SIRIUS ASTRONOMER

www.ocastronomers.org

The Newsletter of the Orange County Astronomers

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GET OUT THE VOTE! OCA ELECTIONS COMING SOON!

Starhome Observatory, the unique observatory/home of former OCA President John Sanford, celebrated its seventh anniversary on July 14th. Though Mr. Sanford is retired and no longer lives in Orange County, he continues to remain involved with the OCA and we appreciate his continued contributions!

OCA CLUB MEETING

The free and open club meeting will be held Friday, November 14th at 7:30 PM in the Irvine Lecture Hall of the Hashinger Science Center at Chapman University in Orange. The main speaker is Dr. Elizabeth Barton, Assistant Professor, Department of Physics and Astronomy, UC Irvine

NEXT MEETING: December 12th

STAR PARTIES

The Black Star Canyon site will be open on November 29th. The Anza site will be open on November 22nd. 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, December 5th at the Centennial Heritage Museum at 3101 West Harvard Street in Santa Ana.

GOTO SIG: TBA (contact coordinator for details)

Astro-Imagers SIG: Nov. 18th, Dec. 16th

EOA SIG: Nov. 26th, Dec. 24th

Astrophysics SIG: Nov. 21st, Dec. 19th

Dark Sky Group: TBA (contact coordinator for details)

President's Message

By Barbara Toy

So far, as I write this, we have been suffering through an economic meltdown, brushfires with the sad losses of homes and lives, and the final weeks of the presidential election season, which has also included races for a lot of other positions and the latest set of California propositions for voters' consideration. As you read this, the election should be behind us, but our economic woes will most likely be with us for a while, as will the fire season. Whoever wins a position at any level of government will have a tough job ahead, and I hope they all have the wisdom and courage to make the decisions needed to get us through these difficult times quickly and with a minimum of long-term damage.

Fortunately, we as a club are doing pretty well, and the challenges we face are not the type that threaten our existence and continued activities. Of course, I base that statement on the known challenges we face for the reasonably foreseeable future – we have some reserves to meet our ongoing expenses even if we have a drop in income and we have insurance in case of major disaster. Insurance, though, would cover only physical disasters, not circumstances like a major depression, which we all hope is not coming our way in spite of the economic events of the last few weeks; a major depression would undoubtedly cause us all to reexamine our priorities and needs, including the club.

To those of you who have suffered losses from the recent events on the stock market and the other financial issues that have dominated the news in recent weeks, or who may be facing foreclosure issues, loss of jobs or other losses because of the shrinking economy – my condolences and I hope better times come soon for all of us! Hopefully, club activities will help take your minds off your troubles, and enjoying nights under the stars will give you pleasure and perspective to help get through our current difficult times. Fortunately, it doesn't cost anything to look up and enjoy a good view of the heavens – and, as a rare piece of good news among all the problems, the cost of driving to a dark location where you can enjoy that view even more has been going down, as gas prices drop from the highs we had last summer. It would be really nice if that trend, at least, continued for a while…

OCA Elections

Even though the national elections may be over, we still have the OCA election coming up. As I mentioned last month, the nominations for the OCA board close at the end of the general meeting in November, and the voting begins when the ballot is final and posted on the website; a copy will also be sent with the December Sirius Astronomer. The directions for voting are on the ballot, and please be sure to follow the instructions regarding putting the ballot in a sealed envelope with the name of the member who is voting printed legibly on the outside, so your votes can be properly counted – this is needed so the ballot can be checked against the current membership list to ensure that it's from a member who in good standing while maintaining the confidentiality of the ballot itself (so please don't sign your ballot!). If you have more than one member in your household, each member can vote, but each ballot needs to be in a separate envelope marked with that member's name. For the voting itself, please vote for only one candidate for each of the officer positions, and vote for no more than seven candidates for the general trustee positions.

As you might note, there are slots for write-in candidates for each position, and you are welcome to write in candidates. It would be far better, though, if you formally nominated anyone you might want to write in instead, as this would give him or her a much better chance of winning a position. Any write-in candidate has to have the same basic qualifications as a formally nominated candidate – he or she has to have been a member in good standing for at least a year, and, if written in for president of vice president, has to have been a board member for at least a year at some point in the past.

If you read this before in the general meeting in November, you still have time to get your nomination in so that you or your nominee can have the chance to experience the pleasures of being on the OCA Board! I talked about the Board at length last month and won't go over that ground again here – but, really, serving on the Board can be a lot of fun! Do give it a try!

Thanksgiving and the November Star Party at Anza…

You may have noticed on the club calendar that the Anza star party in November is on Thanksgiving weekend. This is due to the fact that Thanksgiving weekend this year happens to fall closer to the new moon than the weekend before (New Moon is actually on Thanksgiving itself, and the weekend before is the Black Star Canyon star party). I guess this gives us astronomers something extra to be thankful for this year, in that we will have nice, dark skies over a long holiday weekend. While there are probably people who won't be able to come to the November star party because of family or other obligations that weekend, there are others who will undoubtedly take advantage of the holiday to enjoy two or three nights under dark skies at Anza – here's hoping the weather cooperates!

And, if you do make it for the star party – microwaved Thanksgiving leftovers make great star party food!

Groups at Anza

As you may know, our Anza site is available for any club member in good standing to use at any time, and members can bring guests to the site, within reason – which is generally defined as less than six guests at a time. If you plan to have six or more guests, that's a "group" and is subject to the group rules, which you can find on the club website (www.ocastronomers.org) in "Files" in the Members section. You also need to clear your group visit with our treasurer and keeper of the official club calendar for such things, Charlie Oostdyk (charlie@cccd.edu, 714/751-5381), so he can make sure that this won't conflict with any other group that's planning to be there or with anything else that might cause a problem (you probably wouldn't want to have your group there when we're having the septic tanks pumped, for instance – though some people might find that interesting…).

