



Comet McNaught dominated the early evening skies during the first two weeks of January as one of the brightest comets in recent memory. OCA member Hassi Norlen took this photo of the comet from the window of a KLM 747 over Greenland on January 13th.

## OCA CLUB MEETING

The free and open club meeting will be held Friday, February 9th at 7:30 PM in the Irvine Lecture Hall of the Hashinger Science Center at Chapman University in Orange. The scheduled speaker is yet to be announced as of press time.

Next General Meeting: March 9th

## STAR PARTIES

The Anza site will be open this month on February 17th. The Black Star Canyon site will be open this month on February 10th. Members are encouraged to check the website calendar, for the latest updates on star parties and other events.

Please check the website calendar for the outreach events this month! Volunteers are always welcome!

*You are also reminded to check the web site frequently for updates to the calendar of events and other club news.*

## COMING UP

The next session of the Beginners Class will be held on Friday, February 2nd (and next month on March 2nd) at the Centennial Heritage Museum at 3101 West Harvard Street in Santa Ana.

GOTO SIG: TBA (contact coordinator for details)

Astrophysics SIG: Feb. 16th, Mar. 16th

Astro-Imagers SIG: Feb. 20th, Mar. 20th

EOA SIG: Feb. 28th, Mar. 28th

Dark Sky SIG: TBA (contact coordinator for details)

# President's Message

By Barbara Toy

Winter sure came with a vengeance in January, didn't it? On a lot of nights, temperatures in Orange County got down into the 30's, and the Black Star Canyon star party ended early because of the cold. We had snow at Anza, and a lot of days when the highs were in the mid-30's and the lows in the 20's or lower, depending on where you were. I'm told that Leon Aslan measured the temperature at his observatory at 15 degrees during the night of January 13, and Joe Busch reported the next day that there was no water at the club observatory. Don Lynn found later that the water pipe for the observatory had frozen, causing a broken fitting, and also that freezing broke a pipe in the Upper Pad area – not a lot of damage, considering how many sub-freezing nights we had. Whether or not this cold spell broke records, it was certainly unusual – which is fortunate for those of us who like to see those great winter objects in dark skies!

January was also enlivened by Comet McNaught, which a number of us saw from Orange County right after sunset on January 12, 13 and 14. The clouds were too thick here to see it before the 12<sup>th</sup>, though Wally Pacholka got a picture of it by driving all the way to Death Valley and Hassi Norlen took a picture of it from the air over Greenland while flying back from vacation on January 10<sup>th</sup>. Unfortunately for our viewing and imaging pleasure, by the 12<sup>th</sup> it was pretty close to the horizon and set before the sky got dark, so we weren't able to see its full glory, but it was bright and had a noticeable tail, even under those conditions. It's too bad our local skies didn't clear up so we could see it three or four days earlier, when it was higher at sunset so we could have seen more of the tail. Here's hoping it won't be too long before the next bright comet comes by – wouldn't it be great to have one that we could see easily even in daylight?

## The OCA Election

We had the OCA election in January, and I'm really sorry for any inconvenience to those who didn't get their January issue of the Sirius Astronomer before the January meeting. Steve Condrey did his best to get the issue together and to the printer early, but was limited by when he received the content. Even though he sent the finalized issue to the printer before Christmas, it takes five working days to get it printed and delivered – which, with the weekends and holidays, turned out to be after New Years. Charlie Oostdyk worked all night after the newsletters were delivered to get the ballots inserted and to finish the processing so they could go out in the mail first thing on January 3 (which was the first day the USPS was in operation after December 30<sup>th</sup>, due to the special holiday to honor President Ford). In spite of Charlie and Steve's hard work, the upshot of all this was that, unfortunately, a lot of members didn't get their newsletters with the enclosed ballots before the meeting on January 12.

We had the ballot available through the website starting on December 10, and we also had plenty of ballots available at the January meeting. I was happy to see that there seemed to be more people than usual voting at the meeting, so Bob Evans definitely had a bunch of ballots to verify and count. And the final results are:

President: Barbara Toy

Vice President: Craig Bobchin

Secretary: Bob Buchheim

Treasurer: Charlie Oostdyk

Trustees at Large: Gary Schones, Tom Kucharski, Steve Short, Alan Smallbone, Steve Condrey, Bill Hepner and Shelia Cassidy.

We had eight excellent candidates for the trustee positions, but only seven positions available – no matter how the election went, we would inevitably lose one good candidate. Kyle Coker, who is very active in the AstroImage SIG and the Outreach program, does regular presentations on the basics of astrophotography for the club's Beginners Class, and is a familiar and helpful "regular" out at Anza, turned out to be that person. Even though he won't have a formal position on the Board this year, we hope he'll remain actively involved in issues of concern to the Board and that he'll run for the Board again next year.

## Heavy Schedule for the Outreach Program

During the regular school year, most of our club's Outreach events are in the schools. The heart of what we do is to take telescopes and other viewing equipment to different schools to let students see what's out there for themselves. Usually these events are for more than one class, and the students' families come, too. Sometimes these are tied in with an "open house" or other school event that brings even more people out to them. We generally have more than a hundred people come to each of these events, and it's not unusual to have 300 to 400 people or more.

