On Feb 15, massive trails of billowing white smoke and a red/orange fireball streaked across the skies of the Russian city of Chelyabinsk, high over the Ural Mountains and 900 miles from Moscow. At the center of this spectacle, what is estimated to be a fifty foot wide, 10 ton asteroid, having travelled over many years to Earth from the distant Oort Cloud at an estimated 40,000 mph, and exploding with the force of a nuclear bomb.

In an interview on NBC, AMNH Director and AAA member Neil DeGrasse Tyson explained “This can happen once a decade…it is a shockwave, basically, and the physics of it is this asteroid is coming in. It hit that Earth atmosphere and it feels like a brick wall to it. When you hit a brick wall, you basically explode. It exploded in mid-air. Below a certain size asteroid, they come in without warning. Something this size, it’s not going to render the human species extinct. Something large enough that we can detect would, and that’s what we are really focusing on, at this point.”

Lighting the sky and brighter than our Sun, the asteroid shattered as plummeted to the ground. One large piece, now a meteorite, cut a hole in the ice in nearby Chebarkul Lake. According to the ITAR-Tass news agency, military spokesman Yarslav Roshupkin reported that a 20-foot-wide crater was found in the same area which could be the result of fragments striking the ground.

The Associated Press contacted both people on the ground and at NASA. "There was panic. People had no idea what was happening. Everyone was going around to people's houses to check if they were OK," said Sergey Hametov, a resident of Chelyabinsk. "We saw a big burst of light then went outside to see what it was and we heard a really loud thundering sound." Donald Yeomans, manager of NASA's Near Earth Object Program, said he thought the event was probably "an exploding fireball event." "If the reports of ground damage can be verified, it might suggest an object whose original size was several meters in extent before entering the atmosphere, fragmenting and exploding due to the unequal pressure on the leading side vs. the trailing side (it panned and exploded)," Yeomans told The Associated Press.

Although it has been over 100 years, Russia is no stranger to encounters with asteroids. The explosion near the Podkamennaya Tunguska River on June 30, 1908, reportedly flattened 500,000 acres of Siberian forest. Scientists calculated that the explosion could have been as strong as 20 megatons of TNT, roughly 1,000 times more powerful than the Hiroshima atomic bomb, Space.com reported. Although standing theoretical models have assumed that this foreign body was as much as 100 feet wide, twice that of the Feb 15 encounter, revised 2008 simulations suggest that widespread damage was actually caused by an asteroid 65 feet in diameter with significantly less mass. Physicist Mark Boslough of the Sandia National Laboratory calculated that the asteroid would have generated a supersonic jet of expanding, superheated gas. The fireball created from this volatile mass would have generated shock waves much stronger at the surface than originally thought.

As with many countries, Russia is extremely active in seeking out new comets and asteroids. In 2012, Russian astronomers Vitaly Nevsky and Artyom Novichonok discovered a new gigantic comet that is currently approaching Earth. The JSON comet, which is expected to become brighter than the full moon, will be visible to the naked eye by late 2013.
WHAT’S UP IN THE SKY
AAA Observers’ March Guide

By Richard Rosenberg

March’s Evening Planets: Only Jupiter and Saturn are visible in the evening sky. Jupiter, in Taurus, gets noticeably lower each week. Saturn, in Libra, rises about 10 PM. Comet Pan-STARRS may be visible with a telescope or binoculars a good part of March, and possibly with the naked eye for part of that period. From March 8-20 the comet is very low in the west. On the 12th, look 4° to the left of the crescent Moon. Remember the comet’s location (the Moon will have moved) for the next few nights. The comet has the potential to be a great one, or a bust.

March’s Evening Stars: The bright winter constellations are still around. They include Taurus the Bull, Auriga the Charioteer, Gemini the Twins, Canis Minor the Little Dog, Canis Major the Large Dog and of course Orion the Hunter. In the south, the spring constellations include Leo the Lion, Bootes the Herdsman and Virgo the Virgin.

March’s Morning Planets: The situation is even worse for the morning sky. Venus and Mars are in conjunction with the Sun early in the month, and won’t be seen. Venus is in conjunction with the Sun early in the month, and cannot be seen in March. It will be too close to the Sun until late April. Mercury is in the morning sky, but very low and probably needed by a telescope to spot. Jupiter (low in the west) and Saturn (becoming more prominent in the east) are the only naked-eye planets to be seen.

March’s Morning Stars: The spring constellations of Bootes and Hercules are in the west. The Summer Triangle (with the constellations Lyra, Cygnus and Aquila and corresponding bright stars Vega, Deneb and Altair) is near the zenith. Sagittarius is very low but if you have a dark sky the view is magnificent. The autumn constellations include Cassiopeia, Perseus, Pegasus and Andromeda.

