



Astronomy Club News January, 2007

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The first “dinner and a movie” meeting was held on December 9th at Morgan Outdoors in Livingston Manor. Part of the Cosmos series was shown the episode was entitled “Heaven and Hell”. Narrated by Carl Sagan, the episode discussed the nature of comets and how the Earth as well as other objects in our solar system had been hit by meteors and asteroids. It also showed how Venus compares to the Earth as far as its surface and atmosphere. The end of the episode provided a strong message concerning the need for environmental protection on the Earth so that our planet remains habitable. The movie was well received. An informative question and answer session was held midway through the episode as well as at the end. Another “dinner and a movie” meeting is in the planning stages for January. Details on the event will be announced in a future email.

The December 23rd observation session was held at Walnut Mountain Park. Four people participated. The sky conditions were good when passing clouds did not obscure the view. The group observed many deep sky objects. Our observation list included M42 (the Orion Nebula), M35 (an open star cluster in Gemini), M1 (the Crab Nebula super nova remnant), and NGC 2392 (the remains of a dying star called the Eskimo Nebula). Four other open clusters (M36, M37, NGC 1907, and M38) in Auriga were also viewed. The session ended around 9:30 due to overcast skies.

The observation session scheduled for December 16th was canceled due to a poor weather forecast.

The proposed 2007 observation dates are shown below. Alternate dates will be announced as needed.

1/13, 1/20, 2/10, 2/17, 3/17, 3/24, 4/14, 4/21, 5/12, 5/19, 6/9, 6/16, 7/7, 7/14, 8/4, 8/11, 9/8, 9/15, 10/6, 10/13, 11/3, 11/10, 12/8, 12/15

The club has selection of astronomy books, Stardate audio CDs, and a Meade 8 inch reflector for members to borrow. Please contact John at 791-5240 or kocis@verizon.net if you are interested in borrowing any of these.

Astronomy News:

Here are some articles from various NASA sources that might be of interest.

December 14, 2006

Comets as Toolkits for Jump-Starting Life

Just as kits of little plastic bricks can be used to make everything from models of the space shuttle to the statue of liberty, comets are looking more and more like one of nature's toolkits for creating life. These chunks of ice and dust wandering our solar system appear to be filled with organic molecules that are the building blocks of life.

The discovery of two kinds of nitrogen-rich organic molecules in comet Wild 2 is the latest addition to the set of bits and pieces useful to the origin of life that has been found in comets.

These discoveries were made by members of the Stardust Preliminary Examination Team, a group of scientists who have been studying the samples returned from comet Wild 2 by NASA's Stardust spacecraft in January 2006.

"These results show that comets could have delivered nitrogen rich organic compounds to the early Earth where they would have been available for the origin of life," said Scott Sandford of NASA's Ames Research Center, Moffett Field, Calif.

"This discovery shows that the menu of compounds available for the origin of life was richer than had been previously thought," said Jason Dworkin of NASA's Goddard Space Flight Center, Greenbelt, Md.

"The two molecules we discovered in comet Wild 2, methylamine and ethylamine, provide a source of fixed nitrogen, a commodity which could have been rare on the ancient Earth. Nitrogen fixation is the conversion of the very stable nitrogen (N₂) gas in our atmosphere to a biologically usable form, like an amine or nitrate -- the same compounds found in fertilizer. Enzymes that fix nitrogen appear to be ancient, so finding a source of fixed nitrogen would have been an early challenge for life from the time of its origin. We determined that at least one type of comet would have provided significant quantities of stable, fixed nitrogen in the form of methylamine and ethylamine," added Dworkin.

This is the first time these molecules have been detected in comets. As the Stardust spacecraft sped through the comet's tail at nearly 21,000 kilometers per hour (13,000 miles per hour), a set of aerogel tiles mounted on a boom trapped dust and gas from the comet. Often referred to as "frozen smoke", aerogel is the world's lowest density solid. Its low density allows it to slow and capture comet dust particles without vaporizing them.

Although the mission's goal was to return samples of comet dust to Earth, the researchers looked for organic molecules that were embedded in the aerogel itself, rather than trapped in dust grains. "We found that the aerogel acted like a sponge, absorbing organic gases from the comet nucleus," said Daniel Glavin of NASA Goddard.

"And just like squeezing a sponge, we squeezed out all the good stuff -- the water-soluble organics -- by boiling samples of the aerogel in ultra-high purity water," added Glavin. The team analyzed the aerogel water extract with a liquid chromatograph mass spectrometer instrument to identify the organic molecules.