One great aspect of these programs is that the people who come are wonderfully enthusiastic. Teachers tell us regularly that the kids talk about what they saw for weeks, even months, afterward, and look forward eagerly to our next visit. Their families

are usually just as excited, and it's amazing how many of the parents and grandparents have always wanted to know more about astronomy but for whatever reason have never followed up with it – for many of them, having a chance to see things through our telescopes is a dream come true.

So why am I telling you this? Well, January through the beginning of Daylight Savings Time (which is early this year – March 11) is the busiest time for our Outreach Program. This is when most schools seem to schedule their astronomy programs, and darkness comes early so it is easy to have a viewing event and still get children to bed at a reasonable hour. Jim Benet tries to limit the number of events he calendars to just two or three a week – the program has become increasingly popular under his leadership, so there can be a lot of pressure to have more, especially as Daylight Savings approaches. Even with limiting the number of events we do, it can be hard for the regular volunteers to cover everything that's scheduled – we really need more volunteers.

What do the volunteers do? Basically, bring a telescope out to the event site, set it up, find an object, and let people look at it through the telescope (for most sessions, you would probably only need to find three or four objects for the whole evening). You can embellish from there – many volunteers develop nuggets of interesting but fairly basic information they can tell people while they're viewing an object, some bring pictures or things like planetarium programs to help illustrate points of interest (and as a backup so there's something to show in case it gets cloudy), most have green laser pointers to help point things out in the sky, some bring printed materials they collect from the Internet and other sources as handouts, and so on. However, it's not necessary to get fancy, and it's certainly not necessary to have a big, high-tech telescope – lots of volunteers bring Dobsonians of different sizes, several people over the years have brought telescopes they borrowed from the Loaner Program, and when I used to bring my little ETX 90 to outreaches it seemed to be as popular with the kids, in particular, as the larger scopes.

How do you get involved? The easiest way is to contact Jim Benet ([jimbenet@pacbell.net](mailto:jimbenet@pacbell.net) or 714-693-1639) and ask to be put on his email list of potential volunteers. He sends out notice of upcoming outreaches to everyone on his email list and also posts the information on the club's website calendar, and it is really helpful to him in planning for these if you let him know in advance when you are coming out for a particular outreach – this also makes it easier for him to let those who are coming out to an event know about any cancellations or changes of plans. He provides directions to each event, and the volunteers meet there and set up, usually on a black-topped area at the back of the school that can be made comparatively dark. Once the people start coming to view, everyone is usually kept very busy for an hour or more until the crowd starts breaking up – the real fun is in talking to the people coming through the line to look through your equipment, answering their questions, and seeing their pleasure and excitement when they see what you're trying to show them (if I don't see any response while they're looking, I check my equipment, and usually find that it's been knocked or drifted off the target).

Doing outreaches is also a great way to get to know other club members and to learn about what's going on in the club. There's generally a lot of visiting back and forth while people are setting up and at the end of the evening as people are breaking things down – those times are also when people tend to show off new equipment, share plans for star parties and other events, talk about current astronomical events, and sometimes even share a bit of club gossip. In other words, they're great social events besides leaving everyone with a warm sense of achievement and of an evening well-spent, and they're really easy to do – but don't just take my word for it, come on out and give it a try for yourself!

### **Recent Developments on the Kuhn:**

Switching gears a bit, last month I talked about recent developments on the project to replace the observatory's moving roof and support structure. Besides this, I'm happy to report that there have been a number of recent advances with the Kuhn itself.

Those who were around in 2002 may recall that the Kuhn's operating system broke down completely, leaving the Kuhn was out of action for about a year. Dave Radosevich provided the skill and a lot of the labor needed to clean and rework the gears, install new drive motors, install a new control system, and have the mirrors re-coated. Others helped as well, both during the major reconditioning work and after, and, since the last hardware problems were corrected, the Kuhn has been a real joy to use.

One of the disadvantages of having a custom telescope is that there isn't any manual you can check for how to adjust or maintain it, unless the people who designed, built or modified it over the years wrote up that information. In the case of the Kuhn, we have documentation on the current commercially-produced operating system, but none on maintaining the telescope itself (and if any of you know of any maintenance documentation, please do let me know about it!). One result was that, even though the Kuhn was somewhat out of collimation after the renovation work, and even though I talked to a lot of people about

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# AstroSpace Update

February 2007

Gathered by Don Lynn from NASA and other sources

**Hybrid gamma-ray burst** – Scientists have found a gamma-ray burst (GRB) that does not fit the characteristics of either the long or short variety of GRB. The newly discovered kind is being called a hybrid GRB. The hybrid GRB was discovered by the Swift spacecraft last June, and was well-studied by many other telescopes, including the Hubble Space Telescope. The long GRBs last over 2 seconds and are believed to be caused by the supernova collapse of a massive star into a black hole. The short GRBs appear to be the merger of 2 neutron stars (or possibly a neutron star and a black hole) to create a black hole (or bigger black hole). The hybrid GRB lasted 102 seconds but did not produce any signs of a supernova. At its distance of 1.3 billion light-years, a supernova should have been easily observed. The galaxy containing the hybrid GRB contains few massive stars, and so has little probability of producing a supernova of a massive star. The brightness and arrival time of gamma rays behaved more like a short GRB than a long one. So scientists are waiting for another hybrid GRB to occur in hopes of determining what it is that exploded. There are a few GRBs in the archived data of the Compton Gamma-Ray Observatory that fit the hybrid GRB pattern, but not enough observation of any of these was made by other telescopes to help unravel this mystery.

