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Rose Center's First Decade: Tyson Looks Back—and Ahead

By Dan Harrison

In its first decade, the AMNH's Rose Center, which includes the new Hayden Planetarium, and the museum itself, have become top destinations for tourists, not to mention all the metro-area residents who visit. Attendance has hit records in the past three years. "This has told me it's possible for science to compete with other cultural institutions," Hayden director Dr. Neil deGrasse Tyson said in an interview last month. "It's an implicit endorsement of the value of making science visible and accessible to the public."

As for the popularity of the Rose Center and the Hayden among locals, Tyson noted the value of having an entrance on Columbus Avenue, even though most Hayden visitors enter on 81st Street. "Not since Lincoln Center opened [almost 50 years ago] has the Upper West Side had a major cultural destination. The Columbus Avenue entrance is a statement to the community. The community has a relationship to the planetarium. Repeat visitors are local. They attend programs, bring their families and create memories for the future. The [relationship with the neighborhood] makes us a better neighbor."

Interviewed in his office as 10th-anniversary celebrations for the Rose Center this month approached, Tyson, who turns 52 this month, noted that in part due to an extended sabbatical, his visibility in the media has been greatest. The sabbatical has enabled him to probe public interest in science in general and the universe in particular. "I'm pleased with what I've seen. Interest in science is real and growing. I not only see this appetite directly but it's also in evidence by an increase in science documentaries and channels. That all this activity is no longer a one-man show is a true metric of increased interest."

Public interest in science and astronomy has stimulated ideas on Hayden exhibits that would energize the public in the near future, Tyson observed. "I have brought what I have seen during the sabbatical into new programs. It's a work in progress."

Because programs in the Hayden's Space Theater are traveling exhibits since they go to other planetaria, they're informed by what the public is interested in. Permanent Rose Center exhibits, Tyson said, stay away, by design, from the "bleeding frontier" of the field, which "changes faster than planning time for exhibits." But Hayden programs, he adds, can go to the bleeding edge with monthly lectures, Asimov panels and special events. This dichotomy in programming, Tyson said, adds up to the best way to bring science to the public.

When his sabbatical ends, Tyson will reduce his celebrated public role to earlier levels. "I derive far greater benefit from research than from media opportunities. Put another way, I derive far less pleasure as a rock star than from research and playing with my kids. But I would be irresponsible not to help advance scientific literacy. I would still serve the public interest after other priorities.

"Back when I was stopped by up to 10 people a day, they would typically ask me more questions about the universe. But as that number rose, the additional people were more likely to ask for my autograph instead, leaving me to wonder if I had failed as an educator."

Tyson said that when he gets back to full time at the Hayden, his role in more creative programming will rise to the fore. "We'll reinvigorate Nights at the Dome and transform other programs. There are many things to do

Tyson continued on page 6

What's Up

By Tony Hoffman

The Sky for October 2010

A Midnight Comet. Comet 103P/Hartley 2, which circles the Sun every 6.9 years, is normally an inconspicuous object, but this month it will make its closest approach since its discovery by Australian astronomer Malcolm Hartley in 1986. Better yet, the comet will be visible in a dark sky far from the Sun. Comet Hartley, which is expected to brighten to about 5th magnitude, will speed across the northern sky this month, passing from Cassiopeia through Perseus and Auriga to southern Gemini. On October 8, in a moonless sky, the comet will pass near the Double Cluster in Perseus. Comet Hartley will pass just 0.12 AU (11 million miles) from Earth and will reach perihelion October 28.

Jupiter Rules. Two planets will be particularly prominent this month. In early October, Venus blazes at magnitude -4.8 in the southwest in the early evening, but is only visible briefly after sunset. By midmonth it will be lost in the solar glare. On October 28, Venus is at inferior conjunction, passing near the Sun as it crosses over to the morning sky.

The real spectacle, though, will be Jupiter. Just past its closest approach to Earth in 50 years, our solar system's largest world will shine at magnitude -2.9 and be visible nearly all night. Jupiter's disk spans nearly 50 arcseconds. Even a small telescope will show at least one cloud belt, and a good pair of binoculars will reveal the four moons that Galileo discovered 401 years ago: Io, Europa, Ganymede and Callisto. The moons are in constant motion, and sometimes their changes in position relative to each other and Jupiter are discernable in a matter of minutes. Transits of the moons and their shadows across Jupiter's disk are a treat to watch, and we'll get a double helping October 30, when both Ganymede and Europa, as well as their shadows, will cross the face of Jupiter in the early evening. Jupiter will pass from Pisces to Aquarius around mid-month.

October 6 Moon is at perigee, 223,355 miles from Earth, 9:38 a.m.
October 7 New Moon at 2:43 p. m.
October 9 Moon lies near Venus and Mars.
October 14 First-quarter Moon at 5:27 p.m.
October 20 Moon lies near Jupiter; Comet Hartley is closest to Earth.
October 21 Orionid meteor shower peaks.
October 22 Full Moon at 9:37 p.m.
October 28 Venus is at inferior conjunction; Comet Hartley is at perihelion.
October 30 Last-quarter Moon at 8:46 a.m.