We frequently host scouts, astronomy classes and other groups at Anza, and our goal is to do this in a way that still allows our members to use the site for viewing and imaging while the groups are there, and in a way that doesn't overload our facilities. Because of this, we generally don't allow groups to visit on star party nights, as that's when we have the greatest number of members on site and when Anza House and our other facilities are in full use.

We've been noting group reservation dates for the Anza site on the club's website calendar, so please be sure to check there before contacting Charlie, to help see what dates might be available. There can be delays between the time a particular group makes a reservation with Charlie and when it gets noted on the calendar, though, so it's important to get the final clearance through Charlie. To maximize the chance that your reservation will be put on the website calendar promptly, please e-mail both Charlie and me to confirm your date once you've cleared it with Charlie.

If you're going to bring a group out with one or more telescopes and you don't have your own pad or observatory, the best place to set up would probably be the Football Field, which is conveniently close to Anza House and also has a lot of room to spread out. If your group is going to leave early (classes often leave around 10:00, particularly in winter), please have them park near the exit from the Football Field pointing out, so they can leave without backing up – this minimizes excess light for anyone else on site, especially if the group comes in more than one vehicle.

If you want your group to have access to the Kuhn telescope and club observatory, you need to have a Star Member host at the observatory and run the Kuhn. We also ask for a donation of $5.00 per person in the group when groups use the Kuhn to help support the observatory and cover the cost of using the facilities. If you are a Star Member yourself, you are welcome to host your group at the observatory after making the appropriate reservations; if not, you would need to contact me (as the Observatory Custodian) to make arrangements for a Star Member to host the group. I can't guarantee that I'll be able to find someone who can do this for you, as we don't currently have many Star Members available to run the Kuhn for groups, but I'll do my best.

All of that may make it seem like more trouble than it's worth to bring a group out to Anza, but generally I don't think that anyone who's tried to schedule a group has had much of a problem doing it. Anza is a great facility for scouts and similar groups working on their astronomy badges, astronomy classes at all levels that need some time in the field to see some astronomical objects for themselves, and groups of family and friends that want to see what you find so interesting when you are in a dark site with a telescope, among others. If you've got a group you'd like to bring, please don't be shy about making a reservation and bringing them – and I hope you all have a great time!

Website Calendar

In October I updated the website calendar for 2009 to show the moon phases, regular club meetings and star parties, major astronomy-related events such as RTMC, and the holidays I could find without too much research. As of the time I'm writing this, I haven't had time to put in information on the 2009 meteor showers – hopefully that'll be included by the time you read this.

If you notice any holidays, astronomical events or other items you think should be included, or if you spot any mistakes, please email me the information at btoy@cox.net. If you try to put the information on the calendar yourself, it won't show up, even if it appears that the information has been accepted – to get information on the calendar, you need to get it to someone who is authorized to enter it (authorized people include our current website editor, Reza AmirArjomand, Charlie Oostdyk, Jim Benet (who inputs all of the outreach information) and me, though I'm sure there are others as well). We are subjected to regular

(continued on page 9)

AstroSpace Update

November 2008
Gathered by Don Lynn from NASA and other sources

Phoenix (Mars lander) used its scoop to nudge aside a rock lying nearby to see what effect the rock had on ice and soil underneath it. The depth of the ice layer below the rock may tell how the ice layer formed. Digging where the rock was showed ice at about the same depth as elsewhere. A sample from the digging has been placed in the microscopy-electrochemistry analyzer. Scientists expect that material seen in the samples turns out to be high concentrations of salts. On Earth salts are left under and around rocks when water has evaporated. A sample from another digging has been placed into the entrance to an oven analyzer and efforts are underway to shake the clumpy material down into the oven. Phoenix has detected snow falling from Martian clouds about 2.5 miles high, though the snow vaporized before reaching the ground. Calcium carbonate and clay were found in the soil by the lander, substances that on Earth form only in the presence of liquid water. For nearly 3 months after landing, the Sun never went below the horizon, since Phoenix landed above the Martian arctic circle in summer. But the season is changing, and frost is forming on the ground each morning. The Sun is setting for several hours now, and the output from the solar panels is dropping each week. So use of the scoop arm will probably end during October, and all instruments will probably be shut down by late December. It is hoped that before shutting down use of the scoop Phoenix will complete more digging crossways to other trenches to make a 3-dimensional map of ice depth in the area. The last instruments to be shut down as power drops will probably be the weather ones.

Mars rover Opportunity is being commanded to drive to Endeavour Crater, which is about 13 miles across, and about 7 miles away from the rover. The huge depth of Endeavour should reveal far more geological history in the rock layers exposed than the rover has seen so far. It may take 2 years to reach this goal, but there are plenty of interesting rocks on the way that will make this venture worthwhile even if the rover doesn't get there before it wears out. The path leads through younger rocks layers than those Opportunity has seen, and there are scattered cobbles that were thrown there when various craters in the area were formed by impact. The rover will be using its new software that allows it to assess hazards and plan a route around them, and the rover controllers will be using new very high resolution images of the area taken by the Mars Reconnaissance Orbiter.