**Cassini** (Saturn mission) – Scientists report that recent radar images of Saturn's moon Titan show the most definitive evidence yet of lakes filled with liquid methane in far north regions of that moon. The evidence included radar reflectivity, shapes, associated drainage channels, and location in depressions. The lakes range in size from under 2 to over 40 miles. Some of them appear only partially full. The varying states of fullness suggest that the lakes are temporary, evaporating over some time period. This implies that Titan has a hydrological cycle, with liquid evaporating, condensing, raining, and draining into the lakes. Bright patches near the edges of some lakes are probably small islands. It is thought that the methane rain and therefore the lake region may shift to the far south when the seasons reverse there (occurs about every 15 Earth years).

**Enceladus** (Saturnian moon) – One of the biggest space news stories of last year was discovery by the Cassini mission that water ice was spraying out of Enceladus. This was explained by geyser action, which required liquid water to exist in pockets near the surface. A new paper gives an alternative explanation of the spewing water ice. The plumes were found to contain 10% carbon dioxide, nitrogen and methane. These do not dissolve in cold liquid water in high enough concentrations to explain this percentage. However these concentrations can occur in clathrates, material in which gas is trapped within frozen crystals. The new theory is that clathrates consisting of carbon dioxide, nitrogen and methane within ice crystals exist near the surface of Enceladus. Tidal forces open up cracks in the surface (cracks are observed there) which expose the clathrates to the near-vacuum of space, and the clathrates explode into the plumes we have observed. This would involve no liquid water, and therefore no chance of microbial life having developed in liquid water there.

**Black hole in globular** – The European X-ray spacecraft XMM-Newton found the X-ray signature of a black hole in a globular star cluster at the nearby galaxy NGC 4472. Computer simulations have shown that when a supernova forms a black hole in a globular cluster, gravitational interactions should first perturb the black hole to the center of the cluster, then throw it out, escaping entirely. So theorists had predicted searches for black holes in globular clusters should not produce much. Yet this black hole was found in only the 2nd globular examined. The black hole is brighter in X-rays than it should theoretically be, implying it may be more massive than black holes produced by supernovas generally are. More mass would explain why the black hole has not been thrown out of the globular, since computer simulations show that very massive objects would remain stable in the center of a globular. Extremely few black holes are known in the intermediate range of mass, larger than one left by a supernova ("stellar mass" black holes) and smaller than the ones found in the centers of galaxies ("supermassive"). So if this newly discovered black hole turns out to be intermediate mass, it will be a rare object, and very interesting for further study.

**Black hole in dwarf galaxy** – Astronomers have found evidence of a supermassive black hole at the heart of a dwarf elliptical galaxy about 54 million light years away. It is only the second time a supermassive black hole has been discerned in a dwarf galaxy, and only the third time that astronomers have observed a double nucleus at the heart of a galaxy. The double nucleus turned out to be the concentrations of stars at the ends of a disk of stars orbiting the black hole. The galaxy lies in the Virgo Cluster and is about 1 percent the size of the Milky Way. It is the smallest galaxy containing a supermassive black hole. It had been speculated that dwarf galaxies like this could not make black holes at their centers.

**Dwarf galaxies discovered** – Further analysis of the Sloan Digital Sky Survey II (SDSS-II) has found 8 new dwarf galaxies orbiting the Milky Way. They are all small and dim and were lost among the stars of the Milky Way in all previous observations. Color filter and brightness data in the SDSS-II allow computers to estimate distances and sort out distant stars from the foreground ones. The galaxies appear in the constellations of Canes Venatici, Bootes, Leo, Coma Berenices, Ursa Major and

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## A Great Big Wreck

by Dr. Tony Phillips

People worry about asteroids. Being hit by a space rock can really ruin your day. But that's nothing. How would you like to be hit by a whole galaxy?

It could happen. Astronomers have long known that the Andromeda Galaxy is on a collision course with the Milky Way. In about 3 billion years, the two great star systems will crash together. Earth will be in the middle of the biggest wreck in our part of the Universe.

Astronomer John Hibbard isn't worried. "Galaxy collisions aren't so bad," he says. A typical spiral galaxy contains a hundred billion stars, yet when two such behemoths run into each other "very few stars collide. The stars are like pinpricks with lots of space between them. The chance of a direct hit, star vs. star, is very low."

