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The Night that Amateur Astronomers Took Back the Park

By Jason Kendall

There are times when astronomers are called upon to do more than just relish the wonders of the night sky. Sometimes they must address the deep needs of their community.

Such an event happened on the night of June 10. In upper Manhattan's Inwood Hill Park, where I do all my public stargazing events, a woman was raped. I didn't know about it until the next day, and in between, two other women were sexually assaulted in Washington Heights, just down the street.

These three events stunned everyone in my neighborhood. Until I learned otherwise, I was afraid the rape victim had been attacked as she sought my observing event, even though I'd canceled it due to clouds. It was no comfort to learn that she was attacked while walking alone in the Dyckman Fields, far from the hilltop.

I talked with police and wrote a piece on my web page about the attack and how we couldn't cede the parks at night to criminals. We needed to take back our park.

As northern Manhattan's most vocal advocate of the use of the parks at night, I quickly realized it was my responsibility to state unequivocally that the criminals wouldn't take our safety from us. I decided to hold a stargazing event in support of community safety.

On Wednesday, June 15, the call was heard. With more than 2,000 hits on my article and on the event announcement two days earlier, I knew I had done the right thing. That night, more than 100 people showed up, including AAA members Bruce Kamiat, Howard Fink, Leo Genn, Jordan Kushner and Ji Yong Chung, each of whom brought equipment and enthusiasm. Sam Grundell of the Columbia University astronomy undergraduate group

Redshift brought a telescope.

We looked at the storms of Saturn and the craters on the Moon. Their grandeur gave everyone pause, helping ease concerns and giving a hopeful turn to the evening. And the community responded. I saw more women at this event, especially in groups, than I'd ever seen before. Many offered thanks, some tearfully, for our effort and support.

Some who came out were quiet, just chatting among themselves, considering what's next to be done. Even the neighborhood group of hula-hoopers, about 15, brought their hoops out at night, and taught people their dance. The Inwood Safety Patrol talked to residents informally about the park, and people of all kinds chatted about the horrible events and how to make our living area safer, which was the real purpose of the event.

We needed to come out and take back our park, to demand that it be ours and to show support for the women whose lives have been horribly altered. As urban astronomers, we have a keen interest, and a sometimes lonely voice, as we advocate the night sky. But as much as we love the sky, we need to be aware that people can perceive our outreach as naïve, and even dangerous. It's our obligation to make our sacred night sky sessions safe, so that fear doesn't win. To that end, every stargazing event in an urban environment must be thought of as an opportunity to help keep our parks safe for everyone's use, not just astronomers.

We hope that the club's efforts to take back the park and remove one more hiding place for such criminals, preserving room for our daughters, sisters, wives, mothers and friends to experience the night sky safely in our great city. ■

What's Up

The Sky in July 2011

By Richard Rosenberg

July's Evening Sky. In twilight you may be able to spot Mercury low in the northwest. Saturn, near Virgo, will be up until around midnight. As the sky darkens, follow the arc of the Big Dipper's stars to the bright stars Arcturus and Spica. Up in the east is the [Summer Triangle](#), formed by the stars Vega, Deneb and Altair. Low in the south is the constellation Scorpius, followed by Sagittarius. If the sky is dark, marvel at the Milky Way.

July's Morning Sky. The Summer Triangle and the Milky Way have moved to the west but still dominate the dark sky. Jupiter has risen and is well up in the east. It's followed by Mars. The Red Planet is pretty faint and is dominated by nearby Aldebaran, the brightest star in Taurus. To the northeast is the constellation Auriga the Charioteer, with the brilliant star Capella. Early in the month, Venus can be seen around dawn but it is quickly lost as it falls back toward the Sun.

July 1 New Moon at 4:54 a. m. Partial eclipse of the Sun, but it will be seen only in part of Antarctica.

July 2 A half hour after sunset, look to the Moon's upper right to spot Mercury.

July 4 The Moon is 6 degrees below Regulus, the bright star of Leo. Earth at farthest from the Sun, 94,512,000 miles.

July 7 The Moon is 8 1/2 degrees below Saturn.

July 8 The star Spica in the constellation Virgo is only 4 degrees to the upper right of the the Moon. The Moon itself is at first-quarter phase at 2:29 a. m.

July 10 Uranus is stationary, beginning retrograde motion. It will move east to west with respect to the stars.

July 11 The Moon is only 2½ degrees above Antares.

July 15 Full Moon, 2:40 a. m.

July 20 Mercury at greatest eastern elongation from the Sun—its farthest point from the Sun, as seen from Earth.

July 23 This morning the Moon is 7 ½ degrees above and to right of Jupiter. The Moon is also at last quarter at 1:02 a. m.

July 26 The Moon is 7 degrees above Aldebaran, the brightest star in Taurus the Bull.

July 27 The Moon is within 3½ degrees of Mars.

July 30 New Moon, 2:40 p. m.

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Sun May Become Quieter, But It Hasn't Been Recently

By Dan Harrison

Some unusual solar readings, including fading sunspots and weakening magnetic activity near the poles, could be indications the Sun is preparing to be less active in coming years. Results of three studies indicate that even as the current sunspot cycle swells toward solar maximum, the Sun could be heading into a more dormant period, with activity during the next 11-year cycle greatly reduced or even eliminated.

