SIRIUS ASTRONOMER

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The Newsletter of the Orange County Astronomers

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UPDATE: SEPTEMBER MEETING MOVED TO SEPTEMBER 16TH!

Rob Roberson captured this image of NGC 891 from our Anza site on August 7 of this year. Located 30 million light-years from Earth in the constellation Andromeda, it's known as the 'Outer Limits Galaxy' because of its use in the closing credits of the classic 1963-1965 television science fiction series 'The Outer Limits'.

OCA CLUB MEETING

The free and open club meeting will be held September 16th at 7:30 PM in the Irvine Lecture Hall of the Hashinger Science Center at Chapman University in Orange. This month, our featured speaker is Dr. Hugh Ross presenting 'A Testable Cosmic Creation Model'.

NEXT MEETINGS: October 7th, November 11th

STAR PARTIES

The Black Star Canyon site will be open on October 1st. The Anza site will be open on September 24th. 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, September 2nd at the Heritage Museum of Orange County (formerly the Centennial Heritage Museum) at 3101 West Harvard Street in Santa Ana. Next month the class will be offered on October 14th.
GOTO SIG: TBA
Astro-Imagers SIG: Sept. 20th, Oct. 18th
Remote Telescopes: TBA
Astrophysics SIG: Sept. 9th, Oct. 21st
Dark Sky Group: TBA

Around OCA for September 2011

By Barbara Toy, OCA Observatory Custodian and Member Liaison

In case you haven't heard about it yet, the club's general meeting dates for September and October have been changed. The September meeting will be a week later the usual, on September 16, and the October meeting will be a week earlier than usual, on October 7. This is because Chapman University needs the lecture hall where we meet for their own events – as Bob Buchheim said at the August meeting, we don't know what you'll find if you show up on our usual nights those two months, but we'll be interested in your report about it as we don't plan to be there ourselves.

Because of the shift in the September meeting, the Astrophysics meeting will be moved to the second Friday of the month, September 9. In October, the Beginners Class will be moved to the second Friday of the month instead of the first Friday, and will therefore be on October 14. These changes are all shown on our website calendar, so please check there to confirm what is happening when.

As many of you are probably aware, we have access to the Irvine Auditorium at Chapman University thanks the generosity of the University and to the sponsorship of John Yules, a physics professor at Chapman University. We really appreciate the fact that they let us use not just the auditorium but also the sound system and projection system for our meetings, all without charge to us as our meetings are considered educational activities, given the nature of the presentations and the fact that our meetings are open to the public. It seems that a lot of our speakers would be of interest to Chapman students, but I don't know how many of them take advantage of the fact these are taking place in their own backyard.

Back Story On A Supernova

If you've been reading Helen Mahoney's series on objects that every amateur astronomer should observe at some point in his or her career, you may recall her August article on supernovas. For any of you who have not been reading her column, I strongly urge you to go back through your recent issues of the Sirius Astronomer and check them out – besides being informative, they're fun reading. Her column on supernovas was certainly timely for those of us who have been able to observe the most recent supernova found in M51 – a transient object that demonstrated that even objects millions of light-years away can change visibly in the eyepiece over a period of days or weeks. Seeing how bright it was in the eyepiece and knowing where it actually was located brought home a sense of how much energy it was churning out to make it as bright as foreground stars that are in our own galaxy, even though it was so much further away.

One of the things that Helen talked about her column was the discovery of Supernova SN 1994i, also in M51, using the Kuhn telescope. This has been jointly credited to Wayne Johnson, a past president of the club and a gentleman who used the Kuhn a lot for supernova searches in the years before he moved to Tucson, and to Helen's husband, Doug Millar. It turns out there was more to the story of this discovery than Helen covered in her brief account.

Jim Leonard is a long-time club member, who used to have a pad at Anza and was a regular out there. He's since retired and moved to Inyokern, though he keeps in touch and still has an interest in club affairs. One of the pleasures of my positions in the club over the time I've been a member has been the chance to get to know members like Jim who can no longer actively participate in club activities but who periodically fill me in on bits of club history and are interesting people to know.

After he read the account of the discovery of SN1994i in Helen's August article, Jim sent me an account of his involvement with the discovery, which I'm excerpting below (with some minor edits):

> I had just acquired my CCD camera and that afternoon of April 1, 1994, I loaded my 10-inch LX200 and headed for Anza for the weekend and to try out my new Starlight Xpress camera. When I arrived at Anza, Wayne [Johnson] told me the observatory camera had died and was not available for operation. I was torn between setting up [the camera] myself or letting Wayne use it and in hopes of learning how to operate it from a more seasoned camera operator then myself, I decided to let Wayne use it and keep tabs and maybe learn something.

Without Jim's generosity, there would have been no camera in the observatory that night that could have captured the images of M51 that led to the discovery and documented it. Since it was new and Jim hadn't had a chance to use it yet, that means that its "first light" image with Jim was a new supernova – a truly cool way to inaugurate a camera! Of course, one has to wonder if Jim himself might not have been the person to capture the first image of SN1994i from his pad through his own telescope if he hadn't loaned the camera to Wayne….

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TOP TWENTY THINGS AN ASTRONOMER SHOULD SEE

1 A Total Solar Eclipse—Part 1

By Helen Mahoney

They call it a divine coincidence. The diameter of the sun is 400 times larger than that of the moon, but the moon is 400 times closer to the earth. Thus, the apparent diameter in the sky of those two celestial bodies is the same. That means that when the moon moves directly in front of the sun, the bright photosphere of the sun is eclipsed, allowing the beautiful gossamer detail of the corona to be visible to the naked eye.