Hibbard knows because he studies colliding galaxies, particularly a nearby pair called the Antennae. "The two galaxies of the Antennae system are about the same size and type as Andromeda and the Milky Way." He believes that the Antennae are giving us a preview of what's going to happen to our own galaxy.

The Antennae get their name from two vast streamers of stars that resemble the feelers on top of an insect's head. These streamers, called "tidal tails," are created by gravitational forces—one galaxy pulling stars from the other. The tails appear to be scenes of incredible violence.

But looks can be deceiving: "Actually, the tails are quiet places," says Hibbard. "They're the peaceful suburbs of the Antennae." He came to this conclusion using data from GALEX, an ultraviolet space telescope launched by NASA in 2003.

The true violence of colliding galaxies is star formation. While individual stars rarely collide, vast interstellar clouds of gas *do* smash together. These clouds collapse. Gravity pulls the infalling gas into denser knots until, finally, new stars are born. Young stars are difficult to be around. They emit intensely unpleasant radiation and tend to "go supernova."

GALEX can pinpoint hot young stars by the UV radiation they emit and, in combination with other data, measure the rate of star birth. "Surprisingly," Hibbard says, "star formation rates are low in the tidal tails, several times lower than what we experience here in the Milky Way." The merging cores of the Antennae, on the other hand, are sizzling with new stars, ready to explode.

So what should you do when *your* galaxy collides? A tip from GALEX: head for the tails.

To see more GALEX images, visit [www.galex.caltech.edu](http://www.galex.caltech.edu). Kids can read about galaxies and how a telescope can be a time machine at [spaceplace.nasa.gov/en/educators/galex\\_puzzles.pdf](http://spaceplace.nasa.gov/en/educators/galex_puzzles.pdf).

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



*This GALEX UV image of the colliding Antennae Galaxies shows areas of active star formation, which is not in the tidal tails as one might expect.*

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Hercules. One of the newly discovered galaxies is about as far (1.4 million light-years) as it can be and still be gravitationally bound, so it may not be a satellite galaxy of our Milky Way. It could be orbiting within the local group of galaxies, but not orbiting a specific galaxy. It may deserve further study, since its distance probably kept it from being disrupted by close passage by large galaxies, and so more closely resembles the way dwarf galaxies looked when they formed. The other 7 dwarfs will probably eventually be torn apart by tidal forces of the Milky Way. Several of them appear disrupted in the SDSS-II images. It is probable that early in the history of our galaxy, many more of these dwarf galaxies were torn apart, and the ones we are discovering are simply the leftovers that haven't been consumed yet.

**Hubble Space Telescope (HST)** – A team of astronomers using HST has created the first 3-dimensional map of the large-scale distribution of dark matter in the universe. This new map provides the best evidence to date that normal matter, largely in the form of galaxies, accumulates along the densest concentrations of dark matter. The map reveals a loose network of filaments that grew over time and intersect in massive structures at the locations of clusters of galaxies. The map stretches halfway back to the beginning of the universe and shows how dark matter has grown increasingly “clumpy” as it collapses under gravity.

The dark matter map was constructed by measuring the shapes of half a million faraway galaxies. To reach HST, the light of the galaxies traveled through intervening dark matter. The dark matter deflected the light slightly as it traveled through space. Researchers used the observed, subtle distortion of the galaxies' shapes to reconstruct the distribution of intervening mass along HST's line of sight, a method called “weak gravitational lensing”. Researchers created the map using the HST's largest survey to date of the universe, the Cosmic Evolution Survey. It covers an area of sky nine times the area of the Earth's moon. This allows for the large-scale filamentary structure of dark matter to be evident. To add 3-D distance information, the HST observations were combined with multicolor data from powerful ground-based telescopes and the orbiting XMM-Newton X-ray telescope.

Astronomers have long known that **open star clusters** eventually dissipate, as their stars spread out into their galaxy. They do not have enough mass to hold them together by gravity. A study of the bright young stars (B-type) in galaxy NGC 1313 using HST has found many of those stars have escaped from the open clusters where they formed. From the new observations scientists estimate that open clusters typically dissipate within 25 million years. This is the first time this has been measured in a normal galaxy. A recent measure of a pair of colliding galaxies found that open clusters there dissipated in about 10 million years. Type O stars, which explode as supernovas within a few million years, typically do not escape their open clusters. In fact, the supernovas of Type O stars may shock their open clusters into disintegrating.

HST observed a blizzard of particles in a disk around a young star (AU Microscopium) revealing the process by which planets grow from tiny dust grains. The particles are as fluffy as snowflakes and are roughly 10 times larger than typical interstellar dust grains. The fluffiness suggests that the particles were shed by collisions of snowball-sized objects, which should theoretically exist during the **planet formation** process. The fluffy particles were deduced from observations of polarized light. Theory says that fluffy particles should soon dissipate, so this observation says the formation process is more complex than current theory.

**Gas giant formation** – Observations using the Spitzer infrared space telescope and the Submillimeter Telescope in Arizona show that gas giant planets either form within the first 10 million years of a sun-like star's life, or not at all. Astronomers made the most comprehensive search for gas around 15 sun-like stars, most with ages ranging from 3-30 million years. All of the stars had little gas, less than 1/10 of a Jupiter, showing that most the gas had either been used in gas giant planet formation or had been blown away by the star.