Jupiter Returns to Evening Sky

By Joseph A. Fedrick

The South Equatorial Belt still appeared a very pale, faint blue-gray in my 60mm refractor and 150mm reflector during late August. The Great Red Spot appeared to darken somewhat from its appearance earlier this year and was visible at 100x in my 60mm refractor as it crossed the meridian at 10:30 p. m. August 30 and as it approached the meridian late on the evening of September 1. It appeared a shade of salmon pink in my refractor on those dates just north of the grayish south temperate belts, but was more easily visible in my 6-inch reflector August 30.

Io's shadow was barely visible transiting Jupiter's disk at midnight August 30-31 in the 100x eyepiece of my 60mm refractor. In the past, I've seen the shadows of Io and Ganymede using only my 60mm refractor at 100x. Europa's shadow is undetectable with my 60mm refractor and barely visible in my 6-inch reflector, while the shadow of Ganymede is very large and dark black as seen with both telescopes. I don't think I've ever seen a shadow transit of Callisto.

The south equatorial belts seem a very slight bit more visible in my scopes lately, but still appear very pale. I plan to continue to observe Jupiter to see if a so-called South Equatorial Belt revival--return of the usual dark gray-brown hue of the belt--occurs this year. ■

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A Message from AAA President Richard Rosenberg

Hello members:

One of the best parts of observing is showing children the sky. I'd like to mention a few of my favorite memories.

Two years ago, we were observing at Fulton Ferry State Park, on the Brooklyn side of the East River just north of the Brooklyn Bridge. A few of us were waiting for Jupiter to appear above the trees. A boy, perhaps 10, had joined us and began playing with the scope. We saw he wasn't doing anything harmful so we let him continue. After chatting with club members and the public for a while, I looked up, saw Jupiter and hollered, "There it is," whereupon the boy mentioned he'd been looking at it for five minutes while we were talking! He was able to point one of our eight-inch Dobsonian scopes at Jupiter. For about an hour thereafter, he followed Jupiter across the sky.

Early this year at the High Line in lower Manhattan, I brought my 11x80 binoculars (my tripod was broken so my scope was unavailable). Most people understandably prefer to look through a scope rather than binoculars, but a young boy, also about 10, was different. When I pointed out Venus, Mars and Saturn in the western twilight, he took my five-pound binoculars and found them with no trouble. But this was just the beginning. Ignoring the telescopes, every few minutes he'd notice a new object, generally a star, ask me what it was, then borrow the binoculars to take a closer look. He kept this up until the end of the session.

Back in Brooklyn only a few weeks ago, I showed a young girl (maybe 8) the Moon. After she took her turn, she watched me keep the scope aimed at the Moon. The scope was at high power to show close-up views of lunar features, and it required manual adjustment every two minutes. What's more, the scope was slightly damaged, and the finder scope couldn't be exactly aligned with the main scope. After a while, I moved to set up another scope. The girl took my place. She looked at the Moon as it appeared in the finder and in the eyepiece. Then she figured out where to position the Moon in the finder so it would show up in the eyepiece, and made small adjustments to center the Moon in the eyepiece. She did this every few minutes, as people took a look, and stayed a long time until her folks picked her up.

Among many enjoyable observing sessions, these three stick in my mind. Getting children interested in the sky is one of the most important things we do.

Rich Rosenberg, president@aaa.org, (718) 522-5014

With Date Change, Two AAA Lectures Are Scheduled This Month

The November 5 AAA lecture by Michael Tuts, Columbia University professor of physics, has been changed to Friday, October 22 at 6:15 p. m. in the Kaufmann Theater of the AMNH. He'll discuss "Particle Physics at the Large Hadron Collider and Cosmology."

Dr. Max Tegmark, MIT physics professor, will begin the AAA's 2010-11 lecture series Friday, October 1 with a talk on "The History of the Universe in One Hour."

Other lectures are as follows: December 3, Suzanne Young, University of New Hampshire and NASA, "Top 10 Discoveries of the Phoenix Mission to Mars." January 7, Robert Nemiroff, Michigan Technological University, "Best Astronomy Pictures of the Day, 2010." February 4, Neil Weiner, NYU, "Illuminating Dark Matter." March 4, Andrea Dupree, Harvard-Smithsonian Center for Astrophysics, "Searching for Extrasolar Planets with Kepler." April 1, Greg Matloff, New York City College of Technology, "Regreening the Earth Using Space Resources." May 6, David J. Thompson, NASA, "Exploring the Extreme Universe with the Fermi Gamma -ray Space Telescope."

Dupree's talk will be the club's annual John Marshall Memorial Lecture, which honors a past president and executive director of the AAA who was instrumental in the club's growth.. Marshall died in 1997. ■

An Introduction to Cosmology with a Noted Guest Lecturer

By Jason Kendall

This summer, I conducted a six-week class in introductory cosmology. Using an upper-division undergraduate textbook by Dr. Barbara Ryden, "Introduction to Cosmology," I led the class on an admittedly difficult path with a few hardy souls from the club. The goal was to approach the class as a physics course, not shying away from mathematics, providing an understanding of concepts and principles important to the field.