It wasn't always this way. The moon used to be closer to the earth, so it would have blocked the sun without allowing the full corona to be seen. And the moon is continuing to move away from the earth, so there will be a time in the future when there will no longer be total eclipses, but only annular (a "central" eclipse where the moon's diameter is smaller than the sun, leaving a ring of sun in the sky). The moon right now is at the perfect distance for a total eclipse, just as mankind has reached a time in its development to appreciate it.

The moon always casts a shadow, but usually it goes out into space. The five degree tilt of the moon's orbit prevents us from having an eclipse every new moon. But about twice a year, the sun, moon and earth align, and the shadow of the moon hits the earth. Sometimes only part of the shadow, the "penumbra", hits the earth (creating a partial eclipse). When the inner "umbra" hits the earth, the area in shadow, called the path of totality, covers an oval on the earth approximately 100 miles wide, and moves across the earth as the moon passes in front of the sun.

I like being in the umbra. It is one of the most profoundly moving things I have ever experienced. No photograph, video, or written recount comes close to the way it feels to see the sun disappear and day suddenly become night. The ancient people must have been terrified of eclipses. Eclipses have been mentioned in historical writings from ancient Egypt 4500 years ago, and from China and Babylonia 4000 years ago. Myths from them and Norse and Inca civilizations describe dragons, wolfs, or pumas devouring the sun. In many cultures, banging drums or pots, firing cannon, or making other loud noises were a way to scare away the beasts. As a modern, scientifically educated person, I know what is happening and in fact have placed myself in the precise place at the precise time to see the eclipse—and yet it evokes a primal sense of fear that races through my body.

Many people who experience one total eclipse become addicted to the umbra and need to see another and another. I have experienced eight total solar eclipses (and two annular). I even infected my husband Doug with eclipse fever, and he and I use eclipses to plan vacations. They take us to places that we otherwise may not have considered visiting.

Fittingly, on the eclipse trip to Bolivia in 1994, I visited the Isla del Sol, where the Inca Sun god was born. In Turkey in 1999, the eclipse fell on August 11. The night after the eclipse we watched the Perseid meteor shower from an ancient Hittite temple of the Sun. On that trip we also visited Mellitus, the birthplace of the Greek philosopher Thales, who was possibly the first person to predict a solar eclipse in 585 BCE. We find the trips to have multiple layers: there is the eclipse itself, the often exotic location, and the camaraderie of the fascinating people who accompany us.

Next month I will do my best to tell you what it is like to experience a total solar eclipse. Perhaps you will feel inspired to join the ranks of those of us who have stood in the shadow of the moon.

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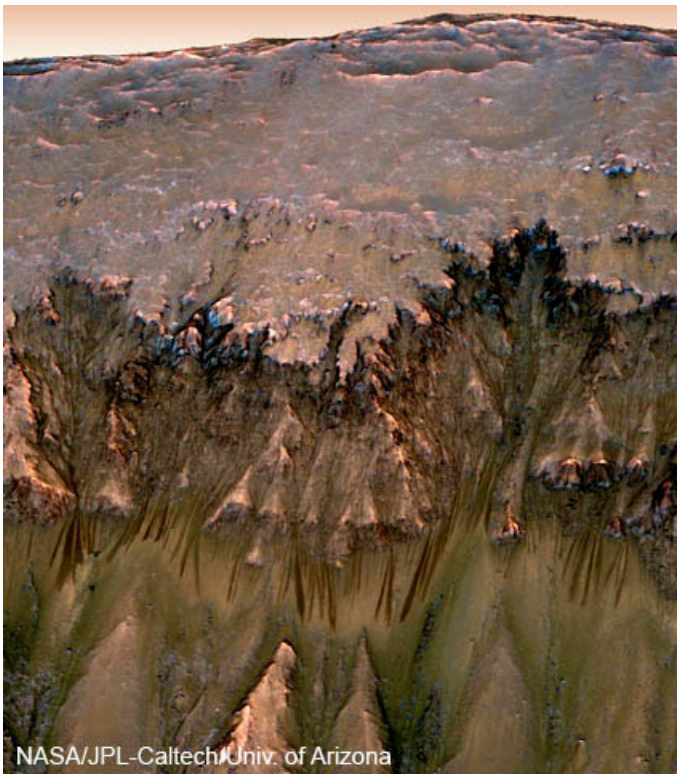
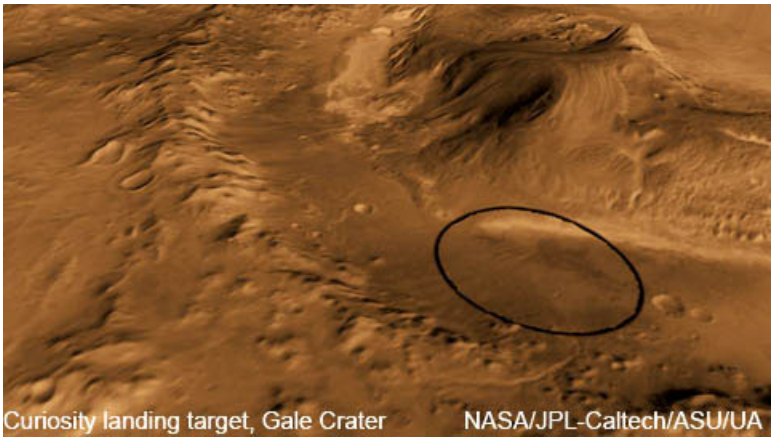
AstroSpace Update

