

# *Catskills Astronomy Club News*

2/1/05

## *Club News:*

The January 15<sup>th</sup> observation session was held at Walnut Mountain Park. Three members attended. At first the lock to the gate was frozen and would not open. After warming the lock it opened but the road to the ball field was too icy to drive up so we observed below the field close to the front gate. By the time we decided to do that the gate lock had refrozen and had to be warmed again to relock the gate. Some of the objects we observed are: Comet Machholz, Saturn, the first crescent moon, The Orion Nebula M42, the reflection nebula M78, the open star clusters M35 and M38, the planetary nebula NGC 2392, and the double stars Castor and Rigel. The multiple star system Sigma Orionis was also observed. The sky clouded up between 9:30 and 10:00.

The January 8<sup>th</sup> observation session was canceled due to poor weather. The next observation sessions are on February 5<sup>th</sup> and 12<sup>th</sup> at Walnut Mountain Park. The drive should be plowed out for us but the road up may still be too slippery to drive up. If the snow is too deep to observe outside the front gate we may have to use our alternate observation site at the Town of Thompson Park in Monticello.

The Northeast Astronomy Forum at Rockland County Community College in Suffern, NY will be held on April 16<sup>th</sup> and 17<sup>th</sup> in the college field house. Our club would like to setup a table on the balcony of the field house near the entrance to the show on Saturday April 16<sup>th</sup>. Anyone interested in helping out at the table please contact John at [kocis@verizon.net](mailto:kocis@verizon.net).

Some members who attended the dinner meetings that were held last winter have expressed interest in repeating this again when the weather looks poor for an observation session. When an opportunity arises for a dinner meeting the membership will be contacted via email.

We also may try to have a solar observation session on a Saturday afternoon in the future when the weather cooperates.

The club has selection of astronomy books, Stardate audio CDs, a Macintosh computer with astronomy software, and a Meade 8 inch reflector for members to borrow. Please contact John at 791-5240 or [kocis@verizon.net](mailto: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.

Status Report: 2005-016

January 13, 2005

### *Deep Impact Mission Status Report*

NASA's Deep Impact spacecraft is out of safe mode and healthy, and on its way to an encounter with comet Tempel 1 on July 4, 2005.

Launched from Cape Canaveral Air Force Station on Wednesday, the Deep Impact spacecraft entered a state called safe mode soon after separation from the launch vehicle. When a spacecraft enters safe mode, all but essential spacecraft systems are turned off until it receives new commands from mission control. When Deep Impact separated from the launch vehicle, the spacecraft computer detected higher than expected temperatures in the propulsion system.

While in the safe mode, the spacecraft successfully executed all mission events associated with commencing space flight operations. Data received from the spacecraft indicate it has deployed and locked its solar panels, is receiving power and achieved proper orientation in space.

"We are out of safe mode and proceeding with in-flight operations," said Deep Impact project manager Rick Grammier of NASA's Jet Propulsion Laboratory. "We're back on nominal timeline and look forward to our encounter with comet Tempel 1 this summer."

Deep Impact is comprised of two parts, a "fly-by" spacecraft and a smaller "impactor." The impactor will be released into the comet's path for a planned collision on July 4. The crater produced by the impactor is expected to be up to the size of a football stadium and two to 14 stories deep. Ice and dust debris will be ejected from the crater, revealing the material beneath.

The fly-by spacecraft will observe the effects of the collision. NASA's Hubble, Spitzer and Chandra space telescopes, and other telescopes on Earth, will also observe the collision.

Comets are time capsules that hold clues about the formation and evolution of the Solar System. They are composed of ice, gas and dust, primitive debris from the Solar System's distant and coldest regions that formed 4.5 billion years ago.

The management of the Deep Impact launch was the responsibility of NASA's Kennedy Space Center, Fla. Deep Impact was launched from Pad 17-B at Cape Canaveral Air Force Station, Fla. Delta II launch service was provided by Boeing Expendable Launch Systems, Huntington Beach, Calif. The spacecraft was built for NASA by Ball Aerospace and Technologies Corporation, Boulder, Colo. Deep Impact project management is by JPL.

For more information about the mission on the Web, visit <http://www.nasa.gov/deepimpact> or <http://deepimpact.jpl.nasa.gov/>.