March “Skylights”

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>March 1</td>
<td>Spica is 1.1° east of the Moon this morning</td>
</tr>
<tr>
<td>March 2</td>
<td>Saturn is 3.3° north of the Moon</td>
</tr>
<tr>
<td>March 4</td>
<td>Mercury is in inferior conjunction, entering the morning sky</td>
</tr>
<tr>
<td></td>
<td>Last Quarter Moon at 4:53 p.m. (EST)</td>
</tr>
<tr>
<td>March 11</td>
<td>New Moon at 3:51 p.m. (EDT)</td>
</tr>
<tr>
<td>March 12</td>
<td>Comet PanSTARRS is 4° left of the very thin crescent Moon. This is the best early opportunity to spot the comet</td>
</tr>
<tr>
<td>March 17</td>
<td>Jupiter is 1.5° northeast of the Moon</td>
</tr>
<tr>
<td>March 19</td>
<td>First Quarter Moon at 1:27 p.m. (EDT)</td>
</tr>
<tr>
<td>March 20</td>
<td>Vernal Equinox at 7:02 p.m. (EDT)</td>
</tr>
<tr>
<td>March 27</td>
<td>Full Moon at 5:27 a.m. (EDT)</td>
</tr>
<tr>
<td>March 28</td>
<td>Spica is 0.9° upper left of the Moon. Venus is in superior conjunction, entering the evening sky</td>
</tr>
<tr>
<td>March 29</td>
<td>Uranus is in conjunction with the Sun, entering the morning sky</td>
</tr>
<tr>
<td>March 31</td>
<td>Mercury’s greatest elongation west of the Sun</td>
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</tbody>
</table>

For additional information visit: www.aaa.org/month313

Astronomical Fact of the Month

A New Earth in Our Milky Way?

By Evan Schneider

Astronomers recently calculated that there are billions of Earth-like planets in our galaxy. The nearest is just around the corner, by galactic standards. Our Milky Way has 75 billion red dwarfs, stars smaller and dimmer than our Sun, hosting a variety of possibly “habitable” planets. Approximately 6% of these systems likely include Earth-sized planets. Doing the math yields 4.5 billion alien Earths, a considerable group of targets to “seek out new life and new civilizations.” A recent study by the Harvard-Smithsonian Center for Astrophysics gleaned data from NASA’s Kepler mission, concluding that another Earth is probably in our own backyard, just waiting to be spotted. Once located, astronomers will use future the James Webb Space Telescope and extremely large ground-based telescopes like the Giant Magellan Telescope to triangulate each candidate.

Nebula of the Month

Rose Nebula N11A

By Evan Schneider

Floating in the Large Magellanic Cloud, a small galaxy 179,000 light-years away from our own Milky Way Galaxy, you will find Nebula N11A, its central stars radiating fiercely as surrounding gas is illuminated in every direction. NASA/ESA’s Hubble took interest in this region of space, producing the photograph below. Utilizing its powerful array, the telescope resolved many large stars that make it glow so intensely. Such information is essential to better understand the formation of massive stars, that is, stars more than 10 times as heavy as our Sun. “We need to study the properties of star-forming regions in our neighboring galaxies to understand how stars are formed in the distant, young universe,” explains Mohammad Heydari-Malayeri who led a French observing team studying these Hubble observations.

Photo Credit: 2 Micron All Sky Survey
Hello Members:

We are pleased to announce that our Winter Astronomy Class for 2013 - The Solar System - was sold out. We actually received more applications than available space. Stay tuned for future classes announcements, as we are expanding our offerings to enrich the AAA membership experience.

Observing is returning to Floyd Bennett Field - new location at the same great site (many thanks to Art Kunhardt for making this possible). Starting this month, we have also added the Bronx to our regular observing sites. Woodlawn Cemetery for night observing, and solar observing at the Riverdale entrance to the Bronx Zoo, will provide our local members with a great opportunity to participate. We now have two scheduled solar observing sessions each month! Check out more about our observing sites at http://www.aaa.org/observing, and check out our calendar at http://aaa.org/calendar.

The AAA Lecture Series continues at AMNH with our next speaker, Shane Larson, from Utah State University. He will be presenting "Whispers from the Cosmos: The Dawn of Gravitational Wave Astronomy" on Friday, March 1. This season's full schedule is available at http://www.aaa.org/lectures1213, as well as in Eyepiece.

Thanks, everyone!
Sincerely,

Marcelo Cabrera
President, AAA

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Become a AAA Urban Starfest Team Member

**Member Volunteers Needed**

Come join your fellow amateur astronomers as we support our club and all of NYC. This Spring’s AAA Spring Urban Starfest is coming!

**Saturday, April 13 7:00 p.m. – 10:00 p.m.**

**Woodlawn Cemetery, Bronx**

At AAA, there are number of different ways that you can volunteer and feel great about encouraging New York City to observe the skies - supporting AAA events, investing in NYC Parks community recreational activities, and contributing to the one of the largest amateur astronomy clubs in the country. Our volunteer opportunities are open to all members, their families and non-members.

For more information and to volunteer:
Contact Susan Andreoli at vp@aaa.org

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**Available Staff Positions for Urban Starfest**

**Pre-Event Staffing Positions**

5 Members to help stuff goody bags

Time Required: One evening in Manhattan, for 2-3 hours, approximately two weeks before the event.