September 2011
Gathered by Don Lynn from NASA and other sources



Martian water – Observations from the Mars Reconnaissance Orbiter have revealed possible flowing salty water during the warmest months on Mars. Dark finger-like features appear and extend down some Martian slopes during late spring through summer, fade in winter, and return during the next spring. Repeated observations have tracked the seasonal changes in these recurring features on several steep slopes in the middle latitudes of Mars' southern hemisphere. The best explanation so far is the flow of briny water. Saltiness lowers the freezing temperature of water. The sites get warm enough to sustain liquid water that is at least as salty as Earth's oceans, though pure water would freeze at the observed temperatures. The features seen are ½ to 5 yards (meters) wide, with lengths up to hundreds of yards (meters). The width is much narrower than previously reported gullies on Martian slopes, and they occur on opposite slopes from the gullies (equator-facing rather than pole-facing), so it's likely a different phenomenon. Attempts to directly detect what the dark material is have not been successful. The settings are too warm for carbon dioxide frost and, at some sites, are too cold for pure (non-salty) water. Salt deposits over much of Mars indicates that brines were abundant in Mars' past, but these new observations suggest liquid brines still form near the surface today in some places. Some aspects of the observations still puzzle researchers. The flows are not dark because of being wet, but are dark for some other (unknown) reason. Perhaps the flows rearrange grains or change surface roughness. How the darkness disappears during winter is completely unknown. Scientists hope that further investigation will solve these mysteries. These results are the best evidence yet for liquid water on the planet's surface today. Frozen water has been detected near the surface in many middle to high-latitude regions. The changing gullies may be aided by liquid water, but other theories exist. Purported droplets of brine appeared on struts of the Phoenix Mars Lander. But the new observations are considered stronger evidence.

Curiosity (next Mars rover) – The landing site for Curiosity has been chosen at the foot of a layered mountain inside Gale Crater. The crater is named for Australian astronomer Walter Gale. It is 96 miles (154 km) across and holds a mountain rising about 3 miles (5 km). Curiosity will land next August. During a prime mission lasting 1 Martian year, researchers will use the rover's tools to study whether the landing region had favorable environmental conditions for supporting microbial life. The portion of the crater where Curiosity will land has an alluvial fan likely formed by water-carried sediments. The layers at the base of the mountain contain clays and sulfates, both known to form in water.



Opportunity (Mars rover) – After a journey of almost 3 years, Opportunity has reached Spirit Point on the rim of the planet's Endeavour Crater. The rover drove about 13 miles (21 km) since climbing out of Victoria Crater. Endeavour, at 14 miles across (22 km), is about 25 times wider than Victoria is. At Endeavour, scientists expect to see much older rocks than those examined by Opportunity during its first 7 years on Mars. The Mars Reconnaissance Orbiter has detected clay minerals at Endeavour that may have formed in an early warmer and wetter period.

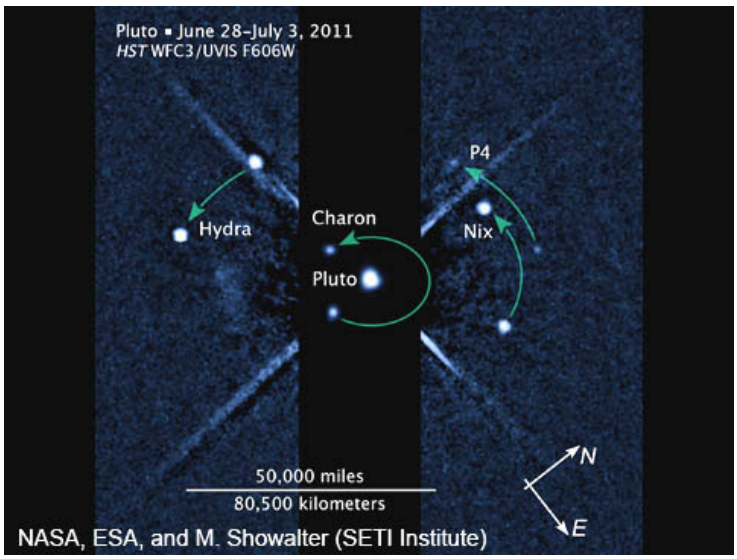
Herschel (infrared space telescope) has tracked water from the geysers of Saturn's moon Enceladus as it forms a ring about the planet, then falls into Saturn's atmosphere. This solves the mystery of where excess water came from that was found in Saturn's upper atmosphere in 1997. Only about 3-5% of the water expelled by Enceladus ends up at Saturn, but this is enough.

Earth Trojan – Jupiter has long been known to have Trojan asteroids, ones that share the planet's orbit, but stay about 60° ahead or behind the planet. These are at the stable Lagrange points, where the Sun's and Jupiter's gravity balance. They are called Trojans because they happened to be named after heroes of the ancient Trojan War. More recently Trojans have been found in

Neptune's and Mars's orbits. Now Earth joined the club. Earth Trojans have long been thought to exist, but have not been found because they are too small and appear too close to daylight. But one was found in a search of data from the WISE all-sky infrared survey, and confirmed with Earth-based observations. It has been designated asteroid 2010 TK7. It is estimated to be 1000 ft (300 m) across. Its orbit is tilted considerably, so that it moves above and below the plane of Earth's orbit. Because of this, it would not make a good candidate for a space mission, since reaching a tilted orbit takes a huge amount of energy. Another candidate to be an Earth Trojan, also found in the WISE data, is being pursued. WISE observed 155,000 asteroids, more than 500 of them with near-Earth orbits.