For information about NASA and other agency programs on the Web, visit <http://www.nasa.gov>.

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*Release: 2005-007*

*Jan. 10, 2005*

### ***Spitzer Sees Dusty Aftermath of Pluto-Sized Collision***

Astronomers say a dusty disc swirling around the nearby star Vega is bigger than earlier thought. It was probably caused by collisions of objects, perhaps as big as the planet Pluto, up to 2,000 kilometers (about 1,200 miles) in diameter.

NASA's Spitzer Space Telescope has seen the dusty aftermath of this "run-in." Astronomers think embryonic planets smashed together, shattered into pieces and repeatedly crashed into other fragments to create ever-finer debris. Vega's light heats the debris, and Spitzer's infrared telescope detects the radiation.

Vega, located 25 light-years away in the constellation Lyra, is the fifth brightest star in the night sky. It is 60 times brighter than our Sun. Observations of Vega in 1984, with the Infrared Astronomical Satellite, provided the first evidence for dust particles around a typical star. Because of Vega's proximity and because its pole faces Earth, it provides a great opportunity for detailed study of the dust cloud around it.

"Vega's debris disc is another piece of evidence demonstrating the evolution of planetary systems is a pretty chaotic process," said the lead author of the study, Dr. Kate Su of the University of Arizona, Tucson, Ariz. The findings were presented today at the 205th meeting of the American Astronomical Society in San Diego.

Like a drop of ink spreading out in a glass of water, the particles in Vega's dust cloud don't stay close to the star long. "The dust we are seeing in the Spitzer images is being blown out by intense light from the star," Su said. "We are witnessing the aftermath of a relatively recent collision, probably within the last million years."

Scientists say this disc event is short-lived. The majority of the detected material is only a few microns in size, 100 times smaller than a grain of Earth sand. These tiny dust grains leave the system and dissipate into interstellar space on a time scale less than 1,000 years. "But there are so many tiny grains," Su said. "They add up to a total mass equal to one third of the weight of our moon."

The mass of these short-lived grains implies a high dust-production rate. The Vega disc would have to have an improbably massive reservoir of planet-building material and collisions to maintain this amount of dust production

throughout the star's life (350 million years, 13 times younger than our Sun). "We think a transient disc phenomenon is more likely," Su said.

Su and her colleagues were struck by other characteristics of Vega's debris disc, including its physical size. It has a radius of at least 815 astronomical units, roughly 20 times larger than our solar system. One astronomical unit is the distance from Earth to the Sun, which is 150 million kilometers (93 million miles). A study of the disc's surface brightness indicates the presence of an inner hole at a radius of 86 astronomical units (twice the distance between Pluto and the Sun). Large embryonic planets at the edge of this inner hole may have collided to make the rest of the debris around Vega.

"Spitzer has obtained the first high spatial-resolution infrared images of Vega's disc," said Dr. Michael Werner, co-author and project scientist for Spitzer at NASA's Jet Propulsion Laboratory, Pasadena, Calif. "Its sensitive infrared detectors have allowed us to see that Vega is surrounded by an enormous disc of debris."

JPL manages the Spitzer Space Telescope mission for NASA's Science Mission Directorate, Washington. Science operations are conducted at the Spitzer Science Center at the California Institute of Technology in Pasadena. JPL is a division of Caltech. The multi-band imaging photometer for Spitzer, which made the new disc observations, was built by Ball Aerospace Corporation, Boulder, Colo.; the University of Arizona; and Boeing North American, Canoga Park, Calif.

Additional information about the Spitzer Space Telescope is available at <http://www.spitzer.caltech.edu> .

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*News Release: 2005-010*

*Jan. 11, 2005*

***New Clues Found in Ongoing Mystery of Giant Galactic Blobs***

Astronomers have numerous technical terms and numbering systems for describing the universe, but one type of mysterious object has yet to be classified. For now, these oddities are named for their strange appearance. They are called blobs.

Today, at the 205th annual meeting of the American Astronomical Society in San Diego, Calif., astronomers presented new evidence in the case of the giant galactic blobs. These blobs are huge clouds of intensely glowing material that envelop faraway galaxies. Using NASA's Spitzer Space Telescope and its powerful infrared vision, the astronomers caught a glimpse of the galaxies tucked inside the blobs. Their observations reveal monstrously bright galaxies and suggest that blobs might surround not one, but multiple galaxies in the process of merging together.