Since Earth is crawling with life, the team had to rule out contamination from our planet before it could say the molecules likely came from the comet. Glavin and Dworkin analyzed dozens of

"pre-flight" aerogels that were not flown on Stardust in order to understand the organic background levels within the aerogel.

The team found high levels of both methylamine and ethylamine in aerogel that was exposed to comet Wild 2. While they did find small amounts of methylamine and trace levels of ethylamine in the pre-flight aerogel, the total amount in the unflown aerogel was over 100 times less. Also, the relative amounts of the two molecules were very different from that found in the comet-exposed aerogel. The different total and relative amounts convinced the team that most of the two chemicals in the Stardust sample came from the comet.

However, since Stardust was in space for seven years, the team had to be sure that the two chemicals weren't simply picked up while the spacecraft was cruising toward Wild 2. Since the pressure in space is so low, the spacecraft can release gas or volatile materials acquired during its manufacture on Earth. This is called "outgassing", and it could have contaminated the aerogel as well.

To reveal the levels of contamination from these two sources, the Stardust team included a special piece of aerogel called the "witness tile" on the spacecraft. It's a piece of aerogel located behind a dust shield that protected the spacecraft from high-speed collisions with comet particles. This location kept the witness tile from being exposed to gas and dust from the comet. But the witness aerogel was exposed to everything else Stardust encountered, including the manufacturing processes, shipping, the launch, spacecraft outgassing, and Earth reentry.

"When we analyzed a sample of the witness tile, we did not detect methylamine or ethylamine, so we don't think Stardust was contaminated with these two chemicals on the way to Wild 2," said Glavin.

NASA's Jet Propulsion Laboratory, Pasadena, Calif., manages the Stardust mission for NASA's Science Mission Directorate, Washington. Dr. Peter Tsou of JPL is deputy principal investigator and is a co-author on seven papers about the mission's initial findings appearing in the Dec. 15 issue of Science Express, the online edition of the journal Science.

For more information about Stardust studies and other mission information, visit:
<http://stardust.jpl.nasa.gov/>

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News Release: 2006-147

Dec. 12, 2006

Massive Mountain Range Imaged on Saturn's Moon Titan

The tallest mountains ever seen on Titan -- coated with layers of organic material and blanketed by clouds -- have been imaged on Saturn's moon Titan by NASA's Cassini spacecraft.

"We see a massive mountain range that kind of reminds me of the Sierra Nevada mountains in the western United States. This mountain range is continuous and is nearly 100 miles long," said Dr. Bob Brown, team leader of the Cassini visual and infrared mapping spectrometer at the University of Arizona, Tucson.

During an Oct. 25 flyby designed to obtain the highest resolution infrared views of Titan yet,

Cassini resolved surface features as small as 400 meters (1,300 feet). The images reveal a large mountain range, dunes, and a deposit of material that resembles a volcanic flow. These data, together with radar data from previous flybys, provide new information on the height and composition of geologic features on Titan.

If Titan were Earth, these mountains would lie south of the equator, somewhere in New Zealand. The range is about 150 kilometers long (93 miles) and 30 kilometers (19 miles) wide and about 1.5 kilometers (nearly a mile) high. Deposits of bright, white material, which may be methane "snow" or exposures of some other organic material, lie at the top of the mountain ridges.

"These mountains are probably as hard as rock, made of icy materials, and are coated with different layers of organics," said Dr. Larry Soderblom, Cassini interdisciplinary scientist at the U.S. Geological Survey, Flagstaff, Ariz.

He added, "There seem to be layers and layers of various coats of organic 'paint' on top of each other on these mountain tops, almost like a painter laying the background on a canvas. Some of this organic gunk falls out of the atmosphere as rain, dust, or smog onto the valley floors and mountain tops, which are coated with dark spots that appear to be brushed, washed, scoured and moved around the surface."

The mountains probably formed when material welled up from below to fill the gaps opened when tectonic plates pull apart, similar to the way mid-ocean ridges are formed on Earth.

Separately, the radar and infrared data are difficult to interpret, but together they are a powerful combination. In the infrared images, one can see the shadows of the mountains, and in radar, one can see their shape. But when combined, scientists begin to see variations on the mountains, which is essential to unraveling the mysteries of the geologic processes on Titan.

A fan-shaped feature, possibly a remnant of a volcanic flow, is also visible in the infrared images. The radar instrument imaged this flow and a circular feature from which the flow seems to emanate on a previous flyby, but not in this level of detail.