The studies looked at a missing jet stream in the solar interior, fading sunspots on the Sun's visible surface and changes in the corona and near the poles. The Sun is in the midst of [Cycle 24](#), and is ramping up toward the cycle's period of maximum activity. But the new findings indicate activity in Cycle 25 could be greatly reduced.

Astronomers examined an east-west zonal wind flow inside the Sun. The latitude of this jet stream matches the new sunspot formation in each cycle, and models successfully predicted late onset of Cycle 24. Cycle 25's flow should have appeared in 2008 or 2009, so scientists believe it will be much delayed, with a minimum longer than what we went through with Cycle 24. Some estimate Cycle 25's start could be delayed to 2021 or 2022 and be very weak, if it occurs at all.

One study tracked a long-term weakening trend in sunspots' strength, and predicts that by the next solar cycle, erupting magnetic fields will be so weak that few, if any, sunspots will form.

A week before the reports were issued June 14, a huge [solar storm on June 7](#) unleashed what some call the most massive eruption of plasma ever seen. The storm revealed a glimpse at the Sun's inner workings.

The huge eruption, a coronal mass ejection (CME), was notable for its size and perplexing behavior. Huge waves of plasma roared off the Sun, only to rain back down. The three-hour storm produced a sudden brightening of the Sun but only a moderate flare. However, it also let loose the CME, a cloud of charged particles that erupted from the surface into space.

Solar continued on page 3

A Message from AAA President Richard Rosenberg

Hello members:

Our club is becoming more of a presence on social-media websites such as Facebook and Twitter. The number of people coming to our events, especially observing sessions, continues to grow. If you belong to an online group, why not mention the AAA to fellow members?

The High Line has been extended to 30th Street. While we'll probably continue to observe around 14th Street, some activities for the future, such as an observatory, are possible.

Although it doesn't have much to do with astronomy (unless you have a solar filter for your telescope), you can get to Governors Island this summer without spending a penny. Free ferries take you from the Battery Maritime Building (10 South Street) in Manhattan or from Pier 6 in Brooklyn (at the end of Atlantic Avenue). It's a beautiful spot for a picnic and for solar viewing. Directions and ferry schedules are at <http://www.govisland.com/html/visit/directions.shtml>.

Once again we have monthly dark-sky observing at North-South Lake in the Catskills. It began June 25 and this month is July 23. Sessions run to October. I hope to see you there.

I recently had cataract surgery to improve the vision in my right eye. The result was spectacular: I can see 20/20. By the time you read this, work on my left eye will be complete, hopefully with a similar result. It's amazing to see naked-eye stars again from the city.

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

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Usually, **CME material** flies far into space, sometimes hurling toward Earth. But this time, a large majority fell back to the surface. Why this happened this way, versus the usual process of ejecting into space, is a mystery. Another mystery: why this super-powerful CME was paired with just a moderate solar flare. The two usually seem to correlate in timing and strength.

In the past, massive solar storms apparently occurred during relatively low sunspot activity. Perhaps we're witnessing a similar situation, a period of relatively inactive sunspot activity during which a few massive violent storms occur.

So far this year, sunspot activity has been sporadic, notes the AAA's Joseph A. Fedrick. "After a brief spurt of activity earlier this year, activity quieted down so only a few relatively small spots were visible on the Sun's projected image (using my 60mm f/15 achromatic refractor and a 20mm eyepiece) on most days.

"However, on Memorial Day weekend, activity briefly increased. A fairly large complex group of sunspots had become visible on the image of the solar disk and was beginning to rotate into view by May 29. Several other prominent dark sunspots or groups of sunspots also appeared on the Sun's disk by that time.

"**The sunspots formed** two parallel bands on the solar disk. By June, the intensity of sunspot activity began to decrease. Many sunspots had grown small and less prominent. However there were several sunspots visible on the solar disk as of June 3."

Meanwhile, a new study finds a giant "[magnetic rope](#)" made of twisting magnetic field lines could produce strong electric currents that trigger solar storms. Scientists have predicted this rope causes violent solar eruptions, but have struggled to prove its existence because of how quickly it moves. Confirming its existence would not only help astronomers understand storm formation, but would be key toward mitigating effects these eruptions can have on satellite communications. ■

More from the Always Active Exoplanet Beat

By Evan Schneider

After two years of research and a “first contact” experience with astrophysicists, astrobiologists and astronomers, *Washington Post* writer Marc S. Kaufman authored his new book, [“First Contact: Scientific Breakthroughs in the Hunt for Life Beyond Earth”](#) (Simon & Schuster, \$26). On June 6, he joined MIT professor of planetary science Dr. Sara Seager at the Hayden to share information on the latest exoplanet research and discuss the potential for life in our universe.

Research has revealed microbial life found a home in 200-degree black smokers 1.2 miles under the sea, where heat is released from subterranean lava flows at 700 degrees. Microbes have been found in Antarctic glaciers and the Atamaca Desert in Chile, a Mars-like environment where it rains once every 10 years. “In fact,” Kaufman said, “more things live under the Earth than on top.