2 Moons – The current best explanation for the formation of our Moon is that a Mars-sized body struck the Earth about 4 billion years ago, and the debris coalesced into our Moon. A new theory is that it coalesced into 2 moons, a large and a small one. Eventually the small one collided with the large, at relatively slow speed, which would cause it to spread around one side rather than causing a crater. This would explain the mysteries of why the far side of the Moon appears much different from the near side, has different surface chemistry, and has a much thicker crust. Simulations of this show it is consistent with dynamical stability of such systems, the timing of the cooling of the Moon and the ages of lunar rocks. The smaller moon was probably initially in the Lagrange point of the larger moon, but became destabilized as their orbit expanded from tidal effects. This 2 Moons theory will take much more data from lunar orbiters and sample returns in order to substantiate it.

4 moons – Astronomers using the Hubble Space Telescope discovered a 4th moon orbiting the dwarf planet Pluto. The tiny satellite, temporarily designated P4, was uncovered in a Hubble survey searching for rings around the former planet. P4 is the smallest known moon around Pluto. Its estimated diameter is 8-21 miles (13-34 km). Charon, Pluto's largest moon, is about 700 miles (1200 km) across, and sizes of the other moons, Nix and Hydra, are not well known, but probably in the range of 20-100 miles (30-160 km). P4 is located between the orbits of Nix and Hydra, which Hubble discovered in 2005. Pluto's entire moon system is believed to have formed by a collision between the dwarf planet and another planet-sized body early in the history of the solar system. The smashup flung material that coalesced into the family of satellites. Scientists believe material blasted off Pluto's moons by micrometeoroid impacts may form rings around the dwarf planet, but the Hubble images have not detected any so far.



No Nemesis – A new study of the ages of known impact craters on Earth shows that there is no periodicity in the timing of impacts. Some previous studies have implied that the Earth gets periodically bombarded. This gave rise to the Nemesis theory (undiscovered companion to the Sun disrupts comets or asteroids every time it orbits by) and the theory that bobbing above and below the galaxy's plane disrupts same. The new study says the periodic bombardment didn't happen, so forget the Nemesis or the bobbing theories. The new study showed a slight general increase in impact rate over the last ¼ billion years. This could be the result of older craters being harder to find (more eroded), but there is some supporting evidence in lunar crater counts to support this slight increase. The new study used a different method of analyzing probabilities (Bayesian statistics) than has been used in previous work.

Darkest exoplanet – Astronomers have discovered the darkest known exoplanet, a Jupiter-sized gas giant known as TrES-2b. Their measurements show that it reflects less than 1% of the starlight falling on it, making it blacker than coal or any planet or moon in our solar system. TrES-2b orbits its star very closely (only 3 million miles, or about 5 million km), so the star's intense light heats the planet to about 1800° F. (1000° C.), much too hot for ammonia clouds that reflect light well on cooler gas giants. Instead its atmosphere contains light-absorbing materials such as vaporized sodium and potassium or titanium oxide. Yet none of these chemicals fully explain the extreme blackness of the planet. The amount of starlight reflected was measured using data from the Kepler planet-finding spacecraft. They detected subtle dimming and brightening due to the planet's changing phase (full to new).

DNA components in space – Researchers have found more evidence that meteorites can carry DNA building blocks created in space. Scientists have detected DNA components in meteorites since the 1960s, but it was questioned whether they were created in space or resulted from contamination by terrestrial life. Amino acids have been found in various carbon-rich meteorites and in comet samples from the Stardust mission. Amino acids are the workhorse molecules of life. In the new work, scientists analyzed samples of 12 meteorites. The team found adenine and guanine, which are components of DNA. Also, in 2 of the meteorites, the team discovered for the 1st time trace amounts of 3 molecules related to these, but which are almost never used by living things. This is evidence that the compounds in the meteorites came from space, not terrestrial contamination. The team also analyzed a sample of ice from Antarctica, near where many of the meteorites were found, and a soil sample collected near another meteorite's fall. The samples had none of the related molecules not used by life, but that were found in the meteorites.

Oxygen in space – The Herschel infrared space telescope has provided the 1st confirmed finding of oxygen molecules in space, in the Orion Nebula. Finding atoms of oxygen is common, but not molecules. The discoverers propose that oxygen is locked up in

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water ice that coats tiny dust grains. But in the area studied, starlight warmed the icy grains, released the water, which then chemically altered to produce oxygen molecules. The amounts found were not large. It is still not understood what is different about the spots where the oxygen molecules were found. To shed light on this, other star forming regions will be searched for oxygen molecules.

Water in space – 2 teams of astronomers have discovered the largest and farthest reservoir of water ever detected in the Universe. It surrounds a huge, feeding black hole (quasar) more than 12 billion light-years away. The water amounts to 140 trillion times that found in Earth's oceans. In this quasar, the water vapor is distributed around the black hole in a region spanning hundreds of light-years. Its presence indicates that the quasar is bathing the gas in X-rays and infrared radiation, and that the gas is unusually warm (minus 63° F, -53°C) and dense (300 trillion times thinner than Earth's atmosphere) by astronomical standards. One team found the water using the Submillimeter radiotelescope in Hawaii, and the other used an interferometer in the French Alps.

Open clusters discovered – Using data from the 4-meter VISTA infrared survey telescope in Chile, a team of astronomers has discovered 96 new open star clusters hidden by the dust in the Milky Way. These tiny and faint objects were invisible to previous surveys, but were seen in infrared, which penetrates dust. By using computer software, the team was able to remove the foreground stars appearing in front of each cluster in order to count the genuine cluster members. Most of the newly found clusters are very small, having about 10-20 stars. These are faint and small compared to typical open clusters. This is probably due to small clusters being more easily hidden by dust. The new clusters may be only the tip of the iceberg. Further work is expected to uncover many more.