"The evidence is mounting that this circular feature is a volcano," said Dr. Rosaly Lopes, Cassini radar team member at NASA's Jet Propulsion Laboratory, Pasadena, Calif. "With radar data alone, we identified it as a possible volcano, but the combination of radar and infrared makes it much clearer."

Near the wrinkled, mountainous terrain are clouds in Titan's southern mid latitudes whose source continues to elude scientists. These clouds are probably methane droplets that may form when the atmosphere on Titan cools as it is pushed over the mountains by winds.

The composition of dunes that run across much of Titan is also much clearer. "The dunes seem to consist of sand grains made of organics, built on water-ice bedrock, and there may also be some snow and bright deposits," Brown said.

Titan is a complex place and scientists are uncovering the secrets of the surface, one flyby at a time. Scientists hope to get more clues from the next Titan flyby, on Dec. 12.

For the new infrared images of the mountains visit: <http://www.nasa.gov/cassini> and <http://saturn.jpl.nasa.gov> and <http://wwwvims.lpl.arizona.edu> . Additional information on NASA news from the American Geophysical Union conference is at <http://www.nasa.gov/agu> .

The Cassini-Huygens mission is a cooperative project of NASA, the European Space Agency and the Italian Space Agency. The Jet Propulsion Laboratory, a division of the California Institute of Technology in Pasadena, manages the Cassini-Huygens mission for NASA's Science Mission Directorate, Washington. The Cassini orbiter was designed, developed and assembled at JPL. The Visual and Infrared Mapping Spectrometer team is based at the University of Arizona where this image was produced. The radar instrument team is based at JPL, working with team members from the United States and several European countries.

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News Release: 2006-150

Dec. 18, 2006

NASA Telescope Picks Up Glow of Universe's First Objects

NASA Telescope Picks Up Glow of Universe's First Objects New observations from NASA's Spitzer Space Telescope strongly suggest that infrared light detected in a prior study originated from clumps of the very first objects of the universe. The recent data indicate this patchy light is splattered across the entire sky and comes from clusters of bright, monstrous objects more than 13 billion light-years away.

"We are pushing our telescopes to the limit and are tantalizingly close to getting a clear picture of the very first collections of objects," said Dr. Alexander Kashlinsky of NASA's Goddard Space Flight Center, Greenbelt, Md., lead author on two reports to appear in the *Astrophysical Journal Letters*. "Whatever these objects are, they are intrinsically incredibly bright and very different from anything in existence today."

Astronomers believe the objects are either the first stars -- humongous stars more than 1,000 times the mass of our sun -- or voracious black holes that are consuming gas and spilling out tons of energy. If the objects are stars, then the observed clusters might be the first mini-galaxies containing a mass of less than about one million suns. The Milky Way galaxy holds the equivalent of approximately 100 billion suns and was probably created when mini-galaxies like these merged.

This study is a thorough follow-up to an initial observation presented in *Nature* in November 2005 by Kashlinsky and his team. The new analysis covered five sky regions and involved hundreds of hours of observation time.

Scientists say that space, time and matter originated 13.7 billion years ago in a tremendous explosion called the Big Bang. Observations of the cosmic microwave background by a co-author of the recent Spitzer studies, Dr. John Mather of Goddard, and his science team strongly support this theory. Mather is a co-winner of the 2006 Nobel Prize for Physics for this work. Another few hundred million years or so would pass before the first stars would form, ending the so-called dark age of the universe.

With Spitzer, Kashlinsky's group studied the cosmic infrared background, a diffuse light from this early epoch when structure first emerged. Some of the light comes from stars or black hole activity so distant that, although it originated as ultraviolet and optical light, its wavelengths have been stretched to infrared wavelengths by the growing space-time that causes the universe's expansion. Other parts of the cosmic infrared background are from distant starlight

absorbed by dust and re-emitted as infrared light.

"There's ongoing debate about what the first objects were and how galaxies formed," said Dr. Harvey Moseley of Goddard, a co-author on the papers. "We are on the right track to figuring this out. We've now reached the hilltop and are looking down on the village below, trying to make sense of what's going on."

The analysis first involved carefully removing the light from all foreground stars and galaxies in the five regions of the sky, leaving only the most ancient light. The scientists then studied fluctuations in the intensity of infrared brightness, in the relatively diffuse light. The fluctuations revealed a clustering of objects that produced the observed light pattern.