**Event Night Staffing Positions**

1 Experienced photographer
1 Experienced writer/Tweeter/ blogger
10 Raffle tables staff
10 Event set-up/ break down/ hand-outs (must be comfortable lifting 15 pounds)
2 Runners

**Our AAA Gift for You**

All volunteers will receive a special event volunteer T-shirt
WHAT IF??

Wile E. Coyote: Astronaut Extraordinaire

By Richard Brounstein

NASA could do much worse. Super-genius Wile E. Coyote is a force to reckon with - a blend of technical expertise and creative talents to rival any engineer or scientist. From his cave in the desert, he has built and operated a personal “Batman-like” flying outfit, a rocket sled, jet-powered roller skates, artificial earthquake pills, and even a large bow to launch himself like an arrow. But it isn’t just his bravery, expertise, or ingenuity that is so impressive. His body is superhuman (or super-coyote). He can withstand enormous g-forces, has the flexibility to fit into tiny spaces without suffering from claustrophobia, withstands intense heat, breaks through solid rock (sometimes), and has incredible personal strength - enough to lift many times his body weight. He also has the physical stamina to be smashed against rock and survive unharmed. This is all the result of being focused on a single life goal - to catch the Road Runner.

There are lessons to be learned from this resilient and determined creature. As we push farther into the universe, the creation of new technologies to master these environments becomes critical. Humans are limited in ability. We need machines to protect our bodies from harsh environments. We need protection from deadly radiation, intense heat, lack of oxygenated gases at suitable pressure, cold, and lack of nutrients. Over time, we also need gravity resistance, or our muscles and bones will degenerate.

Technology will hopefully continue to increase the resiliency of our fragile human bodies to survive in space, allowing us to explore alien planets, moons, comets and asteroids in greater comfort and safety. There are several ways I envision these artificial improvements shaping our future.

The first challenge is leaving Earth’s atmosphere. We need pressurized gasses with sufficient oxygen to breathe. Human lungs do a great job on Earth, but What If lungs could be enhanced with independently powered processors that convert carbon dioxide waste gas back to oxygen. Then, we could exist in any atmospheric condition. Of course, the vacuum of space, or great atmospheric or water pressure are still a threat to human health, so we have more engineering work to do here - but this would be a good start.

Even if physical human engineering succeeds, we still need the ability to communicate effectively. No atmosphere, no sound waves. So, What If devices implanted in our brains allowed thought transmission to an external communication device? If we could establish a cerebral interface with technology, then storage and retrieval of information becomes even more efficient. Apollo astronauts walking on the Moon had checklists written in books attached to their spacesuits. Imagine accessing a storage device checklist through your thoughts. Accessing the internet or large databases of scientific information (geology, star charts, astronomical data, etc.) would be just an impulse away. The current definition of intelligence would change. You would only need to know how to access the information, not retain it.

Wile E. Coyote also manages enormous g-forces, falling hundreds of feet and crawling away uninjured. This would be difficult to engineer into humans - we’re just too fragile. But, can devices help humans to survive a spacecraft’s raid acceleration or deceleration without causing great stress on our vision, heart or lungs? Perhaps. Today, jet fighter pilots, who regularly deal with as much as 5 G’s of acceleration, have access to G-force suits that keep the blood flowing and prevent a blackout. Can technology bring this number up to 10 or 20 sustained G’s to explore more massive planets or execute a hard landing on a planet? Only time will tell.

I can imagine engineered human hearts that force the blood to keep flowing, despite additional external forces. Other devices might protect or reinforce blood vessels and the heart, preventing an astronaut from blacking out. The same could be applied to any of the more susceptible organs. Since our muscles are not strong enough to lift our arms to operate a console in heavy G-forces, they would need an engineering boost for movement of arms and fingers under great stresses.

Once humans are better engineered to survive harsh environments, we may want to consider using technology to improve other abilities. Additional appendages would be useful (add a third or fourth artificial arm to multi-task). Personal rocket packs or rocket jets on our feet would provide increased mobility. Telescopic vision or microscopic vision, with settings to see radio, ultra violet, and infrared wavelengths with digitally-enhanced eyes (Lieutenant Commander Geordi LaForge, USS Enterprise, had the right idea). Artificial muscles for our arms and legs that to give a person many times their strength and speed may be required in an emergency.

What we’re really doing is taking control of human evolution and speeding up the process. If the survival of our species depends upon reaching and living on other worlds, then I prefer a human-controlled evolution over nature. We may not have the amazing abilities of Wile E. Coyote, but we can help ourselves develop faster.

Anyone up for a Road Runner steak? Meep, meep!