In many public lectures on cosmology, we frequently hear prognostications from experts which do little to give true understanding. I decided we'd tackle ideas head-on, enabling participants to relate to real data. The class covered basics in relativity, distance measurement, spacetime curvature, equations of state, modeling the universe with various constituents, Cosmic Microwave Background Radiation (CMB), Big Bang nucleosynthesis, the power spectrum, inflation and structure formation.

The students were varied, ranging from those with little or no physics background, to faculty from universities looking to brush up their knowledge. The course was supported by the NASA/JPL Solar System Ambassadors Program, of which I'm a member.

After the six weeks, I asked the team of the Wilkinson Microwave Anisotropy Probe (WMAP) to provide a speaker. Dr. David Spergel graciously volunteered his time. He's a team leader on the WMAP, the spacecraft that succeeded the Cosmic Background Explorer (COBE) in the study of the CMB.

WMAP's seven-year mission has produced amazing results, giving the age of the universe to within 1%, determining the composition of the universe to high precision and refining measurement of the universe's content to within a few percent. WMAP ushered in precision cosmology, and the Planck satellite will give even greater resolution while confirming WMAP's findings.

Spergel spoke via conference call from Princeton University on the latest results from WMAP. The most important point is that the telescope again confirmed the overwhelming presence (~72%) of dark energy in the universe, an invisible field that causes the universe to expand at an accelerating and exponential rate. WMAP also affirmed the existence of dark matter, 23% of everything, that behaves like normal matter but doesn't interact with light. This leaves only 4% of the universe that consists of what we call normal matter.

Spergel showed many graphs of the "power spectrum" of temperature fluctuations embedded in the CMB. These graphs, which show temperature variation from average as a function of angular separation across the sky, are part of key data obtained by the telescope. The power spectrum measures temperature differences for two directions on the sky at a given angular separation averaged across the whole sky. This is a measurement of the anisotropy in the CMB. These anisotropies have many implications, and models of the content of the universe are strongly constrained by the results.

WMAP's results show the universe in 13.69 billion years old, with error bars of 1%. WMAP also shows the universe is "flat," meaning that on the largest scales, space has little intrinsic curvature. Spergel also allowed us to see results from an upcoming Atacama Cosmology Telescope (ACT) paper that hadn't been submitted to journals as of the conference call. These new results show increasingly detailed measurements of the power spectrum down to tiny angular scales, demonstrating the ACT's ability to see distortions in the CMB due to individual point sources on the sky; lensing effects due to large, early-universe mass concentrations; and those due to hot electrons in massive galaxy clusters.

Spergel described capabilities of ESA's Planck mission, which is expected to improve WMAP results but not challenge the basics. He said that so far, the standard model of the universe, with a Big Bang, inflation and subsequent expansion of a universe filled with matter, dark matter, radiation and dark energy, fits observations. He stated we now live in the golden age of cosmology, where accurate measurements are leading to precise values for the age, content and structure of the universe.

A PDF of Spergel's presentation is available at http://www.moonbeam.net/InwoodAstronomy/events/2010/08/30.shtml..■

Amateurs Played Key Roles in Three Recent Discoveries

Amateur skywatchers have spotted what appeared to be a new fireball on Jupiter, the third apparent impact in 13 months on the planet. On August 20, Japanese amateur astronomer Masayuki Tachikawa caught the fireball on video, according to Spaceweather.com. A separate image of the fireball was later confirmed by Japanese amateur astronomer Aoki Kazuo. Kazuo recorded a flash on Jupiter at the same time and in the same place as Tachikawa, Spaceweather.com reported.

The 490-mile separation between the observers excluded the possibility of the flash coming from an event near Earth. The August 20 fireball came just over a year after another crash on July 19, 2009, when what scientists now think was an asteroid about 1,600 feet wide slammed into the planet. That collision created a massive bruise the size of the Pacific Ocean. On June 3 this year, Australian amateur astronomer Anthony Wesley reported seeing a flash on Jupiter while watching a live video feed of the planet from his telescope. In the Philippines, amateur astronomer Christopher Go confirmed the discovery from his own simultaneous video recording of the event.

Astronomers around the world determined that some object must have whacked Jupiter to unleash a flash of energy bright enough to be seen 400 million miles away. Unlike July 2009, there was no visible scar or debris cloud from the June 3 impact, so astronomers are unsure how deep the object penetrated the atmosphere.

The Hubble's sharp vision and ultraviolet sensitivity sought traces of the aftermath of the June collision. Images showed no sign of debris above Jupiter's cloud tops. That suggests the object didn't descend beneath clouds and explode as a fireball. Like June 3, the fireball didn't produce visible debris, with no visible mark in RGB, UV or methane post-impact.

The June 3 mystery fireball was later identified as a giant meteor that plunged into Jupiter's atmosphere and burned up high above its cloud tops. After comet Shoemaker-Levy 9 broke into more than 20 pieces and pelted Jupiter repeatedly in 1994, astronomers estimated such impacts could occur on Jupiter every 50-250 years. With recent collisions occurring less than a year after the July 2009 incident, researchers are rethinking estimates of the frequency of such planetary impacts on Jupiter.