**Planet-forming disk at Mira** – Astronomers generally assume that dusty disks where planets form are found around young stars, and the disks form planets and dissipate soon after. Now such a disk has been found around the companion to Mira, a dying star. Mira has reached the end of its main sequence life, and has swelled into a pulsating giant. It has long been known that it is throwing off material at the rate of about 1 Earth-mass every 7 years. New infrared observations made by the Keck I Telescope and the Gemini South Telescope showed that about 1% of this material being thrown out is captured into a disk by Mira's companion star. The companion is roughly similar to our Sun, but less massive. Because multiple star systems are common, planets could commonly form from disks around older stars that formed like the disk by Mira. Searches for disks and planets have generally ignored dying stars and multiple stars, so this could be an area ripe for discoveries.

**Asteroid consumed** – Astronomers have discovered a ring of metal-rich gas (iron, magnesium and calcium) surrounding a white dwarf star 460 light-years away in Virgo. The ring is about half a million miles in radius. It is believed that a metal-rich asteroid ventured too close to the star and was torn apart by tidal forces then evaporated by the star's heat to create or enrich the ring. The amount of material in the ring indicates the asteroid would have been at least 30 miles across. Disks are rare

around white dwarfs and no other one is known with substantial metal abundance. This may indicate that planetary systems similar to our Solar System, with an asteroid belt and planets nearby to perturb asteroids toward the star, may be fairly rare.

**Chandra** (orbiting X-ray observatory) has imaged in X-rays the remnant of Kepler's Supernova, seen exploding in 1604. This object has been a bit of a mystery, since it did not exactly match the characteristics of any type of supernova. It has a great deal of iron in the spectrum and there is no detectable neutron star, both of which indicate a Type Ia supernova. But observations show that the exploded material is expanding into pre-existing material, which is characteristic of a Type II. The new observations measured the oxygen and iron in the debris, confirming Type Ia. It may have been a "prompt" Type Ia, a variation that explodes much earlier in the life of the star than normal, and that may have pre-existing surrounding material.

Analysis of Chandra images of the center of our Milky Way galaxy taken at intervals since 2002 shows that a sphere of X-ray light is expanding through the area. This is called a "**light echo**", and indicates that a brilliant surge of X-rays was emitted by the supermassive black hole at the center of the Milky Way about 50 years ago. To make this much X-ray light, an object the size of the planet Mercury would have to have fallen into the black hole.

**Multiple star formation** – Researchers using the Very Large Array radiotelescope have imaged several multiple star systems still in the early stages of formation to try to determine which theory of their formation is correct. The leading theories are: 1) a large disk fragments into pieces that form the multiple protostars (objects that develop into stars); 2) the protostars form separately and capture each other into orbit. One particular observed object (L1551 IRS5) contained 2 star-forming disks that are aligned with each other, indicating theory 1 is correct. Separately forming disks would not be oriented the same direction. But to complicate matters, the same object contained a 3rd disk that was not aligned. Further study is needed to determine if the 3rd disk formed separately (theory 2) or formed together (theory 1) and was later perturbed from its original orientation.

**Triple quasar** – Astronomers using the Keck Telescopes in Hawaii and the Very Large Telescope in Chile have discovered a triple quasar. The first of the 3 was found in 1989, and soon after found to have a dimmer companion. The recent observations found a 3rd nearby, and showed that differences among the 3 were enough to conclude that there is no gravitational lensing making multiple images of a single quasar. About 100,000 quasars are known, of which dozens are double, but this is the first triple. It is so distant that the light took 10.5 billion years to get to us. A quasar is a powerful source of light (including radio and other wavelengths) believed to occur when large amounts of material fall into a supermassive black hole at the center of a galaxy.

**Venus Express** has obtained temperature maps of large areas of the surface of Venus by observing in wavelengths of infrared that penetrate the thick atmosphere and clouds of that planet. "Cool" spots have been found that are only 837 degrees F, more than 50 degrees less than typical areas. So far the cool spots seem to correspond to high elevations, as expected, but further observation and analysis will be done to see if there are warm spots related to volcanism. The areas mapped first, Themis and Phoebe Regions, are known to have volcanic features, but it is not known if any volcanic activity still exists. There are no surface temperature differences between day and night on Venus. The heat is trapped on a global scale by the strongest greenhouse effect in the Solar System, caused by the extremely dense carbon dioxide atmosphere.

**Mars rovers** have been loaded with new software to make them smarter. New capabilities include: 1) recognizing dust devils and clouds, and sending to Earth only the parts of pictures showing them, 2) continuing to recognize the rocks about the rover even as the rovers move, 3) calculating where it is safe to reach with the instrument arm, and 4) better navigation around hazards. The radio system does not have the capacity to send to Earth all the pictures that could be taken to find dust devils and clouds, and most such images have been empty, because the events are somewhat rare. Calculating safe reach was previously done on Earth and sent to the rover, resulting in at least a day's delay in placing the instruments on chosen rocks. The previous hazard avoidance could look only one step ahead, where the new system works a whole plan of many steps. This is the 4th time the software has been upgraded since launch in 2003, and this is the most comprehensive of those upgrades.