Chandra (orbiting X-ray telescope) has measured the Bondi radius of a black hole for the 1st time. This was defined by the cosmologist Hermann Bondi to be the distance from a black hole (or other mass) at which gravity overcomes gas pressure, so material inside this falls in. The measurement was made of the supermassive black hole at the center of galaxy NGC 3115, located about 32 million light-years away. The Bondi radius was found about 700 light-years from the black hole. This allows the mass of the black hole to be calculated at about 2 billion Sun masses, agreeing with other previous methods of measuring the mass. This confirms that this is the nearest billion plus mass black hole. The new measurements showed that about .02 solar mass of material per year is falling in at the Bondi radius. This number was then used to calculate how bright the X-rays should be from all the material falling into the black hole, and the result was about a million times brighter than actually seen. So either most the material that starts falling does not make it all the way into the black hole, or something about the conditions there is suppressing X-ray production. Further work is needed to understand this.

Galaxy richest in dark matter – Astronomers using the Keck II telescope in Hawaii have confirmed that the dwarf galaxy Segue 1 is the richest in dark matter of any galaxy measured. The total matter of the galaxy was calculated from the measured distribution of star velocities. Then the visible matter was subtracted to yield the mass of dark matter. Previous methods of estimating mass had implied this galaxy was rich in dark matter, so these new observations were made to confirm this. The measurements also showed that the stars of this galaxy are unusually low in heavy elements. Detailed iron spectra were taken of 7 stars, and 3 of those were found to be exceptionally low in iron (2500 times less than in our Sun), making them some of the most primitive stars known. Only 30 stars in the Milky Way are known that are this low. Segue 1 contains only about 1000 stars.

Stealing stars – Astronomers have found that hundreds of the stars found in the Large Magellanic Cloud (LMC) were stolen from another nearby galaxy, the Small Magellanic Cloud. By analyzing the spectra of 5900 giant and supergiant stars in the LMC, astronomers found that over 5% of the stars observed are rotating counter to the direction of the majority of LMC stars, or at least greatly included to the general rotation. These peculiar orbits indicate that these stars probably did not form from the rotating and collapsing cloud of gas that formed the LMC. Further examination of these counter-rotating stars revealed another anomaly. The chemical composition of these stars is different. They have fewer heavy elements than typical stars in the LMC, but their composition closely matches that of stars in the SMC. These 2 lines of evidence indicated to the researchers that these stars were stolen from the smaller galaxy by the gravitational pull of the larger galaxy. This result might also help explain the unusually large amount of star formation in the LMC nebula called the Tarantula. This area is on the southwestern rim of the LMC and is a current hotbed of star formation. If the Tarantula Nebula were placed in our own galaxy where the Orion Nebula is, it would have the area of 60 full moons

and its glow would cast shadows. The Tarantula is located at the position where gas from the SMC that is being pulled into the LMC, along with the captured stars, collides with the LMC's own gas at high velocity. The resultant shock wave from this collision of gas pressurizes and concentrates the gas, making star formation much more likely.

More Voorwerps – Hanny van Arkel, a school teacher in Netherlands who volunteers to classify galaxies for the Galaxy Zoo project, found in 2007 a glowing cloud of gas near, but not in, the galaxy IC 2497. The cloud was termed the Voorwerp (Dutch for object). There was nothing else known in the Universe like it. So of course a new project was started to find more objects like it. Intensive study of the Voorwerp with many telescopes using many wavelengths of light showed that likely the cloud was glowing because radiation from the active galactic nucleus was exciting the gas, which had been thrown out of the galaxy earlier by a close encounter with another galaxy. One problem was that IC 2497's nucleus is not now very active. So the search for more Voorwerps started with 18,000 active galaxies known in a sky survey, assigned about 200 Galaxy Zoo volunteers to search for nearby glowing gas, and found 154 possible candidates. Spectra were taken of 49 of the best candidates, and 19 were found to match the characteristics of the Voorwerp. About half of the 19 were found to be more ionized than the current level of radiation from the active nucleus could produce. This confirms the conjecture that Hanny's Voorwerp was telling us that active galactic nuclei can shut down suddenly (say, in 100,000 years or less), while the Voorwerp was still glowing. Most of the new Voorwerps were found by galaxies which are interacting or merging, supporting the explanation that an interaction is necessary to throw a huge gas cloud out of the galaxy, where it will become a Voorwerp if the galactic nucleus happens to become active and spray it with radiation. About half the new Voorwerp galaxies have a double Voorwerp, one on each side of the galaxy. Active galaxies were known to spray radiation both up and down from their disks, so if there are gas clouds on both sides you get a double Voorwerp. Hubble space telescope and X-ray observations are planned on the new Voorwerps.

Planet formation – A team of astronomers measured the distribution of elements in a triple star, 16 Cygni, one of which has planets. All 3 stars formed at the same time and place, and 2 of them are even similar mass, so it was expected that they would have similar composition. However the star with planets has lower amounts of heavy elements than the other 2. It appears that the formation of planets somehow steals heavy elements from the star. This fits with measurements of the distribution of elements in our Sun, which found it has less of some heavy elements than other similar stars. Further work will be needed to see if this depletion is typical, or just a fluke in the few stars studied this way.

ALMA (radiotelescope array) – The 1st European antenna has been delivered to the ALMA observatory site, high (16,400 ft or 5000 m) in the Andes of Chile. ALMA is a joint project in which the United States, Europe and Japan provide antennas, and a few other countries also participate. This antenna happened to be number 16 of the planned 66 antennas, and 16 antennas is enough to begin observations, although at lower capability than the final configuration. Science observations will begin in a few months. Construction is scheduled to be complete in 2013. Antennas are hauled up the mountains on a 28-wheel 130-ton crawler vehicle. The driver has an oxygen mask due to the altitude. The extremely high and dry location allows better penetration of millimeter and submillimeter radio waves from space.