Meanwhile, a network of volunteers donating spare computer time has helped discover a strange pulsing star in deep space. A German man and a couple from Iowa are credited with the find, the first deep-space discovery by Einstein@Home, a project in which 250,000 people from 192 countries allow their personal computers to work on scientific problems in the background. The collective computing power of these computers is substantially greater than the largest supercomputers.

The newly discovered star is a pulsar. The typical pulsar spins about once per second and is highly magnetized. The pulsar that was found was among the more quickly spinning ones, but it also has a low magnetic field. PSR J2007+2722 rotates 41 times per second. While most stars that spin so fast are part of binary pairs of two stars, this one lacks a companion. Scientists think it may have originated as half of a binary, but the second star may have exploded in a supernova that disrupted the pair and sent it off in another direction.

The original observations used to find the pulsar were gathered at Arecibo. After preprocessing, observations were split into chunks and distributed to volunteers around the world participating in Einstein@Home. One computer that discovered the pulsar's signal belongs to Helen and Chris Colvin of Ames, Iowa. The Colvins are information-technology professionals.

In a third development, massive, distant galaxies have been spotted gorging on smaller ones to build up their bulk. Galactic cannibalism has been seen before, but now scientists have observed the behavior in distant galaxies. As they're digested, smaller dwarf galaxies are severely distorted, forming structures such as spindly tendrils and stellar streams that surround their captors. These streams --tidal tails--form because of the stronger gravitational pull on the near side of the small galaxy than the far side. Stars closer to the parent galaxy are pulled in more quickly, while stars farther away lag behind.

In the new study, tidal tails were found around spiral galaxies up to 50 million light-years away. Images were collected by researchers worldwide, working with amateurs using amateur scopes and CCD cameras. The study found major tidal streams with masses 1%-5% of the galaxy's mass are common in spirals. ■

Showing Hospitalized Kids the Wonders of the Sky

By Jason Kendall

On September 15, I shared the night sky with children at the New York Presbyterian Children's Hospital. The kids have life-threatening illnesses and surgeries, and their families stay with them for support. The hospital asked me to give a short talk on astronomy and show the sky through a telescope in a conference room.

My wife Donna and her singers were part of the event, singing her IYA2009 song "Up Up Up in the Sky" as well as a lullaby based on the zodiacal constellations. I talked about many things, including New Horizons and the Kepler Space Telescope, but the highlight was getting the kids, who were out of wheelchairs, and one who was in hers, help me set up a human solar system. Each kid wanted to be his or her own planet.

I gave the children and their families NASA and space posters. The families are going through the hospital stay together, and need things that help them forget for a moment, and release strong emotions.

The hospital creates these events to help families with their difficult job of caring for their children. Apparently, nothing is better than seeing Albireo and the Perseus Double Cluster through a telescope. I was swarmed by kids and adults with my 8" Celestron in the yard.

One particularly touching moment was with six-year-old Malcolm and his father. Clearly tired from the excitement, Malcolm wanted to stay up as long as he could. As I got a poster of galaxies for him, I also gave him a Fermi Cube, a little item with pictures of the Fermi Space Telescope. As I showed it to him, he was enthralled with the images, a tear growing in his eye as I chatted with him about it. His father looked over Malcolm's shoulder, and upon seeing his son enjoying himself, a smile dawned across his face for what looked like the first time in a long while.

Malcolm was too tired to go outside to look through the telescope, but the time was good for him. He said good night, and he and his father walked hand-in-hand into the hospital, their other hands filled with posters and their thoughts no doubt of space, stars and planets.

Donna and I have been asked to return Thanksgiving week, and will be happy to do so.

In March, I was contacted by Discovery Channel to assemble a star party on a Manhattan rooftop. They were filming an episode of Dr. Michio Kaku's "Physics of the Impossible" and wanted an interesting backdrop.

I called club members and others who own scopes. On April 19, the crew contacted me about a shoot that Kaku was doing on exoplanets. He was to chat with Dr. R. Paul Butler of Carnegie Institute of Washington.

As they discussed exoplanet 47 Ursae Majoris, a bunch of amateurs looked up with their scopes. Kaku and Butler enjoyed their time with club members and other observers.

You may view a clip of the event at http://science.discovery.com/videos/sci-fi-science-ii-strange-new-world.html. The show aired September 15. ■

Tyson continued from page 1

beyond the steps that have been taken to bring the visibility of the universe to the public."

Tyson also wants to revive the Hayden's role with the amateur community. "I stepped away from a relationship with amateurs after I left the [AAA] board. I want to draw on amateur astronomers regarding use of scopes so amateurs and professionals can do what they do best."

But not everything will wait until Tyson's sabbatical ends. A new Big Bang presentation is about to debut with "new things to talk about." The renowned Cosmic Pathway has already had what Tyson called "two and a half modifications" to garner greater attention.