"Imagine trying to see fireworks at night from across a crowded city," said Kashlinsky. "If you could turn off the city lights, you might get a glimpse at the fireworks. We have shut down the lights of the universe to see the outlines of its first fireworks."

Mather, who is senior project scientist for NASA's future James Webb Space Telescope, said, "Spitzer has paved the way for the James Webb Space Telescope, which should be able to identify the nature of the clusters."

This analysis was partially funded through the National Science Foundation. Science support to NASA Goddard is supplied by Science Systems and Applications, Inc. NASA's Jet Propulsion Laboratory, Pasadena, Calif., manages the Spitzer mission for NASA. Science operations are conducted at the Spitzer Science Center at the California Institute of Technology in Pasadena. The observations were made by Spitzer's infrared array camera, which was built by NASA's Goddard Space Flight Center, Greenbelt, Md. The instrument's principal investigator is Dr. Giovanni Fazio of the Harvard-Smithsonian Center for Astrophysics.

For graphics and more information about Spitzer:

http://www.nasa.gov/mission_pages/spitzer/main/index.html .

Additional media contact: Josh Chamot of National Science Foundation, 703-292-7730.
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News Release: 2006-145

Dec. 6, 2006

NASA Images Suggest Water Still Flows in Brief Spurts on Mars

WASHINGTON - NASA photographs have revealed bright new deposits seen in two gullies on Mars that suggest water carried sediment through them sometime during the past seven years.

"These observations give the strongest evidence to date that water still flows occasionally on the surface of Mars," said Dr. Michael Meyer, lead scientist for NASA's Mars Exploration Program, Washington.

Liquid water, as opposed to the water ice and water vapor known to exist at Mars, is considered necessary for life. The new findings heighten intrigue about the potential for microbial life on Mars. The Mars Orbiter Camera on NASA's Mars Global Surveyor provided the new evidence. The deposits appear in images it took in 2004 and 2005 but not in a 1999 image of one site or a 2001 image of the other site.

"The shapes of these deposits are what you would expect to see if the material were carried by flowing water," said Dr. Michael Malin of Malin Space Science Systems, San Diego. "They have finger-like branches at the downhill end and are easily diverted around small obstacles." Malin is principal investigator for the camera and lead author of a report about the findings published in the journal Science.

The atmosphere of Mars is so thin and the temperature so cold that liquid water cannot persist at the surface. It would rapidly evaporate or freeze. Researchers propose that water could remain liquid long enough, after breaking out from an underground source, to carry debris downslope before totally freezing. The two fresh deposits are each several hundred meters, or yards, long.

The light tone of the deposits could be from surface frost continuously replenished by ice within the body of the deposit. Another possibility is a salty crust, which would be a sign of water's effects in concentrating the salts. If the deposits had resulted from dry dust slipping down the slope, they would likely be dark, based on the dark tones of dust freshly disturbed by rover tracks, dust devils and fresh craters on Mars.

Mars Global Surveyor has discovered tens of thousands of gullies on slopes inside craters and other depressions on Mars. Most gullies are at latitudes of 30 degrees or higher. Malin and his team first reported the discovery of the gullies in 2000. To look for changes that might indicate present-day flow of water, his camera team repeatedly imaged hundreds of the sites. One pair of images showed a gully that appeared after mid-2002. That site was on a sand dune, and the gully-cutting process was interpreted as a dry flow of sand.

Today's announcement is the first to reveal newly deposited material apparently carried by fluids after earlier imaging of the same gullies. The two sites are inside craters in the Terra Sirenum and the Centauri Montes regions of southern Mars.

"These fresh deposits suggest that at some places and times on present-day Mars, liquid water is emerging from beneath the ground and briefly flowing down the slopes. This possibility raises questions about how the water would stay melted below ground, how widespread it might be, and whether there's a below-ground wet habitat conducive to life. Future missions may provide the answers," said Malin.

Besides looking for changes in gullies, the orbiter's camera team assessed the rate at which new impact craters appear. The camera photographed approximately 98 percent of Mars in 1999 and approximately 30 percent of the planet was photographed again in 2006. The newer images show 20 fresh impact craters, ranging in diameter from 2 meters (7 feet) to 148 meters (486 feet) that were not present approximately seven years earlier. These results have important implications for determining the ages of features on the surface of Mars. These results also approximately match predictions and imply that Martian terrain with few craters is truly young.