ESO/S. Rossi

Spektr R (Russian space radiotelescope) was launched July 18 into a long elliptical orbit reaching out to about the Moon's orbit. The 10-meter (33-foot) dish antenna was deployed successfully after some latching problems were solved. It will be arrayed with radiotelescopes on Earth to create the highest resolution telescope ever, several thousand times better than the Hubble Space Telescope achieves with visible light. Before Spektr R, radiotelescope arrays were limited to the size of Earth. The larger the separation of the telescopes, the greater the resolution. Major contributions and participation in use of Spektr R are from the United States, China, European Space Agency, and 9 other countries.


Kim Shiflett/NASA

Atlantis (Space Shuttle) glided home for the final time, ending a 13-day journey, and bringing the Shuttle Program to an end after 135 flights. It was the 25th night landing. Since STS-1 was launched in April 1981, 355 persons from 16 countries flew 852 times aboard the shuttles. Shuttles deployed 180 payloads, including satellites, returned 52 from space, and retrieved, repaired and redeployed 7 spacecraft.

Falcon 9 (new rocket) – NASA has agreed technically (formal approval expected soon) to allow the SpaceX company to combine 2 demonstration flights to the International Space Station (ISS). The 1st flight was to demonstrate capability of the Falcon 9 rocket to accurately navigate and approach ISS, and the 2nd to dock and deliver cargo held in the Dragon space capsule. The combined

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At any rate, the discovery of this supernova was a team effort in the best tradition of the club, and it's unfortunate that, after the initial flurry of publicity, Jim's contribution has generally been left out of the accounts of the discovery, even when the make of his camera was remembered.

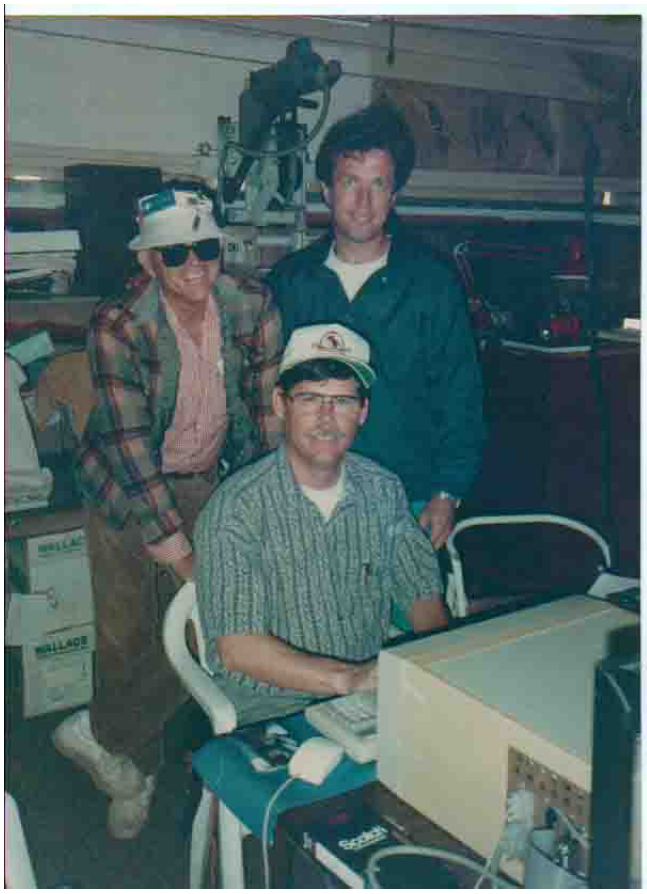
Wayne Johnson also sent me his recollection of how the discovery was made that eventful April 1st night:

> It was Doug who mentioned that we should try for M51 even though it was very low rising in the northeast. I had my doubts about imaging something that close to the horizon, but we were using the 4-inch guide scope with Jim's camera mounted on back of it and the small scope would be more forgiving about where in the sky it could image successfully.
>
> I noticed that there was something different about M51 in the eyepiece of the 22-inch; I had never seen M51 looking like it had a double nucleus before. So the discovery was made visually through the 22-inch since the intruder was easily bright enough (~magnitude 13) to be seen. The supernova suspect was verified when we imaged it with Jim's camera noticing that there was indeed something new near the nucleus. I did not let on to Doug that I thought I had detected something new, but he realized something was going on when I said that there's something strange in M51. He could only guess what I was talking about, but was eager to get some images, which is what we did with Jim's camera. It was only after M51's image was on the monitor that I pointed out the SN suspect to him since there are several local stars superimposed on the face of the galaxy.
>
> It is to my regret that since I included Doug's name (because he suggested M51 in the first place) that I should have also included Jim's name [in the discovery team] because we used his camera…. This must have been a bad luck SN since there was a rift between the two members of the other discovery team. The one guy thought his name should have gone first because his scope and camera were used, however, the other guy was the more seasoned observer. By the way, we were supposed to have discovered the SN thirty minutes after those guys, as it turned out our discovery was actually 30 minutes before them and we should have taken precedent. I have never mentioned this before and it really doesn't matter, but it is their names that are cited, while Doug (and Jim) and I are the dreaded "et al."

Wayne, by the way, hasn't lost his interest in hunting for supernovas, though it is a lot of time-consuming work. Most of his SN-hunting these days is from his own observatory in his backyard in Tucson, one of the few urban areas that is working to keep its skies as dark as possible. Jim is also able to observe and image from his own observatory on his property in Inyokern, which he tells me is also nice and dark. It's good to know they're both continuing with their astronomical interests!