**Mars Reconnaissance Orbiter** (MRO) has imaged the site where Mars Pathfinder, with its rover Sojourner, landed in 1997. By comparing each feature in the MRO image with pictures taken on the surface by Pathfinder, one spot in the MRO image was found not to correspond to anything. This is probably Sojourner, which was still operating 12 weeks into the Pathfinder mission, when radio contact failed. Apparently the rover approached the lander in an attempt to reestablish contact. The new image shows the lander, its ramps, portions of airbag, the parachute, the backshell, and 4 spots that appear to be broken pieces of the heat shield.

**Planet temperatures and winds** – A study of planets quite close to their stars found no difference between the temperatures of the day and night sides of 3 such planets. The most likely explanation for this is that there are very high winds, perhaps as fast as 9000 mph, distributing the heat evenly. The planets are so close to their stars that tidal forces (thousands of times stronger than Earth's tides) have probably locked the same side of each planet to always face its star. This precludes fast

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it, I wasn't able to find anyone who could give me much direction on how to improve it.

Enter one of our newest Star Members, Pat Knoll, who does repair work for Oceanside Photo and Telescope (OPT), and who regularly collimates all kinds of telescopes, including cassegrains. By the end of his Star Member training session, he and the other two new Star Members who were in training with him, Joe Busch and Karl Stahl, had formed an impromptu team to work on the collimation, with Pat at the eyepiece and one of the others making the actual adjustments according to Pat's directions. By the end of that session, we not only had three trained and very capable new Star Members, but the view through the Kuhn was sharper than it had been at any time since I first used it, and I had received training myself on aspects of the telescope that I previously knew nothing about.

Since that memorable session, Pat and Joe, in particular, have taken the Kuhn under their wing and have been finding a lot of different ways to improve it. Among other things, Pat convinced Jerry Brunache, the gentleman who actually ground the Kuhn's mirrors, to come out to the site to help fine-tune the optics, as we suspected that the secondary mirror wasn't in optimal position. This was the first time that Jerry had seen the mirrors he ground in the fully assembled telescope, and the first time he had a chance to view with them. When he finished his adjustments, Pat told me that he moved the focus point so that the full main mirror is now used to form the image – apparently only a part was actually used at the prior focus point – so images are brighter, and there is a lot more back focus, which solves another problem we were having. Since then, Pat has also cleaned both the primary and secondary mirrors. As I write this, I haven't yet had a chance to look through the newly cleaned and aligned optics – but Pat tells me that he found that Stephan's Quintet went from being a dim set of averted vision objects to galaxies he could clearly see straight-on, and I'm really looking forward to seeing that for myself!

In the course of all this, OPT generously donated a new 2-inch dielectric diagonal that also improves the image, and an extension tube, for which we are very grateful. Joe Busch has donated a new computer for the Kuhn, and also a new focuser – Pat is currently working on a new back plate to hold it, and, once he has it working and in place, he plans to repair the current focuser so we have it as a backup. Pat, Joe and Karl keep coming up new ideas for improvements and plans for achieving them – with all that and the plans for the observatory roof, these are exciting times for the Kuhn, and I hope you'll come up to see these changes for yourself at the next Anza star party! ■



And thanks to our Galactic sponsors:  
Astro Hutech and Oceanside Photo and Telescope (OPT)

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**FOR SALE:** Achromat Triplet Objective in thick lens cell, 1602mm Focal Length, 188mm Diameter (f/8.5). Weighs 10lbs. It comes with a certificate. Asking price \$600.00. Contact Vittal at [badithenv@sbcglobal.net](mailto:badithenv@sbcglobal.net).

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rotation from spreading the daytime heat to the night side. The temperature measurements were made by the Spitzer infrared space telescope at 8 different points in each planet's orbit.

**Spitzer** has imaged the Eagle Nebula, where HST took the famous image of the "Pillars of Creation". The new infrared image shows that a supernova has exploded in the nebula (at least 1000 years ago) and the shock from it will likely reach the pillars and blow them away in 1000 years or so. Since light takes 7,000 years to get here from the Eagle Nebula, the pillars are actually already gone.

**Metric Moon** – Only the United States, Liberia, and Burma still primarily use English units (pounds, miles, etc.) – the rest of the world is metric (kilograms, kilometers). And now the Moon will be metric too. NASA has decided to use metric units for all operations on the lunar surface when it returns to the Moon. The decision was made by representatives from NASA and 13 other space agencies discussing ways to cooperate on lunar exploration. Although NASA has used the metric system since about 1990, English units linger on in much of the U.S. aerospace industry. The confusion that can arise was highlighted by the loss of the Mars Climate Orbiter in 1999, which occurred because a contractor provided thruster firing data in English units while NASA was using metric. NASA is considering adopting other standards for its lunar operations such as using the same type of internet protocols on the Moon that we use on Earth.