Mars Reconnaissance Orbiter has imaged hundreds of small fractures, called deformation bands, exposed on the Martian surface that billions of years ago directed flows of water through underground sandstone. Groundwater on Earth often flows in such fractures. Visible effects of water on the color and texture of rock along the Martian fractures provide evidence that groundwater flowed extensively in the past. These features are being considered important for future exploration to understand water-related processes. Deformation bands form from either compression or stretching of underground layers, and can be precursors to faults.

Mars's polar cap – It has long been known that the residual south polar cap of Mars (the part that remains during summer) lies considerably off center (more than 3°) from the south pole. It was announced in 2005 that long term weather patterns explain why the residual cap is where it is, finally solving this mystery. Analysis of data from the Mars Express spacecraft has added more to the explanation and has implicated the Hellas Basin, a very large impact crater on the planet. The great depth (4 miles) and steep walls of Hellas cause winds flowing into the crater, which set up waves that deflect high altitude winds, including those near the pole. A high pressure region persists on one side of the south pole, and a low pressure region on the other side. In the low, dry ice (carbon dioxide) snow falls, but the high is too warm for this. However dry ice frost forms in both regions. The snow is more reflective than the frost, and so remains cooler in the sunlight of summer, and persists longer through summer than the frost. Hence the residual polar cap lies where the low pressure system is, off center from the pole.

Mars water – Another study of the eroded river valleys and lakes found on Mars (now all dry) concluded that rain and flowing surface water had to be common on Mars in the past. This study put dates on this period by studying the impact craters that formed after this period in the valleys and lake beds. Their conclusion is that precipitation and flowing surface water were common during the period 3.8 to 4.0 billion years ago, and became less frequent following this, drying completely by about 3.5 billion years ago.

Messenger (Mercury mission) flew by Mercury October 6, passing just 125 miles from the surface, taking more than 1200 pictures and much other data. All instruments worked as planned during the flyby. The spacecraft will go into orbit about the planet in March 2011 after 15 trips about the Sun since launch. The only previous mission to Mercury, Mariner 10, imaged about 45% of the planet's surface. Messenger's previous (January) flyby imaged about 20% more, and October's flyby about 30% more. The most striking feature of the newly seen area is a large pattern of rays, appearing to emanate from a relatively young crater previously seen by Earth-based radar, but not imaged by spacecraft until now.

Cassini (Saturn mission) will have completed its double flyby of Enceladus by the end of October. The 1st was October 9, at an altitude of only 16 miles, the closest flyby of any object during the Cassini mission, flying right through the plumes of the geysers, in order to sample the geyser material. The 2nd flyby is concentrating on imaging Enceladus, including the geysers, from a greater height (122 miles). 4 more Enceladus flybys are planned in the next 2 years.

Red Spot Junior – Further analysis of images and spectra taken of Oval BA, a storm on Jupiter, both before and after it changed color from white to red (and acquired the nickname Red Spot Junior) has yielded these findings: The reddest area is a ring about the center. Red light from the spot did not strengthen, but blue light weakened; thus the white light, composed of all colors, became red by the loss of blue. The color change was not caused by changes in wind speed, temperature, or rotation, as there was

no significant change in these. It was not caused by any interaction with the Great Red Spot. The most likely cause of the color change was a diffusion of some chemical compound to higher levels within the oval.

Haumea – The IAU has declared a fifth object to be a dwarf planet, and accepted one of the suggestions for a name: Haumea, the Hawaiian goddess of childbirth. The name was appropriate because Haumea, through a collision, gave birth to a pair of small satellites, which have been named Hi'iaka and Namaka, children of the goddess Haumea. The new dwarf planet is mostly rock, with only a thin icy crust, and Haumea is also the goddess of stone. It was found a few years ago in the Kuiper Belt. It is quite elliptical, apparently due to its fast rotation (about 4 hours), and the longest dimension is about the same as Pluto's diameter. Its orbit is quite elliptical also, moving between 35 and 50 AU from the Sun (an AU is the distance of the Earth from the Sun). Interestingly the name Haumea was suggested by Mike Brown, the second to report the discovery, though the first to observe the object, and not officially the discoverer as the result of a very controversial decision. The name suggested by the official discoverer was not selected, supposedly because underworld deities are not being used for this class of object.

Small Kuiper Belt objects – A group of astronomers made a survey of portions of the sky to measure how common small objects (2 to 17 miles across) are in the Kuiper Belt, the region of icy bodies beyond Neptune. They found absolutely none. Rather than declare it a failure, they used this to calculate how rare this size of bodies is in the Kuiper Belt, in order to have not seen any in the survey. This will send some theorists back to their drawing boards, since many had predicted by extrapolation from the number of larger objects in the belt that there should be more than enough small ones to have seen some in this survey. Either objects in this size range conglomerate into larger ones more easily than theorists predicted, or break up into smaller ones more easily than predicted. The objects of the size searched for in this survey are too small for current technology to image, so the study was done by watching many stars to see if these objects passed in front of them.

Asteroid impact – For the first time an asteroid was discovered with a 99+% chance of impacting Earth. It was designated asteroid 2008 TC3, and the next day it hit Earth's atmosphere above Sudan. It was only a several feet across. Although the fireball apparently was not witnessed by anyone, a shock wave from the impact was detected. It probably burned up without any part reaching the ground. On average, objects this size strike the Earth every few months, but none have been discovered before impact until now.