Money has been stable, although some projects have been on hold since the 2008 crash. "Record attendance means the crash hit us less than it would have and less than other cultural institutions. Government funding for science has remained strong. It enjoys bipartisan support, with bickering occurring on the edges." ■

Briefs: Two Major Extrasolar-Planet Discoveries Announced

European Southern Observatory astronomers have discovered a group of at least five planets, with hints of two more, circling a star in an arrangement similar to our solar system. This would be the highest tally of worlds spotted around a star. The planets are 127 light-years away in Hydrus, one of 15 planetary systems known to have more than three worlds. The planets circle star HD 10180 in a pattern like our solar system, only more compactly. The discovery could mean study of complex planetary systems has begun, not just planets. Studies reveal complex gravitational interactions between the planets and provide insights into the system's long-term evolution. The five strongest wobble signals were caused by planets with masses similar to Neptune, 13-25 times Earth mass. Though these planets are relatively large, they're close to their star and orbit in six to 600 days. The closest planet is 5.6 million miles from HD 10180, the farthest about 1.4 AU. All the planets would fit inside Mars' orbit and appear to have nearly circular orbits. One of the two suspected additional planets, if confirmed, would be like Saturn, with at least 65 times Earth mass and a 2,200-day year. The other would be the least massive world found outside our solar system, with a mass 1.4 times Earth's. It's thought to orbit 2% of an AU from its star and does a circuit in 1.18 days. This planet would probably be a small, rocky world.

A group of alien planets which may include one of the smallest, most Earth-sized worlds yet seen has been discovered around a star like the Sun. Two Saturn-sized planets orbit a star about 2,300 light-years away. There's also a candidate for a planet roughly the size of Earth within the same system; early analysis suggests it has a radius 1.5 times Earth's. Analysis of Kepler observations was combined with transit timing and radial-velocity observations to estimate the planets' masses. The system's two larger planets, Kepler-9b and Kepler-9c, have similar diameters, masses and densities as Saturn. However, they're so close to their star their orbits would fit inside Mercury's orbit. The Earth-sized world, if confirmed, would be so close to its star it would look nothing like Earth. Observations suggest the planet has an orbital period about 1.6 Earth days, much shorter than Kepler-9b and 9c. It takes the larger planet Kepler 9b 19.2 days to complete an orbit. Kepler 9c orbits every 38.9 days. Scientists could determine the planets' sizes by measuring the light they block when passing in front of their star. To estimate their masses, researchers observed their gravitational interaction. They lack circular orbits, but they're not highly elliptical.

The solar system may be up to two million years older than previously thought, a new study has found. Researchers studying bits of a meteorite discovered it was 4.57 billion years old, predating estimates of the solar system's age by up to 1.9 million years.

The Moon is shrinking slightly, according to a new study that's discovered a clutch of previously unseen faults on the lunar surface. These structures, lobate scarps, are among the Moon's youngest landforms. Their distribution suggests cooling in the interior is the contraction's likely cause. There's been 328 feet of change in the Moon's radius over 1 billion years. Scientists could gauge the fault scarps' age by comparing them to other geological landforms, and using a dating method to examine the presence of impact craters on the structures.

Monster black holes at the heart of galaxies may have originated from galaxy collisions during the early universe, models suggest. Astronomers found the presence of supermassive black holes within the first billion years of the universe, meaning they took much less time to form than thought. New calculations suggest mergers between massive protogalaxies of the early universe provided a breeding ground for supermassive black holes, each forming during only 100 million years or so. Simulations suggest a merger could have formed an unstable, rotating disk of gas, which funneled gas amounting to more than a 100 million times the mass of the Sun into a small cloud in only 100,000 years. In a new model, the black hole grows much faster than the galaxy. So the black hole may not be regulated by growth of the galaxy, but the galaxy is regulated by growth of the black hole.

Scalding water vapor has been discovered in the atmosphere of an aging star, surprising scientists who thought the chemistry of such stars would forbid it. Water exists as a gas at 1,300 degrees in the outer atmosphere of IRC+100216, 500 light-years away. Water's chemical signature isn't a rarity in stars, but in certain elderly stars made mostly of carbon, water was thought

Continued on page 8

Briefs: Astronomers Discover a Pulsating X-ray Neutron Star

Continued from page 7

to be absent. As some stars grow old, they become carbon-rich. One of the first molecules to form in these stars is carbon monoxide. Until now, scientists thought available oxygen in a carbon-rich star would be used up in CO, leaving none to bond with hydrogen to form water.

Asteroids can split into pieces, creating two smaller rocks with separate paths around the Sun, a new study finds. The process can happen non-destructively: Just add sunlight and lots of time. The discovery comes from an analysis of 35 "divorced asteroid pairs." They've come very close together at some point in the last million years. Researchers determined the sizes of these asteroids by measuring their relative brightness, and studied the spin rate of each pair with aphotometry. Asteroids averaged less than six miles wide. In the pairs, the smaller was always less than 60% as big as its companion. Many asteroids are believed bits and pieces held together by each other's gravity. If the solar-induced spin gets fast enough, a chunk on an asteroid's end can split off. In binary-asteroid pairs, theory goes, this chunk sticks with the bigger asteroid and the two rotate around each other. But calculations predicted the baby can break free if it's less than 60% as big as the parent.