Richard Brounstein’s monthly column, “WHAT IF,” explores what today seems improbable or impossible. Stay tuned for more fascinating concepts.
Disco Infant May be Twins

Two of NASA’s great observatories, the Spitzer and Hubble space telescopes, have teamed up to uncover a mysterious infant star that behaves like a strobe light. Every 25.34 days, the object, designated LRLL 54361, unleashes a burst of light. Although a similar phenomenon has been observed in two other young stellar objects, this is the most powerful such beacon seen to date. The heart of the fireworks is hidden behind a dense disk and envelope of dust. Astronomers propose the light flashes are caused by periodic interactions between two newly formed stars that are binary, or gravitationally bound to each other. LRLL 54361 offers insights into the early stages of star formation when lots of gas and dust is being rapidly accreted, or pulled together, to form a new binary star. Astronomers theorize the flashes are caused by material suddenly being dumped onto the growing stars, known as protostars. A blast of radiation is unleashed each time the stars get close to each other in their orbits. This phenomenon, called “pulsed accretion”, has been seen in later stages of star birth, but never in such a young system or with such intensity and regularity. “This protostar has such large brightness variations with a precise period that it is very difficult to explain,” said James Muzerolle of the Space Telescope Science Institute. Discovered by NASA’s Spitzer Space Telescope, LRLL 54361 is a variable object inside the star-forming region IC 348, located 950 light-years from Earth. Data from Spitzer revealed the presence of protostars. Based on statistical analysis, the two stars are estimated to be a few hundred thousand years old. The Spitzer infrared data, collected repeatedly during a period of seven years, showed unusual outbursts in the brightness of the suspected binary protostar. Surprisingly, the outbursts occurred every 25.34 days, a very rare phenomenon. Astronomers used Hubble to confirm the Spitzer observations, revealing a detailed stellar structure around LRLL 54361. Hubble observed two cavities above and below a dusty disk, visible by tracing light scattered off their edges. They likely were blown out of the surrounding envelope of dust and gas by an outflow launched near the central stars. The disk and the envelope prevent the suspected binary star pair from being observed directly. By capturing multiple images over the course of one pulse event, the Hubble observations uncovered a spectacular movement of light away from the center of the system, an optical illusion known as a light echo. Muzerolle and his team hypothesized the pair of stars in the center of the dust cloud move around each other in a very eccentric orbit.

Doom in a Black Hole

New data from NASA’s Chandra X-ray Observatory suggest a highly distorted supernova remnant may contain the most recent black hole formed in the Milky Way galaxy. The remnant appears to be the product of a rare explosion in which matter is ejected at high speeds along the poles of a rotating star. The remnant, called W49B, is about a thousand years old, as seen from Earth, and located about 26,000 light-years away. “W49B is the first of its kind to be discovered in the galaxy,” said Laura Lopez, who led the MIT study. “It appears its parent star ended its life in a way that most others don’t.” Usually when a massive star runs out of fuel, the central region of the star collapses, triggering a chain of events that quickly culminate in a supernova explosion. Most of these explosions are generally symmetrical, with the stellar material blasting away more or less evenly in all directions. However, in the W49B supernova, material near the poles of the doomed rotating star was ejected at a much higher speed than material emanating from its equator. Jets shooting away from the star's poles mainly shaped the supernova explosion and its aftermath. The remnant now glows brightly in X-rays and other wavelengths, offering the evidence for a peculiar explosion.

Quotes From the Curiosity Soil Team

Curiosity’s Chemistry and Mineralogy instrument, CheMin, manages the identification of minerals in rocks and soil, crucial for the mission's goal to assess past environmental conditions. Each mineral records the conditions under which it formed. CheMin uses X-ray diffraction, the standard practice for geologists on Earth using much larger laboratory instruments. This method provides more accurate identifications of minerals than any method previously used on Mars. X-ray diffraction reads minerals' internal structure by recording how their crystals distinctively interact with X-rays.

David Bish, CheMin co-investigator: “So far, the materials Curiosity has analyzed are consistent with our initial ideas of the deposits in Gale Crater recording a transition through time from a wet to dry environment. The ancient rocks, such as the conglomerates, suggest flowing water, while the minerals in the younger soil are consistent with limited interaction with water. Much of Mars is covered with dust, and we had an incomplete understanding of its mineralogy. We now know it is mineralogically similar to basaltic material, with significant amounts of feldspar, pyroxene and olivine, which was not unexpected. Half the soil is non-crystalline material, such as volcanic glass or products from weathering of the glass.”

David Blake, NASA Ames Research Center: "Our team is elated with these first results from our instrument. They heighten our anticipation for future CheMin analyses in the months and miles ahead for Curiosity… Our quantitative results provide refined and in some cases new identifications of the minerals in this first X-ray diffraction analysis on Mars."
WHY WE EXPLORE

**NASA Mission: Human Desire to Explore Ourselves**
By Amy Wagner

**Former NASA Administrator James Fletcher predicted that, if there was one space age development to save the world, it would be Landsat and its successor satellites. Since 1972, NASA’s Landsat spacecraft program has continuously taken images of Earth, providing an unparalleled data archive, unmatched in quality, detail, coverage, and length.**

“It was the granddaddy of them all, as far as starting the trend of repetitive, calibrated observations of the Earth at a spatial resolution where one can detect man’s interaction with the environment,” lauds Darrel Williams, Landsat 7 Project scientist.