Solar wind low – Analysis of data from the Ulysses spacecraft shows that the pressure of the solar wind is 20% lower than the mid 1990s, the lowest it has been since spacecraft have been monitoring it (about 50 years). The speed of the solar wind has decreased only about 3%, but the temperature of the wind particles and the density of particles have dropped, thus reducing the pressure. The Sun's magnetic field is also weakening. The heliosphere, the bubble surrounding the Sun which resists interstellar winds, is dependent upon the strength of solar wind and the magnetic field, so this weakening is causing the heliosphere to shrink. This is apparently causing more cosmic rays to penetrate the heliosphere, which should make space travel outside the Earth's magnetic field more dangerous. The 2 Voyager spacecraft should leave the heliosphere sooner than predicted, which is good news for the Voyager scientists. NASA is about to launch IBEX (scheduled for October 19), which will image the heliosphere from near Earth (the Voyagers can only measure it as they pass through it), and IBEX should be able to detect the heliosphere shrinkage.

Sunspot low – Astronomers who count sunspots announced that 2008 has had the most sunspotless days of any year in more than 50 years. Having many sunspotless days is to be expected, since the Sun is switching from one 11-year cycle of sunspots to the next. This year is not the record, at least not yet, since many more sunspotless days occurred in cycle transition years in the late 1800s. It has long been known that the Sun shines slightly brighter (a fraction of 1%) when it has more sunspots (contrary to what might be expected), so it is no surprise that in highly spotless years, such as 2008, the Sun is slightly dimmer than usual. In fact it is the dimmest year on record, though accurate records of the Sun's brightness have not been kept nearly as long as sunspot records.

Sun's shape – Although it was never intended to, the RHESSI spacecraft (whose mission is to study solar flares in X-rays and gamma rays) makes extremely accurate measurements of how round the Sun is. The Sun is smoothly spherical within 0.001%, yet small deviations exist, and in fact vary with solar activity. The Sun develops cantaloupe skin during times of solar activity, slightly changing the average diameter in some areas, but not others. Measurements made in 2004 have been analyzed and it was found that the equatorial radius was larger by about 5 miles (out of more than 430,000), of which about 4 miles is attributed to rotation forces and the remainder due to solar activity. This measurement puts strong limits on internal motions within the Sun, as they would be reflected in bulges on the surface. Thus it is now certain that the core of the Sun cannot be rotating much faster than the surface. Also, a fear of Relativity scientists has been allayed: the equatorial bulge is not enough to substantially affect Mercury's orbit, which would have upset the conclusions from measuring very small deviations in Mercury's orbit, and attributing these to the effects of General Relativity.

Flyby anomaly – Several spacecraft have exhibited unexplained changes in speed during gravity assists flying by Earth, including Galileo, NEAR, Cassini, Rosetta, and MESSENGER. The changes are small (1/2 inch per second more speed change than calculated for NEAR, the largest example), but easily measurable. A new paper claims that the anomalies are all explained by a known effect of Special Relativity that was not included in the calculations.

Colliding planets – Two rocky planets orbiting a mature Sun-like star about 300 light-years away recently (in astronomical terms) suffered a violent collision. A massive disk of dust (a million times the dust orbiting our Sun) was found in infrared light circling the star, and causes other than a collision were ruled out. Supporting observations were made with Chandra (orbiting X-ray telescope) and various Earth-bound telescopes. The dust lies about the distance from the star as Venus and Earth's orbits lie from the Sun.

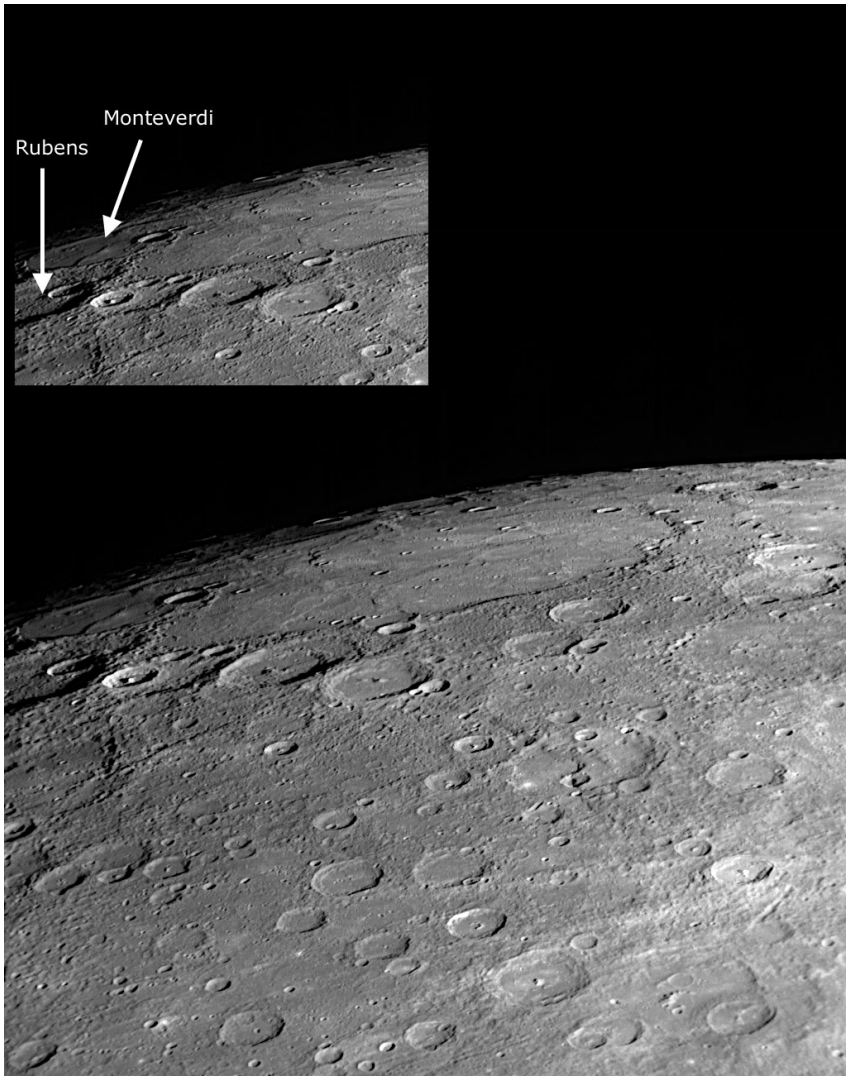
(continued on page 8)

