and, indirectly, its thermal history.

NASA and other space agencies have been studying concepts to establish an International Lunar Network -- a robotic set of geophysical monitoring stations on the moon -- as part of efforts to coordinate international missions during the coming decade.

For more information about NASA science exploration missions, visit: http://www.nasa.gov/topics/moonmars

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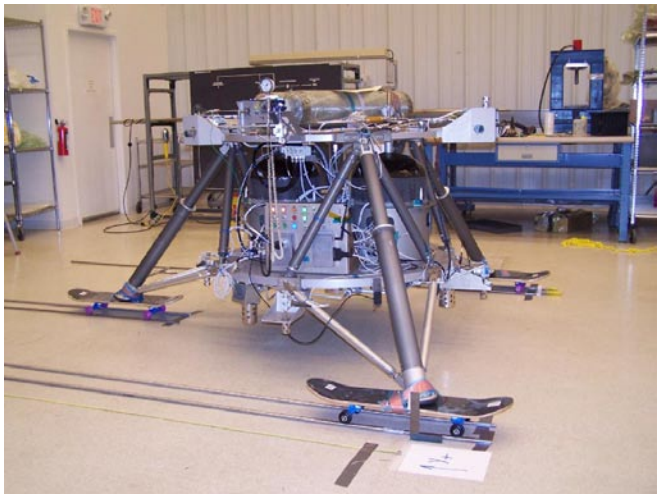
NASA's New Lander Prototype Skates Through Integration and Testing

NASA engineers successfully integrated and completed system testing on a new robotic lander recently at Teledyne Brown Engineering's facility in Huntsville in support of the Robotic Lunar Lander Project at NASA's Marshall Space Flight Center in Huntsville, Ala.

The lander prototype was placed on modified skateboards and a customized track system as a low-cost solution to control movement during final testing of the prototype's sensors, onboard computer, and thrusters. The functional test focused on ensuring that all system components work seamlessly to sense, communicate, and command the lander's movements.

The prototype will be transported to the United States Army Redstone Arsenal Test Center in Huntsville this week to begin strap-down testing, which will lead to free-flying tests later this year.



The robotic lander prototype was placed on modified skateboards and a customized track system as a low-cost solution to control movement during final testing of the prototype's sensors, onboard computer, and thrusters. Credit: NASA/TBE

The lander prototype will aid NASA's development of a new generation of small, smart, versatile landers for airless bodies such as the moon and asteroids. The lander's design is based on cutting-edge technology, which allows precision landing in high-risk, but high-priority areas, enabling NASA to achieve scientific and exploration goals in previously unexplored locations.

Development of the lander prototype is a cooperative endeavor led by the Robotic Lunar Lander Development Project at the Marshall Center, Johns Hopkins Applied Physics Laboratory of Laurel, Md., and the Von Braun Center for Science and Innovation, which includes the Science Applications International Corporation, Dynetics Corp., Teledyne Brown Engineering Inc., and Millennium Engineering and Integration Company, all of Huntsville.

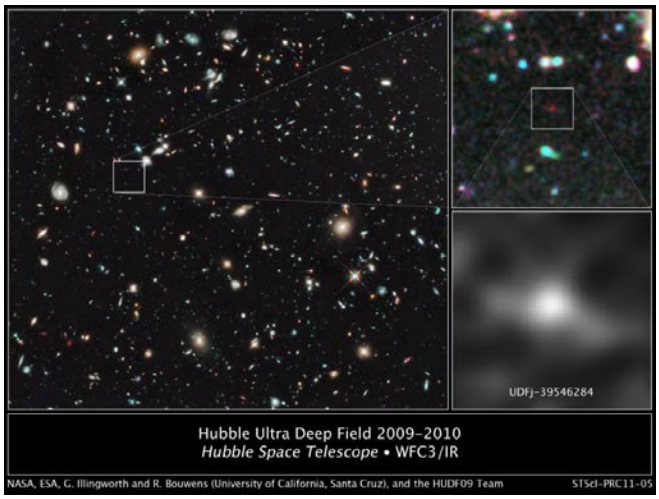
For more information on the Robotic Lunar Lander Development Project, please visit http://www.nasa.gov/roboticlander.

NASA's Hubble Finds Most Distant Galaxy Candidate Ever Seen in Universe

Astronomers have pushed NASA's Hubble Space Telescope to its limits by finding what is likely to be the most distant object ever seen in the universe. The object's light traveled 13.2 billion years to reach Hubble, roughly 150 million

years longer than the previous record holder. The age of the universe is approximately 13.7 billion years.

The tiny, dim object is a compact galaxy of blue stars that existed 480 million years after the big bang. More than 100 such mini-galaxies would be needed to make up our Milky Way. The new research offers surprising evidence that the rate of star birth in the early universe grew dramatically, increasing by about a factor of 10 from 480 million years to 650 million years after the big bang.



The farthest and one of the very earliest galaxies ever seen in the universe appears as a faint red blob in this ultra-deep–field exposure taken with NASA's Hubble Space Telescope. This is the deepest infrared image taken of the universe. Based on the object's color, astronomers believe it is 13.2 billion light-years away. (Credit: NASA, ESA, G. Illingworth (University of California, Santa Cruz), R. Bouwens (University of California, Santa Cruz, and Leiden University), and the HUDF09 Team)

"NASA continues to reach for new heights, and this latest Hubble discovery will deepen our understanding of the universe and benefit generations to come," said NASA Administrator Charles Bolden, who was the pilot of the space shuttle mission that carried Hubble to orbit. "We could only dream when we launched Hubble more than 20 years ago that it would have the ability to make these types of groundbreaking discoveries and rewrite textbooks."