Mars Global Surveyor began orbiting Mars in 1997. The spacecraft is responsible for many important discoveries. NASA has not heard from the spacecraft since early November. Attempts to contact it continue. Its unprecedented longevity has allowed monitoring Mars for over several years past its projected lifetime.

NASA's Jet Propulsion Laboratory, Pasadena, manages the Mars Global Surveyor mission for the NASA Science Mission Directorate, Washington. For more information about NASA and agency programs, visit:

<http://www.nasa.gov>

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News Release: 2006-144

Dec. 5, 2006

NASA Telescope Sees Black Hole Munch on a Star

A giant black hole has been caught red-handed dipping into a cosmic cookie jar of stars by NASA's Galaxy Evolution Explorer. This is the first time astronomers have seen the whole process of a black hole eating a star, from its first to nearly final bites.

"This type of event is very rare, so we are lucky to study the entire process from beginning to end," said Dr. Suvi Gezari of the California Institute of Technology, Pasadena, Calif. Gezari is lead author of a new paper appearing in the Dec. 10 issue of *Astrophysical Journal Letters*.

For perhaps thousands of years, the black hole rested quietly deep inside an unnamed elliptical galaxy. But then a star ventured a little too close to the sleeping black hole and was torn to shreds by the force of its gravity. Part of the shredded star swirled around the black hole, then began to plunge into it, triggering a bright ultraviolet flare that the Galaxy Evolution Explorer was able to detect.

Today, the space-based telescope continues to periodically watch this ultraviolet light fade as the black hole finishes the remaining bits of its stellar meal. The observations will ultimately provide a better understanding of how black holes evolve with their host galaxies.

"This will help us greatly in weighing black holes in the universe, and in understanding how they feed and grow in their host galaxies as the universe evolves," said Dr. Christopher Martin of Caltech, a co-author of the paper and the principal investigator for the Galaxy Evolution Explorer.

In the early 1990s, three other resting, or dormant, black holes were suspected of having eaten stars when the joint German-American-British Röntgen X-ray satellite picked up X-ray flares from their host galaxies. Astronomers had to wait until a decade later for NASA's Chandra X-ray Observatory and the European Space Agency's XMM-Newton X-ray observatory to confirm those findings, showing that the black holes' X-rays had faded dramatically -- a sign that stars were swallowed.

Now, Gezari and her colleagues have, for the first time, watched a similar feeding frenzy unfold, as it happens, through the ultraviolet eyes of the Galaxy Evolution Explorer. They used the telescope's detectors to catch an ultraviolet flare from a distant galaxy, then watched the flare diminish over time, as the galaxy's central black hole consumed the star. Additional data from Chandra, the Canada France Hawaii Telescope in Hawaii and the Keck Telescope, also in Hawaii, helped the team chronicle the event in multiple wavelengths over two years.

Black holes are heaps of concentrated matter whose gravity is so strong that even light cannot escape. Supermassive black holes are believed to reside at the cores of every galaxy, though some are thought to be more active than others. Active black holes drag surrounding material into them, heating it up and causing it to glow. Dormant black holes, like the one in our Milky Way galaxy, hardly make a peep, so they are difficult to study.

That's why astronomers get excited when an unsuspecting star wanders too close to a dormant black hole, an event thought to happen about once every 10,000 years in a typical galaxy. A star will flatten and stretch apart when a nearby black hole's gravity overcomes its own self-gravity. The same phenomenon happens on Earth every day, as the moon's gravity tugs on our world, causing the oceans to rise and fall. Once a star has been disrupted, a portion of its gaseous body will then be pulled into the black hole and heated up to temperatures that emit X-rays and ultraviolet light.

"The star just couldn't hold itself together," said Gezari, adding, "Now that we know we can observe these events with ultraviolet light, we've got a new tool for finding more."

The newfound feeding black hole is thought to be tens of millions times as massive as our sun. Its host galaxy is located 4 billion light-years away in the Bootes constellation.

An artist's concept and additional information about the Galaxy Evolution Explorer is online at http://www.nasa.gov/mission_pages/galex/.

The California Institute of Technology in Pasadena, Calif., leads the Galaxy Evolution Explorer mission and is responsible for science operations and data analysis. NASA's Jet Propulsion Laboratory, also in Pasadena, manages the mission and built the science instrument. The mission was developed under NASA's Explorers Program managed by the Goddard Space Flight Center, Greenbelt, Md. Researchers sponsored by Yonsei University in South Korea and the Centre National d'Etudes Spatiales (CNES) in France collaborated on this mission.