“Mars most likely had water in its atmosphere and possibly life on the surface while Earth was forming its continents 4.2 billion years ago,” he continued. Recent discoveries by astrophysicist Mike Mumma, director of the [Goddard Center for Astrobiology](#), revealed methane is released at certain times of the year on Mars. Since methane is generated from biological forms, there’s a strong possibility that some form of life exists beneath the Martian surface. The Mars Science Lab Curiosity (<http://marsprogram.jpl.nasa.gov/msl/>), NASA’s next rover, will be outfitted to look for organic material.

Kaufman suggested the abundance of certain building blocks of life in the universe--water, hydrocarbons, etc.--make it more likely that life has had an opportunity to develop. With 300 billion stars in the Milky Way and exoplanets being found in the habitable zone, a distance from a star similar to Earth’s from the Sun, the likelihood of finding life increases exponentially.

Exoplanet detection comes through Doppler resonancing, where a star’s wobble is recorded while an orbiting planet interacts on a gravitational level, or in observing a transiting planet, where the measured light of a star decreases while an orbiting planet passes in front of it. Transiting measurements are more difficult since we must be on the same plane as the planet and star to meas-

ure decreased light.

Seager discussed a trip she and Kaufman took to the Pontifical Academy of Sciences in Rome to meet with Vatican representatives. In 2008, a Vatican official said believing in alien life doesn’t contradict faith in God. The church thus took a more enlightened approach to extraterrestrial life more than four centuries after Bruno was burned at the stake.

Seager believes that astrobiologists need to study planetary atmospheres. Finding oxygen and other life-supporting elements can lead to finding life itself. “So far, 36 exoplanet atmospheres have been studied, and no life is prevalent, but the research started us on our way to understanding what other worlds are like.”

Looking for an Earth-like planet can be difficult. Our Sun is 10 billion times brighter than Earth. Astrobiologists look at stars only 1,000 times as bright as their planets, and the sizes of planets are similar to Jupiter.

In 1984, the [Kepler telescope mission](#) concept was conceived. Twenty-five years later, it launched, monitoring 150,000 stars continuously. Hoping for a five-year deployment cycle in the future, Seager suggested launching smaller scopes targeting smaller bright stars. Labeled “Cube Sats,” they would be research nanosatellites, working in groups in low-Earth orbit. Choosing 250 target stars out of 3,000 candidates will be difficult and time-consuming, but scientists want to weed out the field of targets before setting parameters for each scope, then focus on a smaller number due to small equipment size.

If life is found on Mars, it will dramatically increase the probability of life throughout the universe. This, in turn, could increase NASA’s and private industry’s desire to fund additional research.

Will we find life forms similar to humans? No one knows for sure, but, Seager noted, books like “Rare Earth: Why Complex Life is Uncommon in the Universe” by Peter D. Ward and Donald Brownlee postulate that microbial life may exist easily in the universe but complex life may require too many prerequisites. ■

An Astronaut's-Eye Look at Living and Working in Space

By Evan Schneider

With shuttle **Endeavor's landing** for the last time and Atlantis' final flight this month, the 30-year history of [NASA's space-shuttle program](#) is almost over. When it's completed, 355 astronauts will have flown. Only 23 of them were from another country.

On May 3, the French Consulate General sponsored a meeting with one of them, Jean-Francois Clervoy, who discussed "Living and Working in Space."

From a standing start, the shuttle was ultimately developed with 2.5 million parts, 1,000 plumbing valves, 1,000 switches and 27,000 thermal tiles. Burning 10 tons of booster rocket fuel per second in its first two minutes of flight and one ton per second with its main engines, generating 45 gigawatts during those first two minutes straining to achieve orbit and traveling at Mach 25, the shuttle was greater than the sum of its parts, climaxing years of technological gains and creative engineering.

Clervoy explained the many challenges of living in space. Displaying personal photographs and videos imparted a feeling of being there with him. Weightlessness, organization and storage are three tangible challenges for working in an enclosed environment. Crew members must perform complex tasks while working as a team. Working on the ISS, astronauts must learn Russian, since none of the signage is in English.

"Training is harder than space flight," Clervoy observed. "We're conditioned by facing the worst possible scenarios, conceptually dying once or twice during training. In the simulator, we're trained to think it's real. In the reality of space flight, we're trained to think it's a simulation." Through this process, astronauts are desensitized to control their fear and to know where to go and why under every condition.

In addition to physical and psychological challenges, there are other ongoing issues: to remain protected from radiation (recorders on each astronaut's body monitor exposure) and to steer clear of space debris. A protective sphere is established by North American Aerospace Defense Command, running 12 hours ahead of the shuttle's path to track potential debris impacts.

As astronauts look out of the shuttle and the ISS with interior lighting active, they see a black sky with Earth below in daylight. Clervoy was told by a fellow astronaut to turn off the lights on the command deck and wait 10 minutes for his eyes to adjust. When he did, he saw countless stars that filled the sky with their brightness. It was looking at the Milky Way edge-on and seeing an apparent white cloud which is billions of stars shining by their own light.