"It is possible that extremely bright galactic mergers lie at the center of all the mysterious blobs, but we still don't know how they fuel the blobs themselves," said Dr. Harry Teplitz, Spitzer Science Center, California Institute of Technology, Pasadena, Calif., co-author of the new research. "It's like seeing smoke in the distance and now discovering that it's a forest fire, not a house or car fire, but still not knowing whether it was caused by lightning or arson."

The findings will ultimately provide a better understanding of how galaxies, including ones like our own Milky Way, form.

Blobs were first discovered about five years ago with visible-light telescopes. They are located billions of light-years away in ancient galactic structures or filaments, where thousands of young galaxies are clustered together. These large, fuzzy galactic halos are made up of hot hydrogen gas and are about 10 times as large as the galaxies they encompass. Astronomers can see glowing blobs, but they don't know what provides the energy to light them up.

"To figure out what's going on, we need to better characterize the galaxies at the center of the blobs," said Dr. James Colbert, Spitzer Science Center, first author of the study.

That's where Spitzer comes in. Spitzer can sense the infrared glow from the dusty galaxies inside the blobs. When Colbert and colleagues used Spitzer to look at four well-known blobs located in a galactic filament 11 billion light-years away, they discovered that one of them appears to be made up of three galaxies falling into each other -- an unusual cosmic event. The finding is intriguing because previous observations from NASA's Hubble Space Telescope found that another one of the four blobs surrounds a merger between two galaxies. The astronomers speculate that all blobs might share this trait; however, more evidence is needed to close the case.

One clue that the scientists might be on the right track has to do with the infrared brightness of the blob galaxies. To visible-light telescopes, these galaxies appear unremarkable. Spitzer measurements revealed that all four of the galaxies studied are among the brightest in the universe, giving off the equivalent light of trillions of Suns. Such luminous galaxies are often triggered when smaller, gas-rich ones crash together, supporting the notion that galactic mergers might make up the cores of blobs.

Even if galactic mergers are fingered as the culprit, the mystery of the giant galactic blobs will persist. Astronomers will have to figure out why mergers are producing such tremendous clouds of material.

"Far from solving the mystery of the blobs, these observations only deepen it. Not only are the gas clouds bizarre, we now know that they contain some of the brightest and most violent galaxies in the universe," said Teplitz.

Other authors of this work include Dr. Paul Francis, The Australian National University Canberra, Australia; Dr. Povilas Palunas, University of Texas at Austin; Dr. Gerard Williger, Johns Hopkins University, Baltimore, Md.; and Dr. Bruce E. Woodgate, NASA's Goddard Space Flight Center, Greenbelt, Md.

NASA's Jet Propulsion Laboratory, Pasadena, Calif., manages the Spitzer Space Telescope mission for NASA's Science Mission Directorate, Washington, D.C. Science operations are conducted at the Spitzer Science Center. The telescope's multiband imaging photometer, which made the new Spitzer observations, was built by Ball Aerospace Corporation, Boulder, Colo., the University of Arizona, Tucson, and Boeing North American, Canoga Park, Calif. The instrument's development was led by Dr. George Rieke, University of Arizona.

Images and additional information about the Spitzer Space Telescope are available at <http://www.spitzer.caltech.edu/Media>.

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News Release: 2005-014

January 12, 2005

### ***Spitzer Finds Stellar "Incubators" With Massive Star Embryos***

NASA's Spitzer Space Telescope has uncovered a hatchery for massive stars.

A new striking image from the infrared telescope shows a vibrant cloud called the Trifid Nebula dotted with glowing stellar "incubators." Tucked deep inside these incubators are rapidly growing embryonic stars, whose warmth Spitzer was able to see for the first time with its powerful heat-seeking eyes.

The new view offers a rare glimpse at the earliest stages of massive star formation – a time when developing stars are about to burst into existence.