The Landsat program is a series of Earth-observing satellite missions jointly managed by NASA and the U.S. Geological Survey. For nearly 40 years, the program has collected spectral information from Earth’s surface, constituting the longest record of continental surfaces as seen from space.

In February, Landsat 5 set the Guinness World Record title for “Longest-operating Earth observation satellite.” Launched March 1, 1984, Landsat 5 has outlived its three-year design life, delivering data of Earth’s land surface for 29 years. It will now be decommissioned due to failure of a redundant gyroscope.

Landsat is overseen by the Earth Science division of NASA’s Science Mission Directorate for space exploration, which focuses on the pivotal question: How is the global Earth system changing, and how will it change in the future? Developing this knowledge base will provide other NASA departments with the ability to track the developments of distant planets, as they are discovered and identified by exoplanet hunters like the Kepler mission. Changes in precipitation patterns, length of growing seasons, severity of storms, and sea level must be understood to determine which aspects of climate change are most harmful – and how we can adapt to those changes we cannot reverse. The Earth Systematic Missions Program observes these changes and the Earth’s response to natural and human-induced forces. The Landsat Data Continuity Mission is the newest effort in its program.

Launched on February 11 on an Atlas V rocket at Vandenberg Air Force Base, the LDCM spacecraft will measure the Earth’s terrestrial and polar regions in the visible, near-infrared, short wave infrared and thermal infrared spectra. LDCM (“Landsat 8”) will extend decades of global land observations informing energy and water management, climate change, forestry, human and environmental health, urban planning, disaster recovery, and agriculture.

Now in polar orbit, LDCM is circling Earth 14 times each day at an altitude of 438 miles, monitoring each location every 16 days. Its Operational Land Imager and Thermal Infrared Sensor are evolutionary advances in technology and performance that will measure new spectral bands not covered by prior Landsats. “LDCM will be the best Landsat satellite yet launched in terms of the quality and quantity of the data collected,” says Jim Irons, project scientist at Goddard Space Flight Center. “OLI and TIRS...will make the observations more sensitive to the variation across the landscape and to changes in the land surface over time.”

The Earth is a complex, dynamic system – atmosphere, lithosphere, hydrosphere, cryosphere, and biosphere are all connected – and our planet is changing on spatial and temporal scales. Unprecedented changes in land cover and use are having profound consequences for weather, climate, ecosystems, carbon cycling, and resource management, economy, human health, and society. Meanwhile, the Earth is in a period of warming. Over the last century, average temperature rose about 0.6°C (1.1°F), and warming accelerated in the last two decades.

Should we be concerned about a warming trend? After all, Earth has witnessed extreme warm periods before, as in the time of the dinosaurs, as well as numerous ice ages - roughly one every 11,000 years for at least the last million years. However, most of Earth’s history did not include humans. As Earth consumes more fossil fuel energy, greenhouse gas concentrations continue to rise, and temperature along with them. The Intergovernmental Panel on Climate Change estimates that Earth’s average surface temperature could rise between 2°C and 6°C by the end of the 21st century.

NASA Earth System Science works with global partners in government, industry, and the public to enhance economic security and environmental stewardship – conducting and sponsoring research to deliver sound science that helps decision-makers reach for new heights and reveal the unknown, so that what we do and learn will benefit all humankind.

(Desire to Explore Ourselves can’t on Page 7)
Earth is the only planet we know to be capable of sustaining life. According to “Earth from Space,” a two-hour NOVA special that aired in February, the number of satellites observing Earth will go from 20 to less than 10 in the next decade. If we fail to replace these satellites, we will lose the ability to track the web of connections fundamental to life on Earth, those that maintain life as we know it in the universe.

The data, which is free and openly accessible to the public, “is used by thousands of users all over the world,” says Del Jenstrom, Deputy Project Manager at Goddard, “And to me, that's very rewarding, to work with such a great team of people on a mission that really does affect people's lives.”

Behind this mission is a more far-reaching one — developing the ability to monitor conditions on other planets, both within our solar system and outward, as we steadily identify more and more exoplanets through space-based and land-based telescopes. Maintaining and continuing the development of these technologies will, one day, allow future missions to report back to NASA, and help them gauge surface conditions and changes, perhaps in preparation for manned missions.

In June, 2010 Morgan Bettex of the MIT News Office reported, “A team of astronomers, including a researcher from MIT’s Kavli Institute for Astrophysics and Space Research, has become the first to measure wind in the atmosphere of an exoplanet. By detecting heavy winds on HD209458b, a huge exoplanet located 150 light years away that is slightly more than half the mass of Jupiter, the researchers could then measure the movement of the planet as it orbited its host star - also another first for exoplanetary research.”

Scientists continue to be focused on conditions that will be encountered on alien worlds. Exoplanet discovery started in 1995. Today, the NASA Exoplanet Archive reports that 834 planets have been discovered around 650 stars, and there are 2,717 Kepler candidates and confirmed planets.

From Curiosity’s Dashboard

PASADENA, Calif. - NASA's car-sized rover, Curiosity, has taken significant steps toward understanding how Mars may have lost much of its original atmosphere.