With 16 sunrises and sunsets each day, an 11-day mission provides a chance to take thousands of photos of volcanoes, rivers and land masses along with areas of deforestation. Clervoy avidly supports protecting Earth and its resources. Viewing Earth from above and seeing the thin layer of atmosphere separating it from the cold, irradiated harshness of space provides a perspective of how fragile our planet is.

Clervoy has had an exceptional career. Since joining the European Space Agency in 1992, he's spent more than 675 hours in space. Clervoy's first flight was aboard Atlantis STS-66 in 1994, deploying the CRISTA-SPAS atmospheric-research satellite to determine Earth's atmospheric changes during an 11-year solar cycle. In 1997, again aboard Atlantis on STS-84, he traveled to Russia's MIR Space Station, shuttling four tons of equipment as payload commander.

In 1999, as flight engineer for Discovery STS-103, Clervoy traveled to the Hubble for a critical repair mission. While there, he used a robotic arm to capture and deploy the telescope, and to maneuver NASA space walkers as they completed their tasks.

With completion of the final Atlantis mission, what does the future hold for U. S. space flight? Astronauts will travel to the ISS aboard a [Russian Soyuz spacecraft](#). A 12-flight deal has been confirmed. NASA will also fly supply missions on [SpaceX](#) rockets through 2016.

Meanwhile, private enterprise continues to develop, flying suborbital flights 62 miles above Earth for three minutes at \$200,000 per person. Parabolic flights, 5-7 miles above Earth, will continue for research purposes. ■

Review: Some Recently Published Books in Astronomy

By Dan Harrison

Veteran astronomy journalist Govert Schilling has hit a home run with “Atlas of Astronomical Discoveries” (Springer, \$39.95). A perfect marriage of superb writing and brilliant illustration, the book covers 100 discoveries in four centuries, from “Galileo Galilei Discovers Mountains on the Moon” to “Stephan Udry Discovers the Habitable Exoplanet Gliese 581c.” The richness of the book comes through in every two-page spread, whether it’s “Richard Carrington Discovers Solar Flares,” “Hans Bethe Discovers the Energy Source of the Stars,” “Jocelyn Bell Discovers Pulsars” or much, much more. “In the next 400 years,” says Schilling, “the cosmos will again change very little. But we are likely to have to wait much less for new revolutionary developments in astronomy. A few orbits of the Sun, at most.”

Eye-piece usually mentions first-time editions, not subsequent ones. An exception is being made, however, with “How to Photograph the Moon and Planets with Your Digital Camera” by Tony Buick and Philip Pugh (Springer, \$39.95, paper). As Pugh notes, “the world of digital photography and its use for astronomy is changing very rapidly.” The standard price of a digital camera has plummeted from more than \$400 at the time of the first edition to \$200 and standard pixel size has jumped from 3 to 12. Against this, “the price and quality of CCD cameras dedicated for astronomy (once the province of professionals and financially gifted amateurs) is now working in our favor.” The book’s title is a misnomer since it covers solar photography as well as stars, constellations, nebulae and comets, although most of the content is devoted to the Moon and planets.

Not only did Sir Isaac Newton believe in God, he felt God “sat enthroned at the center of creation,” notes Edward Dolnick in “The Clockwork Universe: Isaac Newton, the Royal Society & the Birth of the Modern World” (Harper, \$27.99). But “the great irony of Newton’s life” was that many felt science was “devoted to demoting God.” This, Dolnick says, made for a debate over gravity that in some ways anticipated the 19th-century battle over evolution. Such insights punctuate a book that, per its subtitle, discusses not just Sir Isaac but “the geniuses of the Royal Society, the men who made the modern world.” They challenged the tradition that

new is dangerous, that the mission of academia was “not to discover the new but transmit a heritage.”

The Manga Guides from No Starch Press teach science using original Japanese comics and lighthearted story lines. The series has now trained its lens beyond Earth with “**The Manga Guide to the Universe: A Cartoon Guide to Astronomy**” (\$19.95). It takes readers on a voyage through the solar system, Milky Way and faraway galaxies. Readers learn about astrophysics and astronomy, and encounter the universe’s greatest mysteries, such as dark matter, cosmic expansion and the Big Bang. The guide also teaches readers about theories of the universe’s origins, evolution, and geometry; ways to measure and observe heavenly bodies; how astronomers calculate distances; and discoveries by Copernicus, Galileo, Kepler, Hubble and other greats; stellar classifications, and how a star’s temperature, size and magnitude are related; and the mystery of cosmic background radiation and scientists’ predictions for the future of the universe. The guide also includes a Gallery of Astronomical Marvels, featuring color photographs.