"Massive stars develop in very dark regions so quickly that is hard to catch them forming," said Dr. Jeonghee Rho of the Spitzer Science Center, California Institute of Technology, Pasadena, Calif., principal investigator of the recent observations. "With Spitzer, it's like having an ultrasound for stars. We can see into dust cocoons and visualize how many embryos are in each of them."

The new false-color image can be found at <http://www.spitzer.caltech.edu/Media>. It was presented today at the 205th meeting of the American Astronomical Society in San Diego, Calif.

The Trifid Nebula is a giant star-forming cloud of gas and dust located 5,400 light-years away in the constellation Sagittarius. Previous images taken by the Institute for Radioastronomy millimeter telescope in Spain show that the nebula contains four cold knots, or cores, of dust. Such cores are "incubators" where stars are born. Astronomers thought the ones in the Trifid Nebula were not yet ripe for stars. But, when Spitzer set its infrared eyes on all four cores, it found that they had already begun to develop warm stellar embryos.

"Spitzer can see the material from the dark cores falling onto the surfaces of the embryonic stars, because the material gets hotter as gravity draws it in," said Dr. William T. Reach of the Spitzer Science Center, co-author of this new research. "By measuring the infrared brightness, we can not only see the individual embryos but determine their growth rate."

The Trifid Nebula is unique in that it is dominated by one massive central star, 300,000 years old. Radiation and winds emanating from the star have sculpted the Trifid cloud into its current cavernous shape. These winds have also acted like shock waves to compress gas and dust into dark cores, whose gravity caused more material to fall inward until embryonic stars were formed. In time, the growing embryos will accumulate enough mass to ignite and explode out of their cores like baby birds busting out of their eggs.

Because the Trifid Nebula is home to just one massive star, it provides astronomers a rare chance to study an isolated family unit. All of the newfound stellar embryos are descended from the nebula's main star. Said Rho, "Looking at the image, you know exactly where the embryos came from. We use their colors to determine how old they are. It's like studying the family tree for a generation of stars."

Spitzer discovered 30 embryonic stars in the Trifid Nebula's four cores and dark clouds. Multiple embryos were found inside two massive cores, while a sole embryo was seen in each of the other two. This is one of the first times that clusters of embryos have been observed in single cores at this early stage of stellar development.

"In the cores with multiple embryos, we are seeing that the most massive and brightest of the bunch is near the center. This implies that the developing stars are competing for materials, and that the embryo with the most material will grow to be the largest star," said Dr. Bertrand Lefloch of Observatoire de Grenoble, France, co-author of the new research.

Spitzer also uncovered about 120 small baby stars buried inside the outer clouds of the nebula. These newborns were probably formed around the same time as the main massive star and are its smaller siblings.

Other authors of this work include Dr. Giovanni Fazio, Smithsonian Astrophysical Observatory, Cambridge, Mass.

NASA's Jet Propulsion Laboratory, Pasadena, Calif., manages the Spitzer Space Telescope mission for NASA's Science Mission Directorate, Washington, D.C. Science operations are conducted at the Spitzer Science Center, Pasadena, Calif. JPL is a division of Caltech.

The new Spitzer image is a combination of data from the telescope's infrared array camera and multiband imaging photometer. The infrared array camera was built by NASA Goddard Space Flight Center, Greenbelt, Md.; its development was led by Fazio. The multiband imaging photometer was built by Ball Aerospace Corporation, Boulder, Colo., the University of Arizona, Tucson, and Boeing North American, Canoga Park, Calif. The instrument's development was led by Dr. George Rieke, University of Arizona.

Additional information about the Spitzer Space Telescope is available at <http://www.spitzer.caltech.edu>.

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News Release: 2005-006

January 7, 2005

### ***Mars Reconnaissance Orbiter Mission Status***

Even as the Spirit and Opportunity rovers complete a year of successful operation on Mars, the next major step in Mars Exploration is taking shape with preparation of NASA's Mars Reconnaissance Orbiter for launch in just seven months.

The orbiter is undergoing environmental tests in facilities at Lockheed Martin Space Systems in Denver, Colo., where its Atlas V launch vehicle is also being prepared. Developments are on schedule for a launch window that begins on Aug. 10.