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Analysis of comet samples from the **Stardust** mission revealed 2 kinds of nitrogen-rich organic molecules (ethylamine and methylamine) not previously known in comets. These are chemicals that were probably needed during the development of life on Earth, and may have been contributed by comets that impacted our planet in its early history.

Examination of part of the Legacy Survey being made on the Canada-France-Hawaii Telescope has revealed several **gravitational lenses** (gravity bending light per General Relativity) caused by groups of galaxies. Gravitational lenses have commonly been used when caused by individual galaxies or by clusters of galaxies, but not by a group (smaller than a cluster).

The Planetary Society is offering a **prize** of up to \$50,000 for the best plan to track precisely the asteroid Apophis, which has a small probability of striking the Earth in 2036. It is hoped that some of the world's space agencies will implement such a plan, and such tracking will prove that it will miss Earth or that Apophis needs to be moved before 2036.

The first **Jules Verne**, a European spacecraft capable of transporting over 8 tons of cargo to the Space Station, has completed test in a space simulation chamber, in preparation for first launch this summer. It uses state-of-the-art heat pipes as part of the system that keeps contents at room temperature. ■



The Moon and Venus from Huntington Beach, CA, 1/21/07 (Michael Mirjahangir)

# GoTo Group Tour of Meade's Irvine Factory

by Mike Bertin

On a fine day last September (Friday, 9/15/06) sixteen OCA GoTo Groupies gathered on Oak Canyon Road in Irvine for a tour of the Meade Factory. Meade sells more telescopes each year than any other company — more than half a million! Most of these are smaller scopes that they supply to Walmart, Costco, and other mass marketers — the kind of telescopes we tell beginners to avoid. At the Meade factory in Irvine they manufacture larger scopes, including the LX200 line, the new advanced Ritchey-Chretien RCX400 telescopes, and they do the assembly for Coronado solar telescope products. We had a chance to see all of these, including a visit to the optics area, usually off limits to outsiders.

Our host for the day was Scott Roberts, who recently made a presentation to OCA about the 4M Community, Meade's community astronomy outreach program. Scott started with a brief description and history of the company. At 168,000 square feet the Irvine facility is the largest vertically integrated telescope factory in the world. Some assembly plants for small scopes in Asia are larger, but they are not vertically integrated. Meade has all the functions from R&D to raw materials, manufacturing to marketing, and sales to administration in the Irvine plant. Meade also makes binoculars, biological microscopes, and the Simmons line of rifle sunsights and has assembly and manufacturing at other locations.

The company was founded on a shoestring in 1972 as a mail order supplier of small imported refractors. Scott showed us a copy of Meade's July 1972 ad in Sky & Telescope magazine. Its tag line was "Advertising is Expensive". By the late 1970's they were manufacturing their own 6 and 8 inch Newtonian reflectors, and eventually Schmidt Cassegrain telescopes. The LX200 line of GoTo telescopes was Meade's first big innovation of the 1990's. The ETX line of small telescopes brought affordable Go To scopes to the market, a milestone for the late 1990's. The ETX90 was the "VW Bug" of the telescope industry. Recently they began offering Ultra High Transmission Coatings, increasing light transmission by about 20%, the equivalent of having a 10% larger aperture. Meade's most recent innovation is the RCX 400 Advanced Ritchey Chretien telescope, which provides a very flat field of view from edge to edge.

John Diebel was a 26 year old engineer working in radar development at Hughes Aircraft when he obtained a loan to order a \$2,500 selection of amateur telescopes from a Japanese manufacturer. He selected the name Meade Instruments because it reminded him of Lake Meade, and the name was easy to say. It was originally spelled "Mead"; another engineer at Hughes suggested adding the final "e". His sales in the first year were \$8,000 all from the S&T ad. Scott Roberts worked at OPT in the 1980's and in 1986 — the Comet Halley year — he joined Meade, which was by then competing neck and neck with industry leader Celestron. Shortly thereafter John Diebel sold Meade to a St. Louis based investment firm; Scott was worried about his timing. Meade did go through a down period, and in 1991 the parent company was headed toward bankruptcy. John Diebel bought the company back for \$1000, and assumed the company's \$2,000,000 debt. Meade hasn't looked back since.

Scott started our walk around the factory in the raw materials section, where the metal and glass that goes into Meade scopes is received, sorted and stored. In the machine shop we saw a bevy of CNC (computer numerically controlled) machines taking pieces of raw metal and turning them into finished parts ready for installation in telescopes. In the same area "pressings" or glass blanks are ground into the shapes used for refracting telescopes or given the rough spherical shape used for the mirrors in Meade reflectors. They are ground to about .002" of the final shape in a few minutes on automated machines. From there they go for final figuring in the optics area.