I was ambivalent about mentioning “**Exoplanets**,” edited by Sara Seager (University of Arizona Press, \$35), because it’s not for the faint of heart. With exoplanets such a hot topic, it was inevitable that the University of Arizona’s Space Science Series would train its lens on them, and MIT’s Dr. Seager, a maven on exoplanets, was the right choice to edit the book. But “Exoplanets” is very technical, with many dense charts and equations. On the other hand, the introductions, both to the book and individual chapters by almost three dozen authors, are informative. If you’re interested in “Exoplanets,” my advice is to browse before buying. ■

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Highlights of Presentations at AAS' Boston Convention

A **short, extremely bright explosion** of light recently spotted [may be the most distant object](#) ever seen in the universe. Scientists are unsure exactly how far away the gamma-ray burst was, but estimates place it at 13.14 billion light-years. The flash occurred when a star died in a supernova explosion and released a jet of high-energy gamma-ray radiation. The blast shined for 10 seconds but packed as much light as several thousand galaxies. Though the initial blast was quick, it glowed for days.

Astronomers have created the most complete [3-D map of our local universe](#). The map shows all visible structures to 380 million light-years, which includes about 45,000 neighboring galaxies. Near-infrared light, with a longer wavelength than visible light, can penetrate opaque clouds of dust in galaxies. This allowed the survey to look closer to the plane of the Milky Way than previous studies. The map covers 95% of the sky. Because the universe is expanding, measuring an object's redshift, hence its velocity, allows astronomers to deduce its distance, because objects farther away move more quickly. The map could also help answer why the Milky Way moves as it does vis-a-vis the rest of the universe. This motion, about 370 miles per second, has yet to be explained by gravitational attraction of known objects near our galaxy.

For the first time, the Hubble photographed a star that Edwin Hubble observed in 1923, changing the course of astronomy. The variable star pulses brighter and dimmer in a regular pattern, which allowed scientists to determine its distance, first suggesting galaxies exist beyond the Milky Way. [Hubble variable number one \(V1\)](#) is a Cepheid variable. These stars' brightness varies as helium inside them heats and expands, then cools and contracts in a feedback loop. This pulsation's duration is closely linked with the intrinsic brightness, or luminosity, of the star. By calculating a Cepheid variable's luminosity, and comparing it with the star's apparent brightness--which gets dimmer the farther away it is--astronomers can calculate the object's distance. Before Hubble's discovery, many astronomers believed the universe contained only one galaxy, the Milky Way. Some researchers argued fuzzy objects called spiral nebulae, including the Andromeda Nebula, were galaxies in their own right. Observation of V1, established to lie farther than the Milky Way, proved other galaxies exist. Hubble

scientists partnered with amateur astronomers, who took their own observations of the variable star to establish best times at which to view V1.

Alien solar systems with multiple planets appear to be common in our galaxy, but most are quite different from our own, a new study finds. Kepler detected 1,235 alien planet candidates in its first four months. Of those, 408 reside in multi-planet systems, suggesting our configuration isn't so special. What may be special is orientation of our solar system's planets. Some are tilted significantly off the solar system's plane, while most Kepler systems are nearly flat. Candidate planets still need to be confirmed by follow-up studies; researchers estimate at least 80% will pan out. That nearly one-third of Kepler candidates are part of multi-planet solar systems came as a surprise. In our solar system, some planet orbits are tilted up to 7 degrees, meaning alien astronomers looking for transits wouldn't be able to detect all eight planets. In particular, they would miss Mercury and Venus. Planetary systems spotted by Kepler have orbits tilted less than 1 degree. These systems are probably so flat because they lack Jupiter-size planets, whose gravitational influence can tilt neighboring worlds' orbits. Other studies have found many systems with big planets, but their orbits are on the same plane. ■

Letter to the Editor

The May *Eyepiece* contained a story on my April 1 AAA lecture. This otherwise excellent story overestimated the risk from [Asteroid Apophis](#) during its 2029 and 2036 Earth encounters.

Apophis will almost certainly miss Earth in 2029, but will likely pass within the orbits of geosynchronous satellites. Since we know next to nothing about the asteroid's composition, it isn't impossible that Earth's tidal effects during the 2029 encounter may fragment Apophis or produce a tail. Either effect could alter Apophis' solar orbit and increase the odds of Earth impact in 2036.

Availability of a heavy-lift booster in 2029-2035 is therefore essential to deliver interceptor craft to Apophis' vicinity if an Earth impact in 2036 seems likely.

Greg Matloff

Briefs: Moon's Insides Believed Much Wetter than Thought

The Moon's insides are likely as wet as the Earth's upper mantle, new research reports. The discovery, made by studying pieces of lunar magma hurled to the surface by ancient eruptions, comes as a surprise. The prevailing theory of the Moon's formation holds it coalesced from pieces of the early Earth blasted into space by a collision with a Mars-size object. Scientists thought the resulting massive energy would have baked water out of the bits that became the Moon. Researchers analyzed rock from Apollo 17, specifically analyzing melt inclusions, minuscule globules of lunar magma encased within solid crystals. These crystals prevented the magma's water from gassing out during the eruption, largely preserving the original water content of the underground rock. Researchers found water contents 615-1,410 parts per million. These pieces may have been able to hold onto some water before coalescing to form the Moon. The Moon's stores of surface ice, concentrated in craters near the poles, were likely deposited by comets and asteroids in the relatively recent past. But the new study suggests some may be water from the interior ejected by volcanic eruptions. The rock samples the researchers studied are deposits formed by explosive volcanism.