Learning what happened to the Martian atmosphere will help scientists assess whether the planet ever was habitable. The present atmosphere of Mars is 100 times thinner than Earth’s.

A set of instruments aboard the rover has ingested and analyzed samples of the atmosphere collected near the “Rocknest” site in Gale Crater where the rover stopped for research. Findings from the Sample Analysis at Mars (SAM) instruments suggest that loss of a fraction of the atmosphere, resulting from a physical process favoring retention of heavier isotopes of certain elements, has been a significant factor in the evolution of the planet. Isotopes are variants of the same Element with different atomic weights.

Initial SAM results show an increase of 5% in heavier isotopes of carbon in the atmospheric carbon dioxide compared to estimates of the isotopic ratios present when Mars formed. These enriched ratios of heavier isotopes to lighter ones suggest the top of the atmosphere may have been lost to interplanetary space. Losses at the top of the atmosphere would deplete lighter isotopes. Isotopes of argon also show enrichment of the heavy isotope, matching previous estimates of atmosphere composition derived from studies of Martian meteorites on Earth. During the first 12 weeks after Curiosity landed at Gale Crater, an international team of researchers analyzed data from more than 20 atmospheric events with at least one characteristic of a whirlwind recorded by the Rover Environmental Monitoring Station (REMS) instrument.

We inspire the next generation of explorers by providing opportunities for learners of all ages to investigate the Earth system using unique NASA resources, and our Earth System research is strengthening science, technology, engineering and mathematics education nationwide.”

NASA Earth System Science

Kleegor’s Universe

By Joshua M. Erich, www.pixelatedparchment.com
Comet Discoverer's Insights on Sungrazing Comets
By Tony Hoffman

Comet Discoverer and researcher David Seargent has followed up on his 2008 book, *The Greatest Comets in History: Broom Stars and Celestial Scimitars*, with a new work, *Sungrazing Comets: Snowballs in the Furnace*, available in Kindle e-book form ($4.90), focuses on comets that pass extremely close to our star, and includes the latest results and projections in the wake of the spectacular near-death dive and resurrection of Comet Lovejoy in late 2011 and the approach of Comet ISON, a comet with very small perihelion distance and enormous (and perhaps over-hyped) potential.

Sungrazing comets have included some of the most spectacular views ever seen in the sky, including daylight objects that appeared in 1106, 1843, 1882, and 1965. Several of them may have rivaled the full Moon in brightness (albeit in a daylight sky when very near the Sun), including the Great Comet of 1882, widely regarded as the most brilliant comet on record. They also include thousands of tiny comets, some as small as three feet across, that have been discovered in images of the Sun’s vicinity from the SOHO STEREO, and other space borne solar observatories. The vast majority belong to The Kreutz Group, named for the astronomer who noted that several bright comets seemed to have traveled in similar orbits.

Seargent explores the relationships between this family of objects, believed to be the result of the cascading fragmentation over the past few millennia of what was originally a larger comet. He discusses many other sightings of comets (as well as “stars” near the Sun) from the historical record with an eye to determining which belong to The Kreutz Group.

The book also discusses Comet Lovejoy data, which few astronomers expected to survive perihelion, let alone emerge from its solar encounter as a spectacular object, and why there may be an upper limit to these comets’ brightnesses, the relationship between an uptick in the frequency of the SOHO mini-comets and the arrival of larger comets. Clustering data arriving sungrazing comets will provide a greater understanding to the origin and evolution of these fascinating objects.
On a recent walk, I decided to take in a little bit of our night sky from Inwood Hill Park - this time without a telescope. I climbed to the hilltop above the tennis courts, high enough to leave the street lamps 70 feet below. Gazing out into the night sky I saw Orion, rising in the East, with its stars blazing brightly. Setting in the West was the Great Square of Pegasus: Scheat, Alpheratz, Markab and Algenib. Jupiter held sway over it all, shining with its singular brilliance, its light a penetrating glow that always seems quite mysterious when floating in the sky next to Aldebaran and the Pleiades.

I thought to count all of the stars that I could see - going around the entire sky - from ones that are low to ones that are high. It took a few minutes, and I didn't try to trick myself into believing I could see stars that weren't easily seen. There I sat on an abandoned plastic milk crate, in the darkest possible place within a short walk from my home. After five minutes, I had counted 107 stars - just those 107, and no more.

Our night sky is rapidly disappearing under wanton glare, ignorant landlords, paranoid parks officials, poorly designed street lamps, and the bizarre idea that electricity doesn’t come with a price tag. I wear a cowboy hat these days, just so I can tip it into the glare of people who simply must drive (or park) with their car’s high beams blinding us all. But what about my “107”? They were not lost in the glare. And so, I pondered an ancient, but pointed, question: “Why don’t they just fall down out of the sky?” To those wise in the ways of science, this query will spark a laugh, a well-meaning mini-lecture, or both.

My 107 seemed to be painted on the reddish black back- 
ground of the universe - what passes for night sky in NYC. Even though naked-eye observing was limited, the view was so sharp and so clear that night, and the view of Jupiter through the telescope would have been wondrous, to be sure.