"The development teams from JPL, Lockheed Martin and the various institutions providing flight instruments have been working hard and efficiently as a team. Everything has really come together in the last couple of months," said Mars Reconnaissance Orbiter Project Manager Jim Graf of NASA's Jet Propulsion Laboratory, Pasadena, Calif. "The schedule remains tight, even as we continue to meet our major milestones in preparation for a late summer launch. And I am really excited about what this spacecraft, this team and these instruments can do once we get to Mars. The spacecraft engineering bus and the science instruments will be the most capable ever sent to another planet. The science gleaned from this mission will dramatically expand our understanding of Mars."

The Mars Reconnaissance Orbiter carries six primary instruments: the High Resolution Imaging Science Experiment, Context Camera, Mars Color Imager, Compact Reconnaissance Imaging Spectrometer for Mars, Mars Climate Sounder and Shallow Radar. All but the imaging spectrometer are currently onboard. That instrument is the last of several that had been installed but were removed so the science teams could replace an electrical component. It will be re-delivered this month. The orbiter will also carry a telecommunications relay package and two engineering demonstrations.

"We're moving at a robust pace in the testing phase now and we're right on track for getting the spacecraft ready to ship to Florida this spring," said Kevin McNeill, Mars Reconnaissance Orbiter program manager at Lockheed Martin Space Systems. "Mars Reconnaissance Orbiter has been a great spacecraft to work on, in part because we used an 'open structure' design that allows our engineers and the science teams to work in and around the spacecraft during every phase of integration and testing, with even greater ease and accessibility than we've had on previous missions. In many respects, the open design has facilitated the integration and testing of the spacecraft. We'll be in the final phase of testing during the next four months. Then, it's off to Florida."

Located just a few buildings away from where the spacecraft is undergoing tests at Lockheed Martin's facilities near Denver, the company also is building the mission's Atlas V launch vehicle. The Atlas V, designated AV-007, will launch Mars Reconnaissance Orbiter in August from Cape Canaveral Air Force Station, Florida. The Atlas is undergoing final assembly and testing, and will be shipped to Cape Canaveral in March to be readied for launch.

Less than two years from now, the Mars Reconnaissance Orbiter will begin a series of global mapping, regional survey and targeted observations from a near-polar, low-altitude Mars orbit. These observations will be unprecedented in terms of the spatial resolution and coverage achieved by the orbiter's instruments as they observe the atmosphere and surface of Mars while probing its shallow subsurface as part of a "follow the water" strategy.

JPL's Dr. Rich Zurek, project scientist for the Mars Reconnaissance Orbiter, said, "The major discoveries by the Mars Exploration Rovers at the Meridiani and Gusev Crater locales indicate that water did persist on the surface of the planet for some time, so a 'follow the water' strategy is appropriate. However, the rovers have explored just two very small areas of the planet. A goal of this mission is to find many, many locales where water was active on the surface for extended periods and thereby provide a suite of sites for future landers to explore where the potential for further discovery is high and the risk of encountering surface hazards is low."

Additional information about the project is available online at <http://marsprogram.jpl.nasa.gov/mro> .

The Mars Reconnaissance Orbiter mission is managed by JPL, a division of the California Institute of Technology, Pasadena, for the NASA Science Mission Directorate, Washington. Lockheed Martin Space Systems is the prime contractor for the project.

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*News Release: 2005-001*

*Jan. 3, 2005*

## **NASA Rovers' Adventures On Mars Continue**

NASA lit a birthday candle today for its twin Mars Exploration Rovers, Spirit and Opportunity. The Spirit rover begins its second year on Mars investigating puzzling rocks unlike any found earlier.

The rovers successfully completed their three-month primary missions in April. They astound even their designers with how well they continue operating. The unanticipated longevity is allowing both rovers to reach additional destinations and to keep making discoveries. Spirit landed on Jan. 3 and Opportunity Jan. 24, 2004, respectively.

"You could have cut the tension here with a knife the night Spirit landed," said NASA Administrator Sean O'Keefe. "Just remembering the uncertainty involved with the landing emphasizes how exciting it is for all of us, since the rovers are still actively exploring. The rovers created an amazing amount of public interest and have certainly helped advance the Vision for Space Exploration," he said. The twin Mars explorers have drawn the most hits to NASA Web sites -- more than 9 billion in 2004.