An ocean of molten rock sloshes beneath the surface of Jupiter's moon Io, feeding its prolific volcanism, a new study finds. Unlike Earth's magma, which usually clusters in pockets around the edges of tectonic plates, Io's magma is found in a global reservoir at least 30 miles deep. This reserve helps explain why Io is the most volcanically active object in the solar system, spewing out 100 times more lava than Earth's volcanoes combined. Io is the only solar-system body besides Earth with active lava volcanoes; some other satellites, such as Enceladus, harbor ice volcanoes. At least 20% of the rock in the reservoir is melted. The magma ocean likely constitutes 10% of Io's rocky mantle by volume.

Winds 10,000 times faster than an Earth hurricane have been seen streaming molecular gas, the raw material needed to make new stars, away from galaxies. These raging galactic windstorms may have the power to strip galaxies of gas and halt star formation altogether. The Herschel observatory detected these winds, the first time such molecular-gas outflows have been observed in a sample of galaxies. The fastest is blowing at a speed of more than 620 miles per second.

A new kind of supernova, 10 times brighter than the Type Ia supernovas that are relatively common in the cosmos, has been discovered. It can't be explained by any processes that control most supernovas. Astronomers have observed six such supernovas that appear unique.

NASA's repeatedly delayed and over-budget mission to send a huge rover to Mars still faces significant budget, timing and technology challenges before it can launch late this year, a project audit reveals. It found even more money may be needed to launch the \$2.5 billion Mars Science Laboratory (MSL) mission this year. The mission is slated to launch in late November or December. If it doesn't, NASA will need mission redesign.

The young Mars apparently had massive growth, mushrooming to about half its present size in less than 2 million years, scientists say. That Mars accumulated enough dust from the protoplanetary disk that once surrounded the Sun to reach half its present size so quickly suggests Mars was a protoplanet that escaped merging with its siblings. Researchers examined data on isotopes within Martian meteorites. By analyzing ratios of those isotopes as well as others in the meteorites and in chondrites, the building blocks of all planetary objects, one can pinpoint how old Martian rocks are. In previous studies, scientists found large uncertainties in the formation history of Mars because of the unknown composition of its mantle.

NASA will launch a sample-return mission to an asteroid in 2016. A robotic arm will pluck samples, which will be returned to Earth, where scientists will study them for information about the solar system's origin and, possibly, clues to how life may have begun. The mission will be the U. S.' first asteroid sample-return effort. After traveling four years, the spacecraft will approach near-Earth asteroid 1999 RQ36. Within three miles of the asteroid, the craft will begin six months of surface mapping. The arm will collect more than two ounces of material for return to Earth in 2023. The mission will refine RQ36's orbit to ascertain its trajectory and devise strategies to mitigate possible Earth impacts.

By gazing at sunspots' edges, astronomers are pin-

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Briefs: Sunspot's Edges Yield Clues as to How They Form

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pointing details of how they form. Astronomers know they're linked to intense magnetic activity, which can suppress the flow of hot matter, but much about their structure and behavior remains enigmatic. The dark heart of a sunspot, the umbra, is surrounded by a brighter edge, the penumbra, made of many dark and light filaments more than 1,200 miles long. They're relatively thin, about 90 miles wide, making it hard to resolve details that could reveal how they arise. Scientists have now discovered these columns are rapid downflows and upflows of gas, matching recent theoretical models and computer simulations suggesting these filaments are generated by the movement of hot and cold gases known as convective flow. Researchers, focusing on a sunspot last year, found dark downflows of more than 2,200 mph and bright upflows of more than 6,600 mph. Models suggest columns of hot gas rise up from the interior of the sunspot, widen, cool, then sink downward while rapidly flowing outward. Researchers also hope to measure magnetic fields linked with these flows to learn more about how they cause such activity.

A newfound stretch of the Milky Way reveals its distant rim is warped like the edge of a sombrero, and the galaxy may be far more symmetrical than thought. The Milky Way is shaped like a spiral, but how many arms the spiral possesses has long been debated. Recently, scientists suggested the galaxy has only two major arms, the Perseus Arm and the Scutum-Centaurus Arm, stretching out from a central bar, with our Sun lying relatively near the Perseus Arm. One can now trace the Scutum-Centaurus Arm nearly 360 degrees around the galactic system. This newfound extension reaches an average 68,500 light-years away, with its molecular gas the most distant detected in the Milky Way. This stretch of gas makes the Scutum-Centaurus Arm a symmetrical counterpart of the Perseus Arm.

NASA plans to develop a deep-space vehicle, based on an earlier capsule concept, to send astronauts on expeditions to an asteroid and then Mars. The Multi-Purpose Crew Vehicle will carry four astronauts for three-week missions. It's designed to be 10 times safer during launch, re-entry and landing than its predecessor, the space shuttle.