ABOUT OUR SPEAKER

Dr. Elizabeth 'Betsy' Barton completed her undergraduate work at CalTech in 1994 and received her Ph.D in astronomy from Harvard University in 1999. Her current research involves, among other things, a search for the highest-redshift star-forming galaxies yet detected, statistical studies of galaxy interactions and satellite galaxies, and research at low and intermediate redshift into the formation of spiral bulges through *in situ* star formation.

Dr. Barton is actively involved in building the science cases for the next generation of large telescopes: she is currently on the Science Advisory Committee for the Thirty Meter Telescope project, which is a joint undertaking of the University of California, Caltech, and Canada but is currently seeking to expand its partnership. Dr. Barton is the Project Scientist of **IRIS**, the InfraRed Imaging Spectrometer, one of the three first-light instruments for the Thirty Meter Telescope. She is also a member of the Science Working Group created to advise the NSF about federal investment in an extremely large telescope such as the proposed 30-meter Giant Segmented Mirror Telescope (GSMT).

Currently, Dr. Barton is developing the science cases for galaxy evolution and "first light" objects, star-forming galaxies at extremely high redshifts.



The MESSENGER spacecraft obtained this view looking toward Mercury's north pole on October 6, 2008 during its second Mercury flyby. A dominant feature in this Narrow Angle Camera image is the large expanse of smooth plains in the upper left of the view. It may be related to extensive plains in Mercury's high northern latitudes that were identified in Mariner 10 images. The craters Rubens (named for the 17th century Flemish painter) and Monteverdi (named for the Italian composer of the late 1500s and early 1600s) are located near the western edge of the unimaged "gore" region in the Mariner 10 coverage of Mercury's surface. Per IAU naming criteria, Mercury's surface features are named for significant individuals in fields other than science. Most of the surface to the east of these craters is newly imaged terrain. Also visible just right of center in this image is an impressive cliff. Photo credit: NASA/ Johns Hopkins University Applied Physics Laboratory/Carnegie Institution of Washington

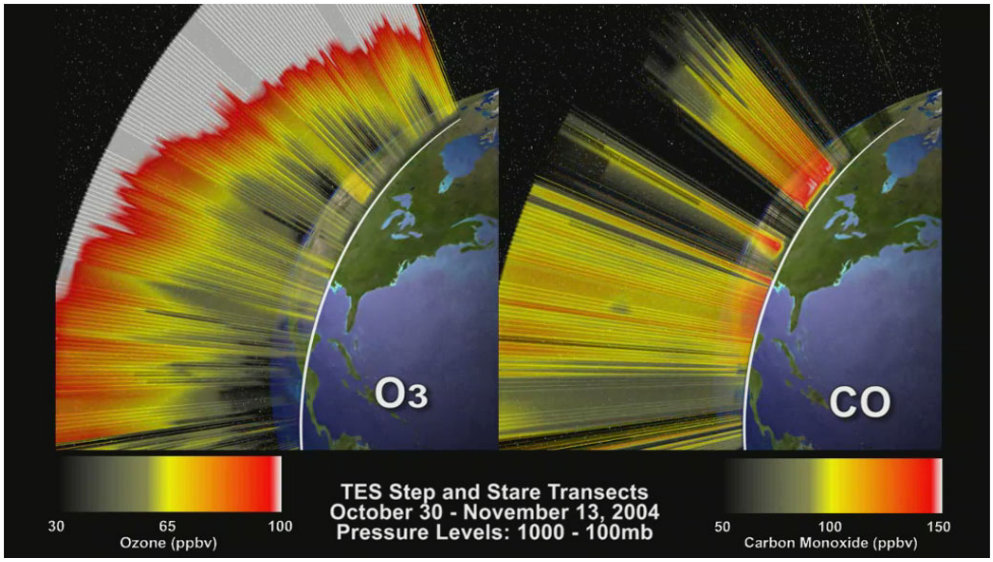
NASA's Space Place

The Chemical Weather Report

"Sunny tomorrow with highs in the mid-70s. There's going to be some carbon monoxide blowing in from forest fires, and all that sunshine is predicted to bring a surge in ground-level ozone by afternoon. Old and young people and anyone with lung conditions are advised to stay indoors between 3 and 5 p.m."

Whoever heard of a weather report like that?

Get used to it. Weather reports of the future are going to tell you a lot more about the atmosphere than just how warm and rainy it is. In the same way that satellite observations of Earth revolutionized basic weather orecasting in the 1970s and 80s, satellite tracking of air pollution is about to revolutionize the forecasting of air quality. Such forecasts could help people plan around high levels of ground-level ozone—a dangerous lung irritant—just as they now plan around bad storms.



Example of visualization of data from the Tropospheric Emission Spectrometer. These frames are from an animation that steps through transects of the atmosphere profiling vertical ozone and carbon monoxide concentrations, combining all tracks of the Aura satellite during a given two week period.

"The phrase that people have used is chemical weather forecasting," says Kevin Bowman of NASA's Jet Propulsion Laboratory. Bowman is a senior member of the technical staff for the Tropospheric Emission Spectrometer, one of four scientific sensors on NASA's Aura satellite.