It should be mentioned that Doug Millar also remains actively involved in astronomy, and is our resident expert in radio astronomy, as a participant. It has been very interesting to see what a talented amateur can accomplish in that area, which most of us regard as pretty much the sole domain of professional astronomers. Doug has been showing us what knowledge and persistence can do to open that world to at least some amateurs, and it's always a pleasure to hear about his further adventures in that area.

The story of the discovery of SN1994i demonstrates how teamwork within the club can let us all do more than we could on our own, and being around other members who can help out with advice, equipment and other assistance is one of the real benefits of club membership. The story also highlights the importance of giving proper credit when you have a success that is based in part on contributions of others – it doesn't diminish your achievement to acknowledge what others did to make that achievement possible



The team that discovered SN1994i on 4/1/94, in the observatory where the discovery was made. Clockwise from left: Jim Leonard, Wayne Johnson, Doug Millar (seated).

(it actually causes people to admire you more), and giving proper acknowledgment makes it much more likely people will continue to help you out when you need it.

Challenges with the Kuhn

The Kuhn telescope is one of the club's major assets, and it's also a complex piece of equipment that presents periodic challenges in keeping it operational. Since Dave Radosevich did the major renovation to the scope that included upgrading the control system several years ago, it has generally been a pleasure to use and has not given us many problems with the mechanics or electronics – a lot of the problems we've had over the years have turned out to be from operator error (I admit to my share of those "learning experiences"); fortunately we've always been able to retrieve the situation, though sometimes it's taken the expertise of people like Pat Knoll to get things working right.

One of the rare hardware problems with the Kuhn showed up in early August, when, to our good fortune, Pat himself had the observatory for the night. He had cleaned the mirror and fine-tuned the collimation, and was expecting a nice evening of putting the scope through its paces and enjoying great views. Instead, the scope ran away in dec when he powered it up and tried to move it, and he couldn't get it to respond to the controls. He was the ideal person to do some diagnostics on the problem, and also to get the scope back to its "park" position so the roof could be closed, but he wasn't able to resolve the problem until he came back the following week with Trey McGriff and a full array of tools and traced the problem to damage from a rat that had been dining on one of the computer cables. Rats, unfortunately, are a fact of life out there, and so far we haven't been very successful in keeping them out of the observatory.

After repairing the cable and doing a lot of cleanup in the area, along with taking prophylactic measures to protect the cables from further rodent attacks, the Kuhn was back in operation. However, in the meantime a problem developed with the mirror, which was sliding around between the pads that hold it. As I write this, another trip is planned out to Anza to re-center the mirror in its cell and adjust the pads that hold it so they all give equal pressure all the way around the mirror – it seems that a lot of the pads have loosened with time. If all goes as planned, the scope should be back in operation for the August star party, and we are hoping that re-centering the mirror will allow us to get better alignment of the optics than we've had in the recent past.

As the current Observatory Custodian, I'm responsible for the Kuhn, but I'm afraid my store of knowledge doesn't include much that's helpful in making these repairs. I've been very lucky that Pat Knoll and his trusty allies, most notably Trey McGriff, Wayne Peters and Joe Busch, have all been willing to help out with the Kuhn, both to keep it in repair and to improve it. They (and Dave Radosevich before them) have been doing their best to educate me on what's needed and how to do it, but I fear it's a slow process…

Here's hoping for dark, clear and steady skies so we can really enjoy our optics!

Magazine Subscriptions

Subscriptions to the Astronomy magazines are now due for renewal, if you subscribed for one year or would like to subscribe at the club rate. You may also extend an existing subscription that does not end in December for one year at the club rate. Bring your check made out to the OCA to the meeting or mail it to: Charlie Oostdyk, Orange County Astronomers, PO Box 1762, Costa Mesa, CA 92628. *Checks made out to the magazine publishers cannot be processed and will be returned to you.* If you already subscribe, please provide the mailing label or the billing invoice with your check. One-year rates are as follows:

	Club Rate	Regular Rate
Sky & Telescope*	**$33.00**	**$37.95**
ASTRONOMY	**$34.00**	**$42.95**

***Sky & Telescope subscribers please note: Due to a change by the publisher, renewals of current subscriptions should now be made directly through Sky and Telescope! New subscriptions at the club rate must still be made through Orange County Astronomers and then renewed through the publisher.**

The DEADLINE for subscribing at the club rates will be the October monthly meeting, October 7th. The publishers will send expiration notices to all current club subscribers about November 1st even if you renew through the club. It takes the publishers a few weeks to process renewals.

CUREA-2011: Two Weeks at Mt. Wilson Observatory

by Bob Buchheim

Many of you heard John Hoot's "call for volunteers" to assist with the Consortium for Undergraduate Research and Education in Astronomy (CUREA) at Mt. Wilson Observatory. Greg Pyros and I answered the call and were selected to participate as teachers, mentors and telescope operators for the 7 undergraduate college students who attended this year's session. Greg took on the challenge of assisting the students with solar observations and projects on the venerable "Snow" 60-foot focal-length solar telescope. I handled the variable-star photometry projects. Members and friends of OCA had quite a presence on the Mountain during this time. In addition to Greg and I, John Hoot provided the 8-inch telescope and CCD setup that was used for photometry projects, Mike Simmons (who makes all the arrangements on and off the mountain for CUREA each year) was on site operating the Snow solar telescope and providing guidance to the students on solar projects and on statistical and data analysis topics. Tom Meneghini operated the 60-inch for CUREA, and also operated the 16-inch and did some crucial repairs on it. Solar physicist Dr. Jim LoPresto, who normally attends CUREA to provide crucial scientific support to solar observations and theory, could not attend in person but did have a "telepresence" giving lectures and providing consultation with the students via internet videoconference. The CUREA Director is Dr. Paula Turner, Professor of Physics at Kenyon College in Ohio. OCA's Mike Rudy was also on the mountain, although not part of CUREA, for a session on the 60-inch telescope.