NASA ceased trying to contact Spirit, the robotic Mars rover that went incommunicado last year. This marks the official end of its successful six-year mission. The rover, which landed in January 2004, functioned more than 20 times longer than predicted and drove 4.8 miles, 10 times longer than planned. Its greatest achievement was uncovering geologic evidence that dry and dusty Mars was far wetter billions of years ago, and could have had an ancient environment that may have been favorable for microbial life.

Super-bright stars are normally found in the centers of star clusters, but scientists have discovered one of the most luminous stars known is a lone wolf. VFTS 682, some 150 times the mass of the Sun, lies in the Large Magellanic Cloud. At first, researchers thought VFTS 682 was hot, young and bright, but otherwise ordinary. However, after more closely analyzing its light, they found we were seeing only a fraction of its light, with much of its energy absorbed and scattered by dust clouds before it reached Earth. The star is also extraordinarily hot, with a surface temp of about 90,000 degrees. VFTS 682 is a near-identical twin of one of the brightest superstars at the heart of the RMC 136 star cluster. Possibly VFTS 682 formed in RMC 136 and was hurled to its location about 90 light-years from the center of the cluster by gravity interactions with stars in the cluster.

In the search for life on other planets, scientists are looking beyond single-celled organisms and developing techniques that would help detect multicellular life. Researchers are proposing a mathematical technique to detect tree-like multicellular structures. Scientists could identify a planet with forests by characteristics of the light it reflects, even if it looks like just a dot. They've come up with various methods to detect life on exoplanets. Some are working to detect composition of gases in the atmosphere. Others are focusing on a reflectance signature such as the "red edge," the difference between light absorbed for photosynthesis and light reflected back in other wavelengths of the near-infrared.

The edge of the solar system is filled with a turbulent sea of magnetic bubbles, according to new NASA research. Scientists made the discovery by using a new

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Briefs: Solar System's Edge Has Sea of Magnetic Bubbles

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computer model, based on data from Voyager 1 and Voyager 2. The probes, launched in 1977, are plying the solar system's outer reaches. A more detailed picture of this region is key to understanding how cosmic rays are spawned, and how they reach near-Earth space.

A **state-of-the-art telescope** snapped its [first images](#) of the southern sky over the Paranal Observatory in Chile. The VLT Survey Telescope's (VST) first image shows the star-forming region Messier 17, also known as the Omega nebula or the Swan nebula, as never seen before. This nebula, full of gas, dust and hot young stars, lies in the heart of the Milky Way, in Sagittarius. The VST's field of view is so large it's able to observe the entire nebula, including fainter outer parts. The second image is a portrait of the star cluster Omega Centauri, the largest globular cluster in the sky, in unprecedented detail, about 300,000 stars. The VST, a 2.6-meter telescope with a 268-megapixel camera at its core, is a visible-light, wide-field survey telescope with a field of view twice as broad as the full Moon. It's the largest telescope designed to exclusively survey the sky in visible light.

The **first comprehensive set** of [maps of the slopes and craters on the Moon](#) is revealing clues about its violent history. Features from hundreds of millions, or even billions, of years ago are still visible. Scientists have developed a detailed map of changes in contours of the Moon from pole to pole. Studying the roughness of these features reveals more about their age and formation. Some events are sudden, such as the craters that formed when comets and asteroids crashed into the Moon. Edges of older craters changed as more space rocks bombarded them, while newer ones have a sharper, more defined rim. Dark, smoother parts of the Moon were formed by volcanism. Even landslides can reveal activity from the past. Moonquakes and impacts from large objects can cause loose material to slide downhill, or even break off part of a cliff. Detailed topography data can help locate potential sites for ice by revealing shaded, stable regions where water is likely to freeze.

A **galaxy already known** to have one huge black hole at its core is actually home to two. Astronomers discovered the second monster black hole at the center of gal-

axy Markarian 739, about 425 million light-years from Earth, toward Leo. Its presence was revealed in Swift and Chandra observations. [The black holes are separated by about 11,000 light-years.](#) Both are intensely active and classified as supermassive. While supermassive black holes are relatively common at the core of galaxies, not all radiate energy to be active galactic nuclei. So it's rare to find one active monster black hole, let alone two, in the same galaxy. Astronomers suspect this can occur when galaxies collide.

The **glowing entrails** of an exploding star, thought to have faded over time, now appear to be lighting up again, a new Hubble photo reveals. The image of well-known [Supernova 1987A](#) shows the closest supernova explosion witnessed in almost 400 years. This has allowed astronomers to study it in unprecedented detail as it evolves. That debris that had faded is brightening suggests the star explosion, 165,000 light-years away in the Large Magellanic Cloud, is turning into a so-called supernova remnant. Supernovas typically transition into remnants when exploded material starts to fade, but the brightness increases due to interactions between debris cloud and surrounding gas. The shift is usually difficult for astronomers to study, but due to the close proximity of the Large Magellanic Cloud, they've made detailed observations of Supernova 1987A from 1994 to 2009. In the new image, [SN 1987A is surrounded by a ring of material](#) that blew off the star thousands of years before it exploded. The ring extends about one light-year across. Inside that ring, the star's guts are rushing outward in an expanding debris cloud. Debris of 1987A is beginning to impact the surrounding ring, which is creating powerful shock waves that produce X-rays that can be observed by Chandra. Those X-rays are illuminating the supernova debris and the heated shock waves are making it glow.