But those 107 still called to me, and spoke in a way I was not sure I had ever heard. You see, before going up there, I had first thought of filling my evening with the loud noise of a local bar, its blaring TV screens demanding that I watch and engage in their fervent needs. Instead, I opted for the 107 - just waiting there for me. These stars have names given many times by many cultures. Their lights shining down on us, gently tugging at our minds, asking us to look up and spend a moment asking silly (or profound) questions, such as “What are they, really,” or “What’s it like out there,” or “How far away are they?”, or “Did my grandfather see the same stars?” Were these the same 107 stars that, tonight, barely broke through our bright planet’s atmosphere?

I know why we block out the night. We have slain all the mythical monsters over the course of history, but we still believe in them. The only ones left, however, are ourselves – still fearing each other. So, we put up garish spotlights on the streets below to extend the daylight. People respond to this intrusion into their homes with thick curtains. The street below is still unsafe in places, even though brightly lit. In fact, much less safe, since no one will open a window at night to look at what was once the glorious street-life below.

Those 107 still hover above, calling us back to the gentle night, with its odd sounds of nocturnal insects and evening birds. When I was a child, my window looked out over our backyard. I would fall asleep to the soft breeze passing through the open window, listening to the owls, squirrels, and rabbits, all coming out to make their way in the darkness. The leaves rustled outside, as the wind moved onward to its unknown destination - and I looked out my window to the night sky. I counted stars then, too. It used to take a just few seconds to count 107 stars, and then I would fall asleep.
FOCUS ON THE UNIVERSE

Preparing to Photograph Comet PanSTARRS

By Stan Honda

One of my earliest astronomical memories is being woken up before dawn by my mother and going out on the front porch of our San Diego house. In the early morning hours, just hanging there in the eastern sky, was Comet Ikeya-Seki - one of the brightest comets ever to be witnessed. It was quiet outside, and there was the comet, stationary, like a large smudge surrounded by stars. I expected it to be moving since newspaper accounts reported the comet to be “streaking” past the Earth - but what’s a seven year old to know?

I don’t think we had binoculars, and I wasn’t into photography then, so a memory is my only record. This year, two comets are expected to be visible to the naked eye. I’m hoping to get ready photographically to record these celestial visitors.

Comet PanSTARRS, discovered by the Panoramic Survey Telescope & Rapid Response System atop the Haleakala volcano in Hawaii, should emerge from the Sun’s glare in early to mid-March, low on the western horizon during twilight, just after sunset. The best period of visibility will be Mar 7-24. The 12th and 13th appear to be the best for dramatic photos: the comet will be seen not far from a crescent moon. Predictions say PanSTARRS will be about a magnitude 3, and binoculars or a small telescope will be needed to see the tail.

Fortunately, a camera with a telephoto lens is very similar to binoculars or a small telescope, with the added advantage of being able to record what you see. For a nice close-up shot, I will use my Nikon 400mm f2.8 lens, possibly with a 1.4x teleconverter attached, making it the equivalent of a 560mm f4 lens. In comparison, an 8x42 binocular – 8 being the magnification, 42 being the front aperture in millimeters – has an angle of view of 7.7 degrees, while a 10x42 binocular has an angle of view of 6.5 degrees. A 400mm lens on a full-frame digital SLR has an angle of view of 6.2 degrees.

Various charts showing the south to north progression of PanSTARRS suggest it will be quite low (around 10 degrees or less) from the horizon. Here in New York it’s often hard to even see the horizon, much less any object in the sky at that low altitude. One solution - get yourself to a higher altitude. If you have access to the roof of a building that has a clear view west, you might be in luck. The tracking chart shows the comet at a compass heading of about 267 degrees on Mar 12 and 269 degrees on Mar 13. I often use an old-fashioned compass to try and predict where an object will be in relation to the horizon. Then I’ll see if there is an interesting building, tree, or landmark near comet and Moon projected location in the sky.

Since there will be an interesting conjunction, I want to use a lens that also shows the Moon and a foreground landmark for perspective. I’m going to borrow a Nikon 200-400mm f4 zoom lens, which will give me a pretty wide range – from a view of 12.3 degrees to 6.2 degrees. On the 12th, the crescent moon and the comet may be around 3-4 degrees apart and about 7 degrees above the horizon. If that’s the case, I’d want a lens with enough of a view to take in both objects and some interesting building or landscape. The 200-400mm zoom should give enough flexibility to frame a nice photo.

I’ll be using my Nikon D4 camera on the RAW setting for maximum quality. Shooting in RAW allows for more control of the image. You can compensate for under-or over-exposure and correct the color balance more accurately than with a JPEG file. It’s often good to bracket your exposures - shoot one photo at what the camera says is the right setting, then shoot one at one f-stop over that exposure and one at an f-stop under the exposure. You can also change shutter speeds for the same effect - if the correct exposure is 1/60 second, shoot a second photo at 1/30 second and a third at 1/125 second. (Many digital SLR cameras will do this automatically, look for “Bracket” on the camera menu.).