Aura and other NASA satellites track pollution in the same way that astronomers know the chemical composition of stars and distant planetary atmospheres: using spectrometry. By breaking the light from a planet or star into its spectrum of colors, scientists can read off the atmosphere's gases by looking at the "fingerprint" of wavelengths absorbed or emitted by those chemicals. From Earth orbit, pollution-watching satellites use this trick to measure trace gases such as carbon monoxide, nitrogen oxide, and ozone.

However, as Bowman explains, "Polar sun-synchronous satellites such as Aura are limited at best to two overpasses per day." A recent report by the National Research Council recommends putting a pollution-watching satellite into geosynchronous orbit—a special very high-altitude orbit above the equator in which satellites make only one orbit per day, thus seeming to hover over the same spot on the equator below. There, this new satellite, called GEOCAPE (Geostationary Coastal and Air Pollution Events), would give scientists a continuous eye in the sky, allowing them to predict daily pollution levels just as meteorologists predict storms.

"NASA is beginning to investigate what it would take to build an instrument like this," Bowman says. Such a chemical weather satellite could be in orbit as soon as 2013, according to the NRC report. Weather forecasts might never be the same.

Learn more about the Tropospheric Emission Spectrometer at tes.jpl.nasa.gov.
Kids can learn some elementary smog chemistry while making "Gummy Greenhouse Gases" out of gumdrops at spaceplace.nasa.gov/en/kids/tes/gumdrops.

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(continued from page 5)

The star has been found to be a close binary, that is, two stars orbiting each other. This is the first evidence of any kind for planets orbiting a close binary star. Some astronomers predicted that planets would not form around close binaries, due to the disturbing effects of the second star on the planet formation process. Because dust is dispersed by stellar radiation and other processes, the newly discovered dust ring could be no more than a few hundred thousand years old. Mature planetary systems such as our solar system seem to be stable, that is, the larger bodies no longer collide. So the question arises how this mature system had a collision. The suggestion was made that a passing star destabilized the planets' orbits, but no nearby star has been found.

COROT (exoplanet search spacecraft) has discovered a planet-sized object orbiting its parent star closely, but it is too massive to be a planet. It has the mass to be a brown dwarf, but its size is much too small. It is about the size of Jupiter, but 20 times its mass. Scientists are unsure how to classify it.

Hubble Space Telescope (HST) took an image of a small galaxy that happens to lie in front of a larger galaxy. Dark dust lanes from the front one are silhouetted against the background one. The surprise is that the dust lanes extend far beyond the visible edge of the galaxy. The question that arises is whether dust lanes commonly extend farther than the stars of a galaxy, and astronomers haven't seen this because galaxies in front of galaxies are rare, or whether the extended dust lanes are rare.

HST suffered a failure of its data control system, stopping all operations. There is a second unit on board, but it had never been turned on, and switching to use it is a complex multi-day operation. The decision was quickly made that the Shuttle mission to repair HST needs to replace this failed unit. So the Shuttle mission was postponed from October 14 to probably February 2009.

Least luminous galaxy – A team of astronomers has discovered the least luminous, most dark-matter-filled galaxy known. The galaxy is called Segue 1, and is one of about 2 dozen small galaxies orbiting our Milky Way. It is a billion times fainter than the Milky Way. Only a few hundred stars were found in it. But it is about 1000 times more massive than it appears, due to a large content of dark matter. The astronomers say this discovery provides clues to how galaxies form and evolve, especially small scale. In the past 2 years the number of known dwarf galaxies orbiting the Milky Way has about doubled.

Milky Way rotation – Attempts to measure the rotation of our Milky Way galaxy by measuring the motions and distances of Cepheid variable stars have in the past showed a pattern that cannot be explained by a smooth simple rotation of the galaxy. Because Cepheids' intrinsic brightnesses are related to their periods of varying, their distances can be calculated fairly precisely from their periods and apparent brightnesses. Thus this method should give an accurate picture of the motion of every part of the galaxy that contains a Cepheid. Yet all attempts showed that all Cepheids were falling toward us slightly in addition to a smooth rotation about the galactic center. Debate has ensued as to whether this was a result of a complex type of rotation or of some property of the Cepheids. A new observation of 8 Cepheids by the high-resolution spectrograph on the ESO telescope in Chile showed that motion of certain chemical elements in the atmospheres of the Cepheids was giving slightly wrong readings for the motion of the star itself. If correction for this factor is applied to all known Cepheids in our galaxy, it should eliminate the "falling toward us" effect. This means the Milky Way is smoothly rotating, without the secondary motions that the previous Cepheid surveys were showing.

Galactic magnetic field – Using a radio telescope, a team of astronomers has obtained the first direct measurement of a protogalaxy's magnetic field, which is so distant that it appears as it was 6.5 billion years ago when the (radio) light left there. The principal theory of a galaxy's magnetic field has it arising slowly over the life of the galaxy due to a dynamo effect. But the new measurement shows the magnetic field as 10 times stronger than the Milky Way's. Clearly theory will have to be rethought. Further observations are needed to see if this measurement represented only a small part of the galaxy, where local conditions could amplify the field. Star formation is believed to be stunted by high magnetic fields, so more research is needed to support this expected relationship.