On one side of the optics corridor dozens of machines were polishing glass blanks ranging from 3 inches to 20 inches in diameter down to the tight tolerances needed for good optical quality. On the other side of the corridor are labs where the glass is tested for its dimensions and optical quality, anti-reflective and high transmission coatings are added, mirrors are aluminized, and systems are tested for aberrations. Finally a group of Meade "gnomes" figures and tests matched sets of corrector plates and mirrors that will go together into a finished telescope. This final step is as much art as science, and the gnomes have a lot of leeway as to what they pass for shipment. Meade has a 3-strikes quality program in which every employee participates. If a production worker passes a defective part he or she gets a strike. Three strikes and you're out, fired. It's a strong incentive. The gnomes don't want to get any "strikes" against them.

In the coatings lab Bill Rich explained Meade's automated polishing and coating processes. Each mirror gets a dielectric "stack" of coatings to increase reflectivity. Each corrector plate (the glass piece at the front of your optical tube) gets anti-reflective coatings on both sides. It may surprise you to learn that when light strikes a glass surface over 4% is reflected. On the corrector plate alone you could lose 8% of the light transmission (4% on the front surface, 4% on the back.) All together, unwanted reflections could cost you up to 40% of the light your telescope gathers. Bill showed us a glass plate, half plain glass and half with anti-reflective coatings. It was amazing; the coated half was nearly invisible. Many telescopes have magnesium fluoride coatings that reduce the light losses to 1-1/2%. Meade's Ultra High Transmission Coating process adds thin, transparent layers of aluminum oxide, titanium dioxide, and magnesium fluoride, reducing the light losses to less than 1/2%. Bill told us an amusing story. Meade's coatings were so clear that many customers thought their telescopes had not received the UHTC treatment. Finally Meade altered the formulation slightly so the coated glasses reflected wavelengths of blue light ever so slightly. The customer complaints stopped.

The mirrors are aluminized in a large chamber in the coatings lab. It takes an hour to pump out the air in and out of the chamber takes hours. The coating itself takes only minutes. Aluminum is prepared on tungsten anodes in the chamber. Heating the anodes



**GoTo Group at Meade's Irvine Factory, 9/15/06. From the left: Vince Laman, Richard Nowicki, Chela Marin, Stephan Tibbetts, Steve Short, Ray Koagel, Reg Salcido, Maria Koagel, Hal Croulet, Mike Bertin, Adnan Din, Dennis Mays, Barbara Mays. Crouching: Scott Roberts of Meade, OCA's Craig Bobchin (picture by Craig Bobchin)**

evaporates the aluminum onto the mirrors in a layer a few millionths of an inch thick. The coating thickness is monitored precisely by a crystal in the coating chamber. As aluminum is deposited on the crystal, its vibration frequency changes. One of our group asked why UHTC isn't standard. This question got two answers, a scientific answer and a marketing answer. The science answer is that UHTC is optimized for visible light, with less light transmission in the infrared or ultraviolet. UHTC isn't right for all observing situations. As for the marketing answer ... who knows? Automatic transmissions on cars were once optional items too.

After figuring and coating the mirrors are sent to the secret room where the gnomes work on them. They are tested with Ronchi gratings that produce a pattern of lines. The ideal set of primary mirror, secondary mirror and corrector plate produces straight, parallel lines when looking at the grating. A plaque on the corridor wall compared good optics with optics that need further work. Sets of mirrors that produce curved or wavy lines are sent back for rework and more figuring, or are rejected outright.

Meade recently purchased Coronado, makers of hydrogen alpha and other solar filters, and Solar Max and PST solar telescopes. Meade is integrating these products into their Irvine manufacturing facility. Bill showed us the area where Coronado solar telescopes are assembled and tested. The solar scopes are first tested with a hydrogen lamp, but eventually all solar scopes are tested outdoors with sunlight.

Alex Sanchez, Meade's final assembly manufacturing manager, showed us the assembly area for LX200 and RCX 400 scopes. We saw a 10 inch RCX on an alt-az mount with a polar wedge, and a 20 inch RCX on a pier. Several equatorial Max Mounts for large RCX's were in various stages of assembly on the factory floor.

Meade advertises that an RCX telescope on a Max Mount is like a tank made by Swiss watchmakers. This is not an exaggeration. I saw a prototype at the Scope City open house in June. The production unit has come a long way. The blue finish on the drive units, the brushed aluminum brackets, and the precise machining are lovely to look at. A 20 inch RCX 400 on a Max Mount is a work of art; it produces a "Wow!" reaction. A 20 inch system will set you back about \$32,000, and you'll need a group of 4 strong astronomers to hoist the telescope onto the mount. It's lovely but it's heavy. This is not a portable system. But once you get it in place the pointing ability is outstanding and the tracking is superb.

After the tour we took a group picture outside the factory — no cameras are allowed inside. And we expressed our thanks to our own Craig Bobchin for arranging the tour, and to Scott Roberts and the other Meade employees for making it an engaging morning. Liliana & Zolatan Barabas, Craig Bobchin, Hal Croulet, Adnan Din, Ray and Maria Koagel, Vince Laman, Chela Marin, Dennis and Barbara Mays, Richard Nowicki, Reg Salcido, Steve Short, Stephan Tibbetts and Mike Bertin participated.

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