In a cosmic first, astronomers have discovered a pulsing X-ray neutron star, the ultra-dense leftover from a supernova explosion, being eclipsed by a companion star in deep space. In this binary system, 22,000 light-years away, Swift J1749, a normal star, is eclipsing a pulsar. The pulsar is only 12 miles across, but 60,000 times denser than our Sun. It spins 518 times per second. The beams the pulsar emits are in the X-ray range. In April, a satellite observed three 36-minute eclipses in the system during one week, as the pulsar passed behind the normal star. This is the first time a fast X-ray pulsar has been observed being eclipsed by its companion star. Tracking the pulsar's motion revealed a great deal about Swift J1749 and could shed light on neutron-star systems like it. The normal star is about 70% as massive as the Sun, but it's 20% larger than its mass and apparent age suggest it should be. The star's surface may be puffed up by radiation from the pulsar, which is only 1 million miles away. This additional heating probably also makes the star's surface especially disturbed and stormy.

If life does--or ever did--exist on Mars, signs of such life might be found in a northern region called Acidalia Planitia, according to a new study. The region appears to be dotted with geological structures known as mud volcanoes, spewing out muddy sediments from underground. These sediments might contain organic materials that could be biosignatures of possible past and present life. Scientists mapped more than 18,000 of these circular mounds. An estimated more than 40,000 mud volcanoes could be found in the region. Scientists ruled out the chance the mounds were caused by other processes and can't be from impact structures, ice-cored mounds, evaporation deposits or structures caused by lava flow.

Astronomers have discovered an asteroid in a region of Neptune's orbit where no previous object was known to exist. The rock, which follows Neptune's orbit, was found in a hard-to-detect area near Neptune, Lagrangian point L5. It has an estimated 62-mile diameter, always trails Neptune and takes the same amount of time to circle the Sun, but there's a key difference between orbits. The asteroid has a highly inclined orbit, meaning for half of its orbit it swings north of Neptune and for the other half it sits south relative to the plane of the solar system.

An unexpected, powerful new kind of star explosion has been discovered, a so-called gamma-ray nova that radiates the most energetic form of light in the universe. Researchers hadn't seen gamma-rays emitted by novas. The gamma rays emerged from a binary system in Cygni 8,800 light-years away, which consists of a white dwarf and a pulsating red giant. In March, amateur Japanese astronomers spotted this nova. which at its peak was just below naked-eye visibility, brighter than at any point in the nearly 75 years scientists had watched the system. Researchers suggest the gamma rays were generated when blast waves from the nova collided with the very dense winds from the red giant. Very few binary systems combine red-giant companions and the kind of white-dwarf stars that burst with novas.

A fresh crater on Mars has revealed a hidden cache of frozen water. An image from NASA's Mars Reconnaissance Orbiter shows a patch of water ice at the bottom of a 20-foot-wide young crater in Mars' northern

Continued on page 9

Briefs: Mars Crater Reveals Hidden Cache of Frozen Water

Continued from page 8

hemisphere. Scientists suspect it formed between April 2004 and January this year. The icy crater is farther south than some other sightings of buried water ice. The ice patch covers up to 20 square feet.

So-called spacequakes are temblors in Earth's magnetic field caused by plasma flying off the Sun that could help generate colorful auroras high in Earth's atmosphere, a new study suggests. While felt most strongly in Earth orbit, the quakes can reach the Earth's surface. Scientists have also discovered starquakes, moonquakes and asteroid quakes.

A giant black hole spouting energy from inside a galaxy is acting like a cosmic magnifying glass, giving astronomers a clear view of an even more distant galaxy behind it. It's the first time a quasar has been discovered acting as a gravitational lens. The discovery gives astronomers a glimpse of two galaxies at once, allowing researchers to photograph the object while weighing and measuring the intervening galaxy and the powerhouse at its core. The quasar is about 1.6 billion light-years away. In this case, scientists are more interested in studying the lens than the magnified image. By studying the way a quasar magnifies light as a gravitational lens, astronomers can measure the masses of quasar host galaxies.

Some scientists have thought the Ice Age 12,900 years ago was triggered by a meteor or comet. But a recent study suggests evidence pointing to the ancient impact is nothing more than fungus and other matter. Samples appear thousands of years before and after the Ice Age in sediment records. But impact-theory proponents aren't backing down.

Titan gets its oxygen from icy geysers on Enceladus, a model of Saturn's magnetosphere and moons reveals. How oxygen made its way onto Titan had been a mystery. Icy geysers on Enceladus shoot water molecules into the magnetosphere, where they break down into oxygen and hydrogen as they travel to Titan. Researchers found oxygen particles can attach to carbon molecules on Titan after they migrate to the moon. These "cages" protect oxygen reacting with methane in Titan's atmosphere and could reach the surface attached to dust particles.

A spot on Mars called Nili Fossae, abundant in clay-mineral-rich rocks, could be a prime spot to search for fossilized remains of Martian life that may have existed 4 billion years ago, a new study suggests. Scientists used the Mars Reconnaissance Orbiter to study clay-carbonate rocks from the ancient Noachian period. They suggest associated hydrothermal activity would have provided energy for biological activity at Nili Fossae. Researchers studied hydrothermal formation of clay-carbonate rocks at Nili Fossae. Data indicate they share similarities with traces of life and biological markers on early Earth.