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Member's Telescopes and Equipment

Derryl Cocks submitted the following observations using his new Stellarvue Nighthawk Next Generation telescope.

NHNG First Light

For 5 nights I submitted to the new equipment cloud cover annoyance.

Last Saturday December 23rd I joined John, Kitty, and Danielle for a viewing session at Walnut Mountain. John brought his Celestron SPC-8 Schmidt-Cassegrain and I brought my Stellarvue Nighthawk Next Generation (NHNG) 3" achromatic refractor telescope <http://www.stellarvue.com/svnhng.html>. Before the session I asked John if I could use the mount he normally has for his Stellarvue AT1010 as my mount was still expected to arrive in the mail. After rearranging the mounting plates I was able to view with John's Bogen tripod and UA Microstar mount.

First we focused on the Orion Nebula or M42. I was impressed with how good the view was

compared to John's SC. I loved how easy it was to view with the feathertouch focuser. I'm also very happy with the Stellarvue FMC Wide Field 2" 30mm and FMC Wide Field 1.5" 15mm eyepieces.

I then focused on Sirius, the dog star. Being the brightest star in the sky I expected some color and sure there was some.

I finally focused on Pleiades, the seven sisters, or M45. All seven stars were clear with no color at all. Kitty and Danielle, also liked the view of the Pleiades through the NHNG.

Our evening was cut short by a bank of clouds that indicated to us they weren't going away anytime soon.

NHNG Second Light

The next evening, Sunday December 24th was clear so I walked to a viewing spot near to where I live. I was using the NHNG on my Velbon camera tripod. The NHNG was far too heavy for this tripod and a steadying hand was needed for viewing. I was lucky there was no wind.

When I focused on Sirius there was no color. I'm sure this was a good indication that the transparency wasn't that good.

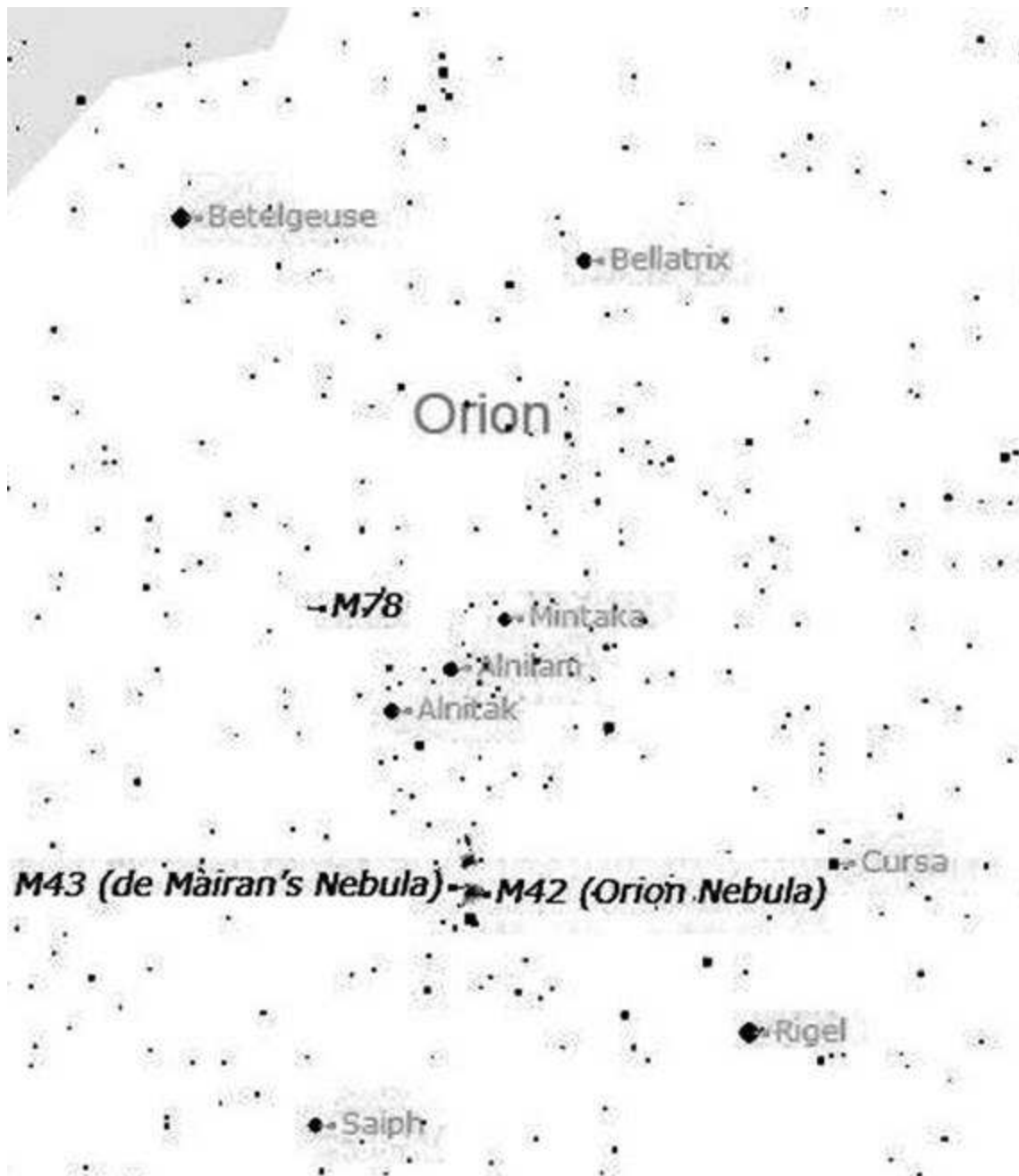
I went back to the Orion Nebula and the Pleiades and they appeared fainter. Getting the NHNG to near zenith to view Pleiades was difficult with the tripod. When I put the 15mm eyepiece into the 2x Barlow and tried to view Pleiades, all I could see were stars moving all over the place!