Dr. Charles Elachi, director of NASA's Jet Propulsion Laboratory, Pasadena, Calif., said, "Little did we know a year ago that we'd be celebrating a year of roving on Mars. The success of both rovers is tribute to hundreds of talented men and women who have put their knowledge and labor into this team effort."

"The rovers are both in amazingly good shape for their age," said JPL's Jim Erickson, rover project manager. "The twins sailed through the worst of the martian winter with flying colors, and spring is coming. Both rovers are in strong positions to continue exploring, but we can't give you any guarantees."

Opportunity is driving toward the heat shield that protected it during descent through the martian atmosphere. Rover team members hope to determine how deeply the atmospheric friction charred the protective layer. "With luck, our observations may help to improve our ability to deliver future vehicles to the surface of other planets," Erickson said.

Spirit is exploring the Columbia Hills within the Gusev Crater. "In December, we discovered a completely new type of rock in Columbia Hills, unlike anything seen before on Mars," said Dr. Steve Squyres of Cornell University, Ithaca, N.Y., principal investigator for the rovers' science payloads.

Jumbled textures of specimens dubbed "Wishstone" and "Wishing Well" look like the product of an explosion, perhaps from a volcano or a meteor impact. These rocks are much richer in phosphorus than any other known Mars rocks. "Some ways of making phosphates involve water; others do not," Squyres said. "We want to look at more of these rocks to see if we can distinguish between those possible histories."

NASA's next Mars mission, the Mars Reconnaissance Orbiter, is due to launch in August. "As great as the past year has been, Mars launch opportunities come along like clockwork every 26 months," said Dr. Firouz Naderi of JPL, manager of NASA's Mars Exploration Program. "At every one of them in the foreseeable future, we intend to go to Mars, building upon the findings by the rovers."

NASA Chief Scientist Dr. Jim Garvin said, "Mars lures us to explore its mysteries. It is the most Earth-like of our sister planets, and many believe it may hold clues to whether life ever existed or even originated beyond Earth. The rovers have shown us Mars had persistently wet, possibly life-sustaining environments. Beyond their own profound discoveries, the rovers have advanced our step-by-step program for examining Mars. We will continue to explore Mars robotically, and eventually with human explorers."

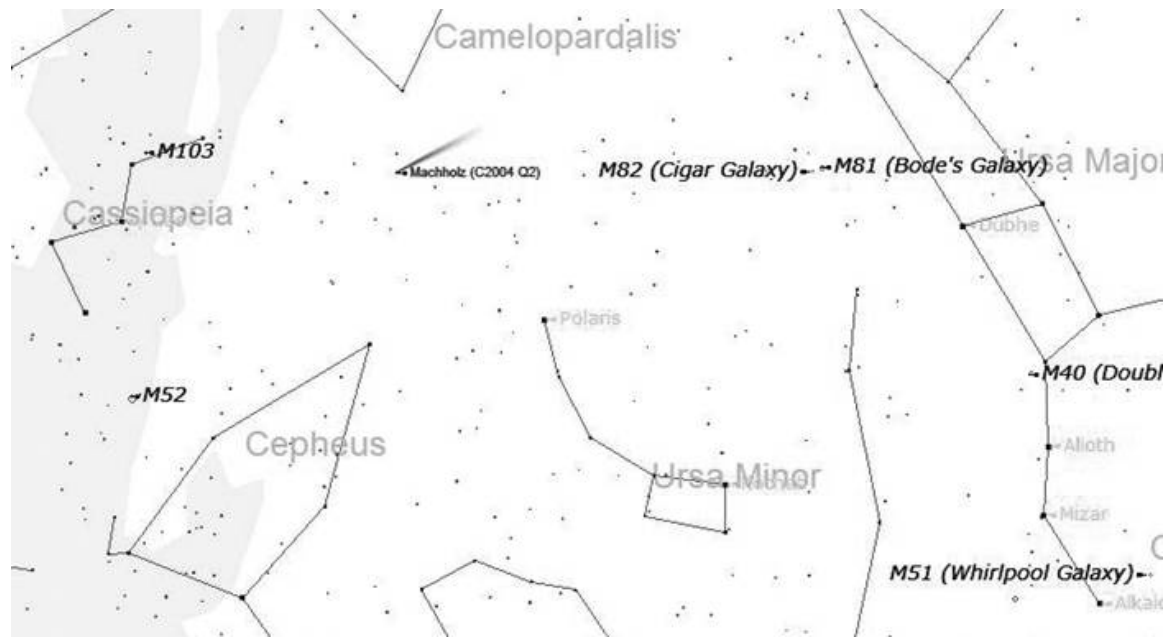
Images and additional information about the rovers and their discoveries are available on the Internet at [http://www.nasa.gov/vision/universe/solarsystem/mer\\_main.html](http://www.nasa.gov/vision/universe/solarsystem/mer_main.html) and <http://marsrovers.jpl.nasa.gov/home/index.html>.