NASA is developing a mission to plunge a car-sized probe directly into the Sun's atmosphere, going where no spacecraft has gone before. Solar Probe Plus will launch no later than 2018. Five science experiments will ride aboard, including a solar-wind particle detector, a 3-D camera and a device to measure the Sun's magnetic field. The spacecraft will take unprecedented close views of the Sun, enabling scientists to better understand and forecast the radiation environment for future explorers. Experiments are designed to solve two key questions: Why is the Sun's outer atmosphere so much hotter than its visible surface, and what propels the solar wind?

Some ancient galaxies may have been packed with frenetic star birth. Researchers using Spitzer found that the birth rate is higher in the center of a 10-billion-year-old, distant cluster that actively formed stars. The birth-rate is the opposite of what's been observed in our local part of the universe, where galactic clusters are full of massive elliptical galaxies packed with only old stars. Why star-making power increases as galaxies become more crowded is a mystery.

A "supervolcano" in massive galaxy M87 is blasting gas outwards. The eruption, driven by a giant black hole in M87's center, is preventing hundreds of millions of new stars from forming. The black hole's reach extends ever farther into the entire cluster. M87 is about 50 million light-years away at the center of the Virgo cluster.

Two asteroids swept past Earth September 8. This

Continued on page 10

Briefs: 14 Large Space Rocks Beyond Neptune's Orbit Found

Continued from page 9

was the first time two were detected within 24 hours, but that's probably because scientists don't know everything out there. With a rough estimate of 50 million unknown asteroids, single asteroids that make close passes usually slip by unnoticed. A 33-foot-wide rock could pass harmlessly between Earth and the Moon's orbit every day. Such an asteroid might hit Earth's atmosphere once every 10 years, but because of its small size, it would pose no substantial threat. In the double flyby, the larger of the two rocks, an estimated 33-to-65-feet wide, passed Earth within 154,000 miles. The second asteroid, 20-to-46-feet -wide, passed within 49,000 miles.

A large asteroid that has a remote chance of hitting Earth would most likely hit in 2182, if it crashed at all. Asteroid 1999 RQ36 has about a 1-in-1,000 chance of hitting Earth; half that risk corresponds to 2182. Using models, scientists found two potential opportunities for the asteroid to hit in 2182. The rock is 1,837 feet across.

Most big, super-hot alien planets astronomers search for in old star clusters may have been destroyed long ago, a new study suggests. These hot Jupiters were likely ripped apart by tidal forces that caused them to spiral into their own stars. In the cramped orbit of a hot Jupiter, the huge planet's gravitational pull can create a tide, or bulge, on its parent star. As the planet orbits, the star's bulge points a little bit behind the planet and essentially pulls against it. This drag reduces the energy of the planet's orbit, and the planet moves a little closer to its star. This causes the bulge on the star to enlarge and sap even more energy from the planet's orbit. This process continues for billions of years until the planet crashes into the star or is torn apart by its gravity.

By tasting rocks and air on Mars, the Phoenix lander discovered secrets about the history of water there during the last 4 billion years. Carbon dioxide in Mars' atmosphere shows evidence of recently interacting with liquid water. When combined with studies of 4-billion-year-old Martian meteorites on Earth, results also suggest Mars has experienced substantial interactions between rock and cold water throughout its history. Scientists used Phoenix' observations of carbon dioxide isotopes in Mars' atmosphere to study its water history.

A meteorite that hit Earth in 1864 has been found to contain microscopic shrapnel from a star that exploded about the time the solar system was born. Analysis of the Orgueil meteorite indicates a nearby star exploded in a supernova around 4.5 billion years ago. From faint remnants of the explosion, researchers can determine what kind of star exploded. This could solve the mystery of why levels of chromium vary by planet and meteorite.

The Lunar Reconnaissance Orbiter has wrapped up the exploration phase of its Moon-watching mission and is shifting into pure science to help scientists better understand the Moon. Until now, it had scouted the Moon to help NASA plan for future exploration missions. LRO's new phase will be more focused on answering specific research questions than on broad exploration.

Astronomers have discovered a cache of 14 large space rocks beyond Neptune's orbit while sifting through Hubble archives. The objects are 25-60 miles across. To find the group, researchers searched through Hubble photos for telltale streaks of light that images of these rocks leave as they move through space during time-lapse exposures. Trans-Neptunian objects are building blocks left over from formation of the solar system.

Popular astronomy explainer Jack Horkheimer died August 20 at 72. Horkheimer was best known for his weekly TV show on PBS, where he was the Star Gazer. The five-minute show debuted in 1976. He was also a longtime guide at Miami's Space Transit Planetarium. ■

Storch Receives Award

Teacher, avid amateur astronomer and AAA member Sam Storch received the NERAL Special Service Award for his work in astronomy education. He ran the Edwin P. Hubble Planetarium at Edward R. Murrow High School in Brooklyn for more than 30 years before retiring last year. He preserved nearly 1,000 books of the AAA's Jane Douglass Memorial Library at the school. "For three decades and a quarter of a million students later, we maintain that you can still see the stars from New York City," Storch says. NERAL, the North East Region of the Astronomical League, gave the award at the Stellefane convention in Vermont in August.■

Events on the Horizon
October 2010

M: members; P: open to the public; T: bring your telescopes, binoculars, etc.;
C: cancelled if cloudy;
HQ: at AAA headquarters, Downtown Community Center, 120 Warren St.
AMNH: For ticket information, call (212) 769-5200

For directions to AAA observing events, check the club's website, www.aaa.org.