For the finale of the evening I wanted to see the Andromeda galaxy or M31. I was using a free star map from www.skymaps.com. I was able to find Aldebaran in Taurus then I kept looking across to Pleiades and further hopefully to M31. Alas, it was not to be. The conditions were not good enough to find M31 no matter how hard I tried.

I've had 2 satisfying nights of viewing with the NHNG and I'm sure I'll have plenty more.

Mid Evening Observing Highlights for January

Orion is prominent in the southern sky. Below the three stars in Orion's belt the Orion Nebula (M42) can be seen. Auriga and Taurus are high in the sky. The bright star Aldebaran can be found in Taurus in the eastern part of the sky. The Andromeda Galaxy (M31) is in the western sky. The Great Square in Pegasus is setting in the western sky. The Double Cluster in Perseus can be found close to the zenith. The Milky Way stretches from the southeast to northwest. Full moon is on January 3rd and new moon is on January 19th. The image below shows Orion and the location of M42 and M43 as well as the prominent stars Rigel and Betelgeuse. The location of the reflection nebula M78 is also shown.



NASA Space Place

Space Weather for Air Travelers

By Dr. Tony Phillips

At a time when much of the airline industry is struggling, one type of air travel is doing remarkably well: polar flights. In 1999, United Airlines made just twelve trips over the Arctic. By 2005, the number of flights had grown to 1,402. Other airlines report similar growth.

The reason for the increase is commerce. Business is booming along Asia's Pacific Rim, and business travel is booming with it. On our spherical Earth, the shortest distance from Chicago to Beijing or New York to Tokyo is over the North Pole. Suddenly, business travelers are spending a lot of time in the Arctic.

With these new routes, however, comes a new concern: space weather.

“Solar storms have a big effect on polar regions of our planet,” explains Steve Hill of NOAA's Space Weather Prediction Center in Boulder, Colorado. Everyone knows about the Northern Lights, but there's more to it than that: “When airplanes fly over the poles during solar storms, they can experience radio blackouts, navigation errors and computer reboots—all caused by space radiation.”

In 2005, United Airlines reported dozens of flights diverted from polar routes by nasty space weather. Delays ranged from 8 minutes to nearly 4 hours, and each unplanned detour burned expensive fuel. Money isn't the only concern: Pilots and flight attendants who fly too often over the poles could absorb more radiation than is healthy. “This is an area of active research—figuring out how much exposure is safe for flight crews,” says Hill. “Clearly, less is better.”