I will also take a sturdy tripod and an electronic shutter cable release. For maximum sharpness, I may shoot at a small f-stop of f8, and at twilight I may need a shutter speed of below 1/30 second or so. The cable release will isolate my hands, so there won’t be any camera movement during the exposure.

Check out the location a few days before to see what twilight looks like, and take some test photos to get an idea of exposure and what lens to use. Remember, the Moon is about half a degree across and the comet tail is expected to be about two degrees long. It’s good to have a backup plan – mine generally involves driving somewhere outside of New York City in case the weather is not good.

Perhaps PanSTARRS will exceed the predictions. We’ll have to wait until after the perihelion on March 10. We can look forward to a second comet, ISON, in December, which is supposed to be much bigger and brighter. Watch for photographs and a report on my experience in April’s Eyepiece. Good luck shooting!

Stan Honda is an accomplished professional photographer and contributing writer. In this continuing series of articles, he shares his extensive knowledge of photographic equipment and techniques.

Please visit www.stanhonda.com or submit your photography questions to stanhonda@gmail.com.
**AAA Events on the Horizon**

**March 2013**

**Thursday, March 7**  
6:00 - 8:00 p.m., M  
Seminar on Recent Advances in Astronomy  
4 Washington Place (NYU)  
*Next date: April 11*

**Friday, March 8**  
7:00 - 10:00 p.m., M, P, C  
Observing - Bronx - Woodlawn Cemetery  
*Next date: April 12*

**Saturday, March 9**  
11:00 a.m. - 1:00 p.m., M, P, C  
Solar Observing - Bronx Zoo Riverwalk Entrance  
*Next date: April 13*

**Sunday, March 31**  
1:00 - 3:00 p.m., M, P, C  
Solar observing in Central Park, at the Conservatory Water  
*Legend for Events: M: Members; T: Bring telescopes, binoculars, etc.  
P: Open to the public  
C: Cancelled if cloudy*

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**AAA 2012/2013 Lecture Series Calendar**

The AAA is proud to present an astronomy lecture series from October through May each year. Members and the public are welcome to attend. Admission is free, and no reservations or tickets are required.

Lectures are held at the Kaufmann Theater, American Museum of Natural History, Central Park West between 77th and 81st streets (use 77th Street entrance).

Lectures begin at 6:15 p.m. and run to 8:00 p.m.

- **Mar 1**  
  Shane Larson - USU - “Whispers From the Cosmos: The Dawn of Gravitational Wave Astronomy”

- **Apr 5**  
  Andrew Kessler - Author - “Robot Arms, Cowboy Spacemen and my 90 Days With the Phoenix Mars Mission”

- **Apr 26**  
  National Technical Institute for the Deaf at RIT - Astrodance at CUNY Graduate Center

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**Observing a Reduction in Solar Activity**  
By Joe Fedrick

The Sun seemed rather active in very early January, but subsequently, during late January and all of February so far, I spotted only two sunspot groups when I projected the solar image using my 600 mm f/15 achromatic refract and an old 20mm eyepiece. This year is supposed to be the peak of solar activity for this cycle. However, there is generally nowhere near the level of activity I remember seeing in 1999 and 2001 during the double peak of the last sunspot cycle. Also I remember that in 2001 the Northern Lights were spotted several times from the NY metropolitan area. In fact, I saw the Northern Lights in late October 2011 from Bear Mountain and in November 2001 from the Bronx. I have not seen the Northern Lights during this cycle. As far as I know, no one else has from the NY area. Perhaps this marks the beginning of another solar activity minimum, such as the Mauder minimum during the Little Ice Age, and perhaps this is why our winter weather this year has been closer to normal, with ice and snow and cold, as winter is supposed to be. Perhaps we will see more Sunspots as the winter develops.

Joe Fedrick is an experienced and dedicated AAA observer, always watching the night (and daytime) skies. His continued observations bring us new dimensions to viewing the cosmos and solar activity.

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**The Kepler Space Telescope:**

**Finding New Worlds**

**A Public Lecture by Jason Kendall**

**Presented at The Explorers Club**

**46 E. 70th Street**

**Monday, Mar 25 at 7:00 p.m.**

**Admission: $20 (non-Explorer Club members)**

On January 7, the Kepler Space Telescope (KST) team announced that planets are amazingly common in our Galaxy. Nearly every single Sun-like star has at least one planet around it. KST is hunting for the golden chalice of exoplanets: an Earth-sized planet orbiting a star just like our Sun, orbiting at the same distance in the “habitable zone.” Kepler’s extended mission may be able to accomplish this goal within the next three years. To its credit, KST has discovered 105 confirmed planets around other stars and 2,740 planet candidates. Come learn how this amazing work has been done. This is an era of unprecedented learning about a fundamental question in astronomy, and in fact humankind.

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**NEXT MONTH IN EYEPiece**

I’m leaving this space empty for you all to guess! Expect more insightful articles by our talented and dedicated staff. Care to join us? Email me at editor@aaa.org - EBS

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**Eyepiece Staff - March Issue**

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