Dark flow – Galaxy clusters are surrounded by hot gas. This hot gas scatters the cosmic microwave background (CMB), and the speed of the galaxy cluster affects that scattering slightly. So a group of astronomers analyzed the CMB, as measured by the WMAP satellite, in the directions of known galaxy clusters to determine the speeds of the clusters. The effect is very small, and has never been observed for any galaxy cluster. But the new analysis averaged the measurements of many clusters and managed to find the very small effect. 700 known galaxy clusters were used, out to distances of 6 billion light-years. The result should reflect the speeds from the expansion of the Universe, with small local motions caused by the gravity of local objects. But the analysis showed another motion, a bulk flow of about 2 million mph toward Centaurus and Vela. The team believes that the only explanation that fits the data is that there is some massive object (such as a supercluster of galaxies) lying further than we can see now, but that during inflation of the Universe, which occurred a tiny fraction of the first second after the Big Bang, the object was close enough to gravitationally pull all the galaxy clusters in that direction. They are calling this effect "dark flow", as if we didn't have enough "dark" names already.

XMM-Newton (orbiting X-ray telescope) – The material falling into black holes heats to millions of degrees from friction, and gas this hot gives off X-rays. The X-rays have often been observed at small (stellar-sized) black holes, but have not been at supermassive black holes that are found at the centers of galaxies, until now. XMM-Newton has observed strong X-ray pulses from a supermassive black hole in a galaxy 500 million light-years away. The frequency of the X-ray pulses seems to be related to the mass of the black hole. Future research is needed to find out why this X-ray behavior is not found commonly with supermassive black holes.

Spitzer (infrared space telescope) – A new star forms from a rotating cloud of gas and dust. Powerful jets of gas emerge from the spin axes. As the cloud shrinks under its own gravity, the star eventually ignites and the remaining dust and gas flatten into a disk,

(continued on page 10)

(continued from page 3)
attempts to put ads or other spam on the calendar, so we're careful to maintain the blocks on unauthorized content there as well as other parts of the website.

Some Joys of the Early Morning

With the days getting shorter, I frequently find that my alarm clock goes off during the week well before dawn, which gives me the chance to enjoy the changing light as the sun climbs closer to the horizon after I resentfully pry my eyes open and roll out of bed (getting up at that hour is not generally a voluntary matter). While walking out to pick up the day's newspaper so I don't roll over it on my way out the driveway, I can enjoy views of stars, planets and other celestial objects from a different perspective than what I've been seeing at Anza – alas, I'm finding it harder these days to stay awake for viewing beyond 1:00 or 2:00 in the morning at the latest, even when viewing conditions are wonderful, and constellations move a lot between then and dawn.

Unfortunately for this early-morning viewing, where I live is often cloudy and foggy for weeks on end. One small benefit of the Santa Ana conditions that caused the recent fire problems was that they also cleared out the clouds and let me enjoy such sights as Orion shining brightly overhead with Canis Major rising behind it, and other naked-eye objects – sadly, even when the sky is clear and incredibly steady, I've no time to bring out a telescope or even binoculars (or I might never make it to work).

On the morning just before the moon was full in October, it was poised above the ocean shortly before dawn, producing an interestingly symmetrical but not exactly linear light trail below it. I couldn't resist getting out the camera, and attempting to capture it, using what I recalled of what I learned from Dennis Mammana in that class he gave in August; if all goes as hoped, this early-morning picture should be somewhere in the vicinity of this column, though the light trail had lost some of the original symmetry by the time I was able to take the picture and the moon itself wound up overexposed.

Although I enjoy a good night's sleep too much to recommend early rising as a matter of course for those that don't need to do it, if you do have to be up that early, I hope you too find that enjoying the beauty of pre-dawn celestial objects hours gets your day going in a good direction – or, if you are ending your day with the dawn, that it gives you a great ending!

Best wishes to all of you, may you all have a wonderful Thanksgiving, and I hope the prospect for all of us is a whole lot better by December than the way things look now, in mid-October!

FOR SALE: brand-new items - 8'F/6 Discovery Optics 1.5" Pyrex Mirror cell; 8"University Optics Alum Mirror Cell; Vega-HP1-1.25"Focuser (Japan Made); Vega-3 Low Profile Helical 2" Focuser; 48 Rini2 Eyepiece in Bolt Case (this item not new but seems to be in good condition. Will sell these items separately for lowest price or as a package for $200 o/b/o. Contact Doug 562-598-6103

(continued from page 8)
from which planets will later form. By the time the star ignites, it stops accumulating material and its jets die out. Spitzer has observed the jets of a young star and found that they are blasting apart water in the cloud into hydrogen and hydroxyl (OH), then are heating the hydroxyl strongly. It appears the water was in the form of ice on the surface of dust grains. Such breaking up of water and heating the products have not been seen before around a young star.

Supernova 1996cr was not noticed in an image until 2001, when it was seen in X-rays by the Chandra spacecraft, and was not identified as a supernova for a few more years. The date it exploded has only been narrowed down to a year-long period spanning most of 1995 and part of 1996, and that was determined from archived visible light images of the area. Data on the supernova have been found from 18 telescopes and further images have been made of the remnant. It has now become clear that it resembled supernova 1987A (the bright one in the Large Magellanic Cloud about 21 years ago), except that it is about 1000 times brighter than 1987A in radio and X-rays. Those two are the only known supernovas that brightened in X-rays over the years following the explosion. The brightening is believed caused by the shock wave from the supernova hitting the boundary of a sphere of space that had earlier been cleared by the stellar wind or possibly an earlier outburst. The difference in X-ray brightness is being attributed to denser surroundings for the newer supernova. It is the only one of the 5 nearest supernovas of the last quarter century that was not immediately seen. It is located in the nearby Circinus Galaxy.