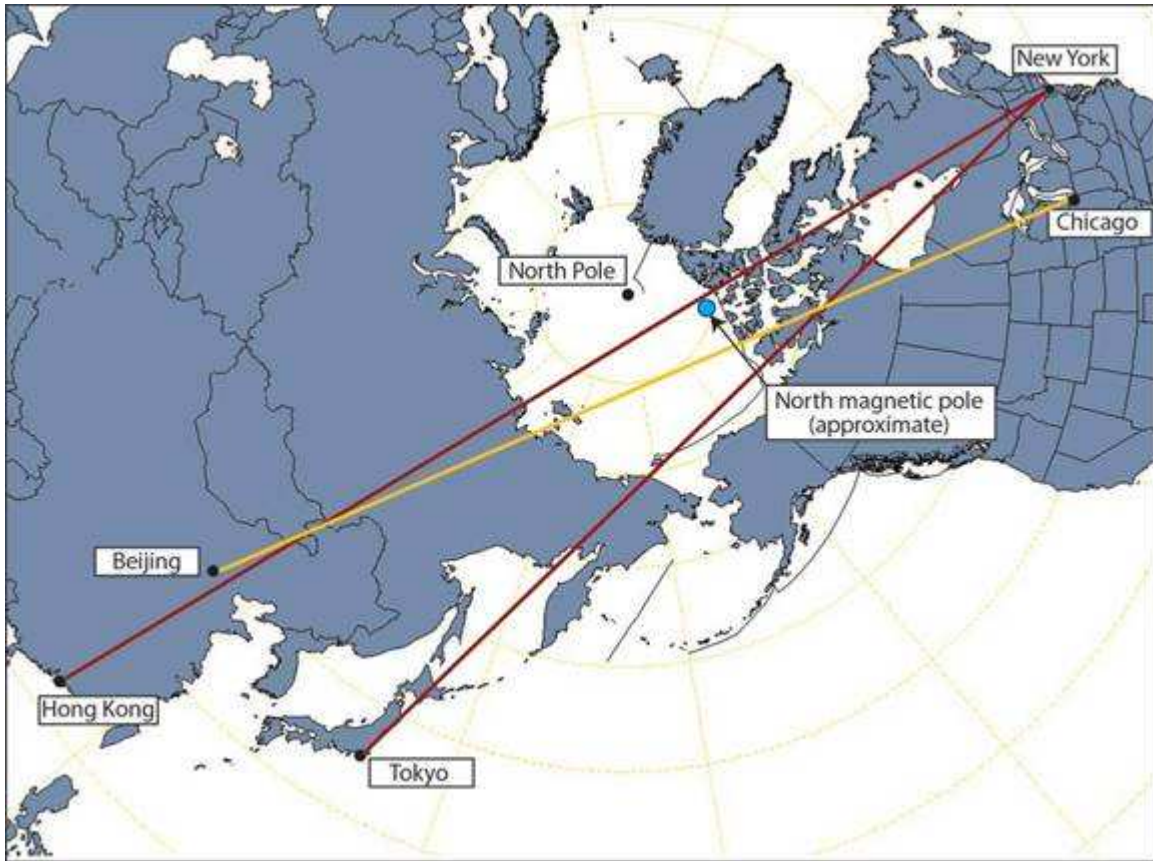
To help airlines avoid bad space weather, NOAA has begun equipping its GOES weather satellites with improved instruments to monitor the Sun. Recent additions to the fleet, GOES 12 and 13, carry X-ray telescopes that take spectacular pictures of sunspots, solar flares, and coronal holes spewing streams of solar wind in our direction. Other GOES sensors detect solar protons swarming around our planet, raising alarms when radiation levels become dangerous.

“Our next-generation satellite will be even better,” says Hill. Slated for launch in 2014, GOES-R will be able to photograph the Sun through several different X-ray and ultra-violet filters. Each filter reveals a somewhat different layer of the Sun's explosive atmosphere—a boon to forecasters. Also, advanced sensors will alert ground controllers to a variety of dangerous particles near Earth, including solar protons, heavy ions and galactic cosmic rays.

“GOES-R should substantially improve our space weather forecasts,” says Hill. That means friendlier skies on your future trips to Tokyo.

For the latest space weather report, visit the website of the Space Weather Prediction Center at <http://www.sec.noaa.gov/> . For more about the GOES-R series spacecraft, see http://goespoes.gsfc.nasa.gov/goes/spacecraft/r_spacecraft.html . For help in explaining geostationary orbits to kids—or anyone else—visit The Space Place at http://spaceplace.nasa.gov/en/kids/goes/goes_poes_orbits.shtml .

This article was provided by the Jet Propulsion Laboratory, California Institute of Technology, under a contract with the National Aeronautics and Space Administration.



Caption: *The shortest airline routes from the Eastern U.S. to popular destinations in Asia go very near the magnetic North Pole, where space weather is of greatest concern.*