JPL has managed the Mars Exploration Rover project since it began in 2000. JPL is a division of the California Institute of Technology in Pasadena.

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### ***Mid Evening Observing Highlights for February***

Saturn is can be found in the eastern sky in the constellation Gemini. Orion is prominent in the southern sky as is the Winter Triangle of Betelgeuse, Sirius, and Procyon. Look for the open star clusters M41 just south of Sirius and M35 in Gemini. Leo is rising in the east. If you look higher in the eastern the open star cluster M44 (the Beehive Cluster) in Cancer can be seen. The Big Dipper is standing on its handle in the northeast. The galaxies M81 and M82 can be found just west of the Pointer Stars in the Big Dipper (Dubhe and Merak). New moon is on February 8th and full moon is on February 24<sup>th</sup>. Comet Machholz is still visible and can be found midmonth between Cassiopeia and Ursa Minor. The image below shows the location of Comet Machholz as well as M81 and M82 on the evening of February 15<sup>th</sup>.



NASA Space Place

### Stardust Up Close

by Patrick L. Barry and Dr. Tony Phillips

Like discarded lumber and broken bricks around a construction site, comets scattered at the edge of our solar system are left-over bits from the "construction" of our solar system.

Studying comets, then, can help scientists understand how our solar system formed, and how it gave rise to a life-bearing planet like Earth.

But comets have long been frustratingly out of reach -- until recently. In January 2004 NASA's Stardust probe made a fly-by of the comet Wild 2 (pronounced "vilt"). This fly-by captured some of the best images and data on comets yet ... and the most surprising.

Scientists had thought that comets were basically "rubble piles" of ice and dust -- leftover "construction materials" held together by the comet's feeble gravity. But that's not what Stardust found. Photos of Wild 2 reveal a bizarre landscape of odd-shaped craters, tall cliffs, and overhangs. The comet looks like an alien world in miniature, not construction debris. To support these shapes against the pull of gravity, the comet must have a different consistency than scientists thought:

"Now we think the comet's surface might have a texture like freeze-dried ice cream, so-called 'astronaut ice cream': It's solid and can assume odd, gravity-defying shapes, but it's basically soft and crumbles easily," says Donald Brownlee of the University of Washington, principal investigator for Stardust.

Scientists are currently assembling a 3-D computer model of this surface from the photos that Stardust took. Those photos show the sunlit side of the comet from many angles, so its 3-dimensional shape can be inferred by analyzing the images. The result will be a "virtual comet" that scientists can examine from any angle. They can even perform a virtual fly-by. Using this 3-D model to study the comet's shape in detail, the scientists will learn a lot about the material from which the comet is made: how strong or dense or brittle it is, for example.

Soon, the Stardust team will get their hands on some of that material. In January 2006, a capsule from Stardust will parachute down to Earth carrying samples of comet dust captured during the flyby. Once scientists get these tiny grains under their microscopes, they'll get their first glimpse at the primordial makings of the solar system.

It's heading our way: ancient, hard-won, possibly surprising and definitely precious dust from the construction zone.

Find out more about the Stardust mission at [stardust.jpl.nasa.gov](http://stardust.jpl.nasa.gov). Kids can read about comets, play the "Tails of Wonder" game about comets, and hear a rhyming story about aerogel at <http://spaceplace.nasa.gov/en/kids/stardust/>.

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



*The Stardust spacecraft used a grid holding aerogel to capture dust particles from comet Wild 2. In this test, high velocity dust particles are stopped unharmed at the end of cone shaped tracks in a sample of aerogel*