Astronomers don't know exactly when the first stars appeared in the universe, but every step farther from Earth takes them deeper into the early formative years when stars and galaxies began to emerge in the aftermath of the big bang.

"These observations provide us with our best insights yet into the earlier primeval objects that have yet to be found," said Rychard Bouwens of the University of Leiden in the Netherlands. Bouwens and Illingworth report the discovery in the Jan. 27 issue of the British science journal Nature.

This observation was made with the Wide Field Camera 3 starting just a few months after it was installed in the observatory in May 2009, during the last NASA space shuttle servicing mission to Hubble. After more than a year of detailed observations and analysis, the object was positively identified in the camera's Hubble Ultra Deep Field-Infrared data taken in the late summers of 2009 and 2010.

The object appears as a faint dot of starlight in the Hubble exposures. It is too young and too small to have the familiar spiral shape that is characteristic of galaxies in the local universe. Although its individual stars can't be resolved by Hubble, the evidence suggests this is a compact galaxy of hot stars formed more than 100-to-200 million years earlier from gas trapped in a pocket of dark matter.

We're peering into an era where big changes are afoot," said Garth Illingworth of the University of California at Santa Cruz. "The rapid rate at which the star birth is changing tells us if we go a little further back in time we're going to see even more dramatic changes, closer to when the first galaxies were just starting to form."

The proto-galaxy is only visible at the farthest infrared wavelengths observable by Hubble. Observations of earlier times, when the first stars and galaxies were forming, will require Hubble's successor, the James Webb Space Telescope (JWST).

The hypothesized hierarchical growth of galaxies -- from stellar clumps to majestic spirals and ellipticals -- didn't become evident until the Hubble deep field exposures. The first 500 million years of the universe's existence, from a z of 1000 to 10, is the missing chapter in the hierarchical growth of galaxies. It's not clear how the universe assembled structure out of a darkening, cooling fireball of the big bang. As with a developing embryo, astronomers know there must have been an early period of rapid changes that would set the initial conditions to make the universe of galaxies what it is today.

"After 20 years of opening our eyes to the universe around us, Hubble continues to awe and surprise astronomers," said Jon Morse, NASA's Astrophysics Division director at the agency's headquarters in Washington. "It now offers a tantalizing look at the very edge of the known universe -- a frontier NASA strives to explore."

Hubble is a project of international cooperation between NASA and the European Space Agency. NASA's Goddard Space Flight Center in Greenbelt, Md., manages the telescope. The Space Telescope Science Institute (STScI) conducts Hubble science operations. STScI is operated for NASA by the Association of Universities for Research in Astronomy, Inc., in Washington.

January 2011 Celestial Events

supplied by J. Randolph Walton (Randy)

Day	Date	Time (EDT)	Event
Wed	2	17:13	Moon set
		21:31	**New Moon**
Sat	5	04:15	Venus Rises
		06:33	Mercury Rises
		07:05	Sunrise
		17:17	Mars Sets
		17:24	Sunset
		20:10	Moon set
		21:11	Jupiter Sets
		22:15	Saturn Rises
Fri	11	02:18	**First Quarter Moon**
		10:49	Moon rise
		18:18	**Lunar Straight Wall visible**
Sat	12	04:25	Venus Rises
		06:40	Mercury Rises
		06:57	Sunrise
		11:35	Moon rise
		17:32	Sunset
		20:52	Jupiter Sets
		21:45	Saturn Rises
Fri	18	03:36	**Full Moon**
		18:28	Moon rise
Sat	19	04:30	Venus Rises
		06:48	Sunrise
		17:40	Sunset
		19:44	Moon rise
		20:32	Jupiter Sets
		21:15	Saturn Rises
Tue	22	After 19:00	**Zodiacal Light** visible in W after evening twilight for next two weeks
Thu	24	10:15	Moon set
		18:26	**Last Quarter Moon**
Sat	26	02:37	Moon rise
		04:35	Venus Rises
		06:32	Mars Rises
		06:38	Sunrise
		17:48	Sunset
		17:52	Mercury Sets
		20:10	Jupiter Sets
		20:45	Saturn Rises
Fri	Mar 4	15:46	**New Moon**
		18:03	Moon set

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
NGC 1501	Planetary Nebula	Camelopardus	04h06m59.4s	+60°55'14"	13.3
Cleopatra's Eye	Planetary Nebula	Eridanus	04h14m15.8s	-12°44'21"	9.6
The California Nebula	Diffuse Nebula	Perseus	04h03m12.0s	+36°22'00"	5.0
NGC 1664	Open Cluster	Auriga	04h51m04.4s	+43°42'04"	7.2
MSH 04-12	Quasar	Eridanus	04h07m48.4s	-12°11'36"	14.8
NGC 1360	Planetary Nebula	Fornax	03h33m14.6s	-25°52'18"	9.6
Crystal Ball	Planetary Nebula	Taurus	04h09m17.0s	+30°46'33"	10.0
Palomar 2	Globular Cluster	Auriga	04h46m06.0s	+31°22'54"	13.0
K 2-1	Planetary Nebula	Auriga	05h07m07.1s	+30°49'18"	13.8
NGC 1624	Open Cluster	Perseus	04h40m25.4s	+50°26'49"	11.8

A Parting Shot…

We leave you this month with another image from Ernie Rossi in Leesburg, Florida. NGC2244, aka the Rosette Nebula. Ernie used a 4" f/5.4 refractor on GT-5 mount auto-guided. 10X360 second exposures at ISO1600 using a Canon 50D camera, Deepsky Stacker, and Photoshop. As Ernie says… It really does look like a rose.