Friday, October 1, 6:15 p. m.
AAA lecture, FREE, P
MIT physics professor Dr. Max Tegmark will present "The History of the Universe in One Hour" in the Kaufmann Theater of the AMNH. Next date:October 22.

Saturdays, October 2, 9, 16, 23, 30, evening
Observing at Inwood Hill Park, Manhattan, P, T, C
Next dates: Saturdays in November.

Saturday, October 2, dusk
Observing at North-South Lake, Greene County, M, T, C Directions: http://aaa.org/northsouthlake or Rich Rosenberg at 718-522-5014. Last session in 2010.

Tuesdays October 5, 12, 19, 26, dusk-9:45 p. m.
Observing at the High Line, Manhattan, P, T, C

Tuesday, October 5, dusk-10 p. m.
Observing at Cadman Plaza, Brooklyn, P, T, C
Last session in 2010.

Wednesday, October 6, doors open at 7 p. m.
Sci Café at the AMNH, P, AMNH
Museum astrophysicist Michael Shara will discuss "The Next 50 Years of Space Flight" at the Gottesman Hall of Planet Earth. 81st Street entrance. He'll imagine a world where suborbital tourism is popular, a research colony exists on the Moon, we've surveyed—and possibly even docked with—an asteroid, and ships have landed on Mars' moons to prepare for a Mars landing.

Saturday, October 9, dusk
Observing at Great Kills Gateway National Park, Staten Island, P, T, C Next date: November 13.

Saturday, October 9, 1:30-10 p. m.
Annual Astronomy Jamboree, Custer Institute, Southold, N. Y., P
Lectures, star party and much more. Pre-registration required: http://www.custer observatory.org/.

Sunday, October 10, 10 a. m.-5:45 p. m.
10th anniversary celebration of the Rose Center for Earth and Space, P, AMNH
Performances, hands-on activities, presentations by museum scientists, premiere of a new Big Bang presentation—which takes visitors through the universe—and of the Astro Bulletin about the last 10 years of astrophysics.

Sunday, October 10, 7 p. m.
Special Rose Center anniversary Isaac Asimov Debate, P, AMNH
Hayden Planetarium director Neil deGrasse Tyson will moderate a geologist-biologist-chemist-physicist panel on "Is Earth Unique?" Le Frak Theater, 77th Street entrance.

Wednesday, October 13, 8:30-10 p. m.
Observing at Fort Tryon Park near The Cloisters, Manhattan, P, T, C

Thursday, October 14, 6:30-8:30 p. m., 726 Broadway, sixth floor conference room.
Recent Advances in Astronomy Seminar, M
The seminar now incorporates the Observers' Group. Next date: November 11.

Friday, October 15, dusk-11 p. m.
Observing at Carl Schurz Park, Manhattan, P, T, C
Last session in 2010.

Friday, October 15, 8-10 p. m.
Observing at Floyd Bennett Field, Brooklyn, P, T, C

Events continued on page 12

Events continued from page 11

Next date: November 12.

Saturday, October 16, dusk-10 p. m.
Annual Urban Starfest in the Central Park Sheep Meadow, sponsored by the AAA and the Urban Park Rangers, P, T, C Cloud/rain date: Sunday, October 17.

Monday, October 18, 7:30 p. m.
Hayden Planetarium lecture, P, AMNH
In "A Tear at the Edge of Creation," Dartmouth physics/ astronomy professor Marcelo Gleiser will discuss finding a final theory that explains nature in all its complexity. He'll assert nature's creative engine depends on asymmetries manifested in all levels of complexity.

Friday, October 22, 6:15 p. m.
AAA lecture, FREE, P
Columbia physics professor Dr. Michal Tuts will discuss "Particle Physics at the Large Hadron Collider and Cosmology" in the Kaufmann Theater of the AMNH. Next lecture: December 3.

Tuesday, October 26, 6:30-8 p. m.
Hayden Planetarium presentation, P, AMNH
In "Ten Years of Digital Universe," the Hayden's Carter Emmart and Brian Abbot will discuss the planetarium's Digital Universe Atlas, the most complete map of the known universe.

Saturday, October 30, 10 a. m.-noon
Solar Observing at Central Park, P, T, C
At the Conservatory Waters. Next date: November 20.

AMNH, Tribes Mark Meteorite Pact

AMNH officials and members of the Confederated Tribes of the Grand Ronde Community of Oregon in June marked the 10th anniversary of the pact recognizing the tribes' spiritual and cultural connection to the Willamette Meteorite, centerpiece of the museum's Hall of the Universe, and affirming the AMNH's role in maintaining public access to it. AMNH president Ellen V. Futter and Kathryn Harrison, former chair of the Grand Ronde Tribal Council, were among those attending.

The meteorite is the largest ever found in the U. S., at 15.5 tons, and is believed from the iron core of a planet shattered in a stellar collision billions of years ago. The Grand Ronde is successor to tribes that long revered the meteorite. ■

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