A **NASA spacecraft captured new video** of Vesta ahead of a rendezvous with the huge asteroid this month, revealing an odd, dark spot. NASA's Dawn probe will arrive in orbit around Vesta, the second-largest asteroid in the solar system, July 16. The new video is actually a series of 20 photographs taken during a 30-minute period June 1, when Dawn was about 300,000 miles away from the giant space rock. The images, which capture about

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Events on the Horizon

July 2011

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

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

Tuesdays July 5, 12, 19, 26, dusk-10 p. m.
Observing on the High Line, Manhattan, P, T, C
Enter at 14th Street. Next dates: Tuesdays in August.

Wednesday, July 6, 8-10 p. m.
Observing at Brooklyn Heights Promenade, P, T, C
At end of Montague Street. Next date: August 3.

Thursdays July 7, 14, 21, 28, sunset-10 p. m.
Observing and (7/ 28) movie, Pier 1, Brooklyn, P,T,C
Contact Rich Rosenberg at president@aaa.org or 718-522-5014 to check whether observing is on. Info: <http://www.aaa.org/movieswithaview>.

Fridays July 8 and 22, 8-11 p.m.
Observing at Inwood Hill Park, Manhattan, P, T, C
Next dates: August 12 and 26.

Wednesday, July 15, 8:30-11 p. m.

Observing at Carl Schurz Park, Manhattan, P, T, C
Next date: August 12.

Wednesday, July 20, dusk-11 p. m.
Observing at Prospect Park, Brooklyn, P, T, C
Next date: August 31.

Saturday, July 23, 7:30-11 p.m.
Observing at Great Kills Gateway National Park, Staten Island, P, T, C
Next date: August 20.

Saturday, July 23, dusk to when you want to leave.
Observing at North-South Lake in the Catskills, M, T, C Next date: August 20.

Saturday, July 30, 10 a. m.-noon
Solar observing at Central Park, P, T, C
At the Conservatory Water. Next date: August 27.

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10% of a full rotation, reveal several intriguing features on the 330-mile-wide Vesta. For example, the video shows a dark blotch about 60 miles wide near Vesta's equator, moving from left to right across the field of view as Vesta rotates. The images also show Vesta's jagged, irregular shape, hinting at the enormous crater known to exist at Vesta's south pole. Dawn will orbit and study Vesta for a year, then move on to investigate the dwarf planet Ceres, arriving there in 2015. Scientists hope Dawn will help unlock secrets of the early solar system by studying Vesta and Ceres. Dawn will compare and contrast the two bodies, which were shaped by different forces. By the end of its mission, Dawn will have travelled 3 billion miles since September 2007.

Two NASA satellites built to study the Sun have discovered 122 previously unknown sets of twin stars. The satellites noticed dimming that occurs when a star passes in front of the other, as seen from Earth. In addition to finding the eclipsing binaries, data were gathered on 141 previously identified pairs. Although binaries abound in the galaxy, eclipsing binaries are relatively hard to find, because in order to observe one star passing in front of the other, the two must be in a direct line of sight from the point of observation. The previously undiscovered eclipsing binaries don't tend to have a large change in brightness. This suggests the reason they weren't found earlier was because previous instruments weren't sensitive enough. ■

Imaging-Technology Exhibit

“**Picturing Science: Museum Scientists and Imaging Technologies**,” opened at the AMNH June 25 and runs until June 24, 2012. More than 20 sets of large-format prints reveal once-hidden, intricate details of natural phenomena and cultural artifacts.

The exhibit explores how such technologies as infrared photography, scanning electron microscopy and computed tomography make it possible to examine and analyze many specimens and phenomena in detail previously unimaginable. Images in the exhibit include revolving supernovas, long-buried ancient villages, microscopic hairs on wasp antennae and biological fluorescence.

One technology highlighted, electron microprobes, relates to astronomy. These instruments are used to determine chemical makeup of a small sample by scanning its surface with a beam of electrons. Each chemical element in the sample produces X-rays of a different wavelength. Associate curator and AAA member Denton Ebel, a museum meteoriticist, uses an electron micro-

probe to excite atoms on the surfaces of meteorite samples to produce data revealing their mineral composition. Previously, sections of specimens had to be sliced off and pulverized to conduct such analysis. ■

Tech Upgrades to Hayden Space Shows

Hayden Planetarium space shows have begun incorporating substantial upgrades to projection systems to reveal images of the universe at a level of detail previously unable to be shown. For instance, an increased contrast ratio of 500,000:1--most movie theaters are only 500:1--will achieve “true black” and highlight thousands of stars that astrophysicists have been able to identify but unable to project due to technological constraints.

The new system will also be able to project 10-bit color, a leap that required AMNH engineers to develop an entirely new file format, in addition to reconfiguring and building out new servers. “The result is an experience that smoothes color gradients and presents a much truer and realistic view of the universe,” AMNH spokesman Michael Walker told *Eyepiece*. ■

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