Galaxy collision – A deep new image in hydrogen alpha light of the Virgo cluster of galaxies, taken by a wide-field imager on the 4-meter Mayall Telescope in Arizona, has revealed very long (400,000 light-years) filaments of ionized hydrogen connecting the large elliptical galaxy M86 and the disturbed spiral galaxy NGC 4438. These are interpreted as evidence of a high-speed collision between these 2 galaxies in the past, which was previously unsuspected. Spectroscopy of the filaments shows that the velocity of gas in them varies smoothly from end to end in a manner that would be expected after a collision. There are no obvious stars in the filaments. This would be the nearest recent (in astronomical terms) collision of an elliptical and a spiral. Previous studies had shown disturbed hydrogen gas near each of these galaxies, but none that connected them. Some results had suggested that the disturbances in NGC 4438 were the result of colliding with NGC 4435, yet the latter galaxy appeared undisturbed. Previous X-ray images of M86 have shown a long plume of hot gas, which had been interpreted as a tail being stripped by ram pressure as the galaxy falls toward the center of the galaxy cluster. But the new observations suggest the plume is a result of the collision. It appears that the collision stunted star formation in the larger galaxy, the opposite effect from that which occurs in lower-speed collisions. Apparently higher velocity in a collision heats up the gas in the galaxies, making it too hot to form stars. Many astronomers believe that central black hole activity is the principal cause of shutting down star formation in large galaxies, but now collisions have to be considered as a principal cause.

Large Hadron Collider (LHC) in Switzerland accelerated its first beams of protons on schedule the 2nd week of September. However, the beams had not been collided by the time various troubles appeared. Troubles are to be expected with the world's most complicated machine. First there was a faulty transformer in the electrical system, which was quickly replaced. Then a magnet overheated and liquid helium escaped, requiring shutting down the collider. The large magnets that deflect the protons into a circular path are kept at about 2 degrees above absolute zero to make them superconducting. So any magnet repairs involve slowly warming them back to room temperature before repair, and cooling afterward, and this process takes weeks. It appears that repair will last until the first scheduled yearly maintenance period, so particle collisions will have to wait until spring. Why can't they move the maintenance period? Because the LHC has a contract with the Swiss power company that says they will not turn on the collider during a certain period in winter, a requirement demanded by the power company since they cannot generate enough electricity to heat the homes of Switzerland and run the collider at the same time.

Chinese spacewalk – China launched its 3rd manned space mission, again on a Long March rocket, and this one included the first spacewalk by that country. The spacewalk was brief, just retrieving an exterior package and waving their flag. One taikonaut (as Chinese astronauts are often called) emerged from the spacecraft while the other spacewalker remained mostly within the airlock. One used a Russian spacesuit and the other a Chinese spacesuit, which appeared to be a near copy.

Soyuz – Russian troubleshooters have concluded that electrical arcing between the International Space Station (ISS) and space likely caused the problems with 2 recent Soyuz vehicles, in which the discarded sections failed to separate from segment containing astronauts returning to Earth from ISS. This caused a rough ride that landed far from target. Future Soyuz vehicles (including the one launched October 12 to exchange the ISS crew) will have changes to reduce sensitivity to arcing. The separation mechanism that failed has been removed from the Soyuz that was already at ISS.

Instant AstroSpace Updates

Swift (orbiting gamma-ray burst telescope) has found the most **distant gamma-ray burst** ever detected, so far that it took its light 12.8 billion years to reach us. Its redshift was measured at 6.7, meaning its spectral lines are stretched to 7.7 times their normal wavelength by the expansion of the Universe.

There are 2 theories of how 2nd generation stars form: stellar wind (flow of particles) from the 1st generation stars compresses surrounding gas clouds to trigger star formation, or light from 1st generation stars, particularly those that have exploded as supernova, does the same. New observations that combine infrared, visible and X-ray light of a star-forming region called NGC 346 shows that both mechanisms are **triggering star formation** within that region.

The **Stardust** (comet particle sample mission) return capsule was donated to the Smithsonian Air and Space Museum (after the comet samples were removed, of course). The main body of the Stardust spacecraft is still in space, and is en route to its 2nd mission, to flyby Comet Tempel 1 in February 2011. ■

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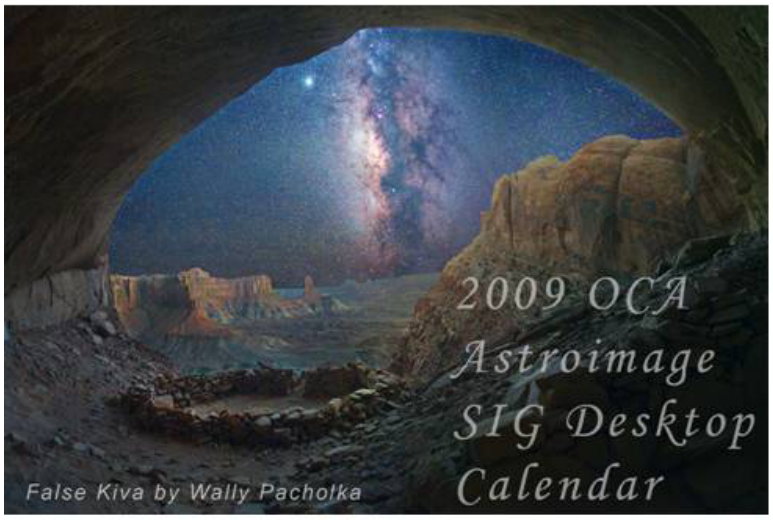

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This image of M42 (the Orion Nebula) was created by compositing images taken in 2002 (luminance) and 2003 (color) from our Anza site using his Takahashi FSQ106. The images were combined using Registrar.

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