Mike Simmons begins aligning the heliostat mirrors of the venerable 60-foot focal length Snow Solar Telescope. Greg Pyros is in the background.

The CUREA is an intense experience for the students, who represented schools from all over the USA, from California to Oregon to New York. Each day includes 2 to 5 hours of classroom lectures, an in-depth tour of one of the facilities or instruments, day-time (solar) and night-time (stars and galaxies) observing sessions. At the conclusion of week #1, each student develops a research project proposal. During the second week, lectures continue and the students gather data for their projects, conduct data reduction and analysis, and prepare their final presentations. As college kids are wont to do, most of them turned the final days into "24-hour affairs" of class, observing, data analysis, chat-sessions and snacking; and very little sleep. They (and I) were pretty tired puppies by the end!

I enjoyed the energy, enthusiasm and diligence that all of the students displayed. For example, one of my students had a project that required an observing cadence of one session each evening (about 9:30 to10:30PM) and another each morning (about 3 to 4AM), and he never missed a session. The kids were presented with an enormous amount of material, ranging from astrophysical theory and math, to principles of photometric and spectroscopic instrumentation, to methods for data analysis and presentation. I was particularly impressed with the challenging nature of the projects that they developed. Almost all of the projects pushed the limits of what could be accomplished in one week with the equipment available.

I took under my wing two students who selected photometric projects. (1) Misha set out to detect the periodic brightness variation of the optical counterpart of Cygnus X-1. I warned him that this was a dangerous project, because the amplitude of the variation was small – only about 0.05 mag – and the period was over 5 days, so that he'd only have one chance to map out the lightcurve. His courage and diligence paid off: he was able to get a nice lightcurve in B-, V- and R-bands that displayed the brightness variation (probably caused by gravitational-tidal distortion of the black hole's companion star), and also showed that the amplitude was the same in all three spectral bands. (2) Jeff set out to create a lightcurve of a short-period eclipsing binary. He was very quick to understand the mathematical principles, and was able to schedule his observation sessions to fill in the complete lightcurve. He used the lightcurve to confirm the previously-reported orbital period, applied color transforms to show that the two stars had almost the same temperature, and used the PHOEBE code to prepare a plausible shape-model of the double-contact binary.

Mike Simmons (left) and John Hoot (right) check the alignment of the solar image on the slit and grating of the Snow solar telescope.

Other student projects included: measurement of the differential rotation of the Sun; characterization of stellar age distributions in galaxies; calibration of stellar spectra and matching them to Planck's curve; absolute

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flight is scheduled for November 30. The Falcon and Dragon are not rated to carry people, but that is planned for the future. The Falcon 9 has had 2 successful flights and the Dragon one. This combining should shorten the time to when non-NASA rockets can supply ISS with first cargo and then astronauts. The Orbital Sciences company is also planning to test their privately developed Cygnus spacecraft in a flight to ISS, scheduled for next February.

Instant AstroSpace Updates

Pan-STARRS 1 (all sky survey telescope in Hawaii) has discovered 2 new **ultra-luminous supernovas**, those too bright to fit the ordinary categories. The 1st was already exploding, but the 2nd was observed throughout its brightening and fading, with multiple filters.

The **Solar Dynamics Observatory** has measured the energy in waves traveling along the magnetic field lines of the Sun and found it is far larger than previous work showed. This may solve the mysteries of how the Sun's corona gets so hot or how the solar wind achieves such high speed.

Juno was launched August 5 on its 5-year journey to Jupiter, where it will spend 1 Earth year orbiting and studying the planet.

NASA has signed an agreement with United Launch Alliance (ULA) to share technical data on the **Atlas V** rocket and on requirements to rate rockets safe for human spaceflight. Apparently the Atlas will become a choice for taking astronauts to ISS.

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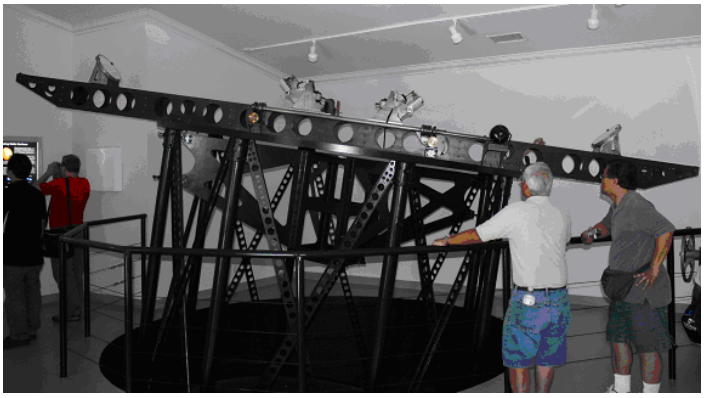

Remember the Michelson stellar interferometer? The original instrument, which was first used on the 100-inch telescope, is on display in the CHARA museum at Mt. Wilson Observatory.

photometry of the T-Tauri-like star DoAr 21 in B, V, R, and I bands; and measurement of the temperature and pressure of the Sun at different depths.

Many of you have attended one of the observing nights with the 60-inch telescope. Remember the wonder and thrill that you felt, seeing Hubble's locker in the basement, and observing through that grand old instrument? The CUREA experience is like that, on overdrive: living, working, and visiting all of the facilities on the mountain top. Students and instructors lived in the "Monastery". The little rooms are spartan, but it is a memorable experience to live in the same dormitory where scientists from the era of Hale and Hubble slept after their long nights or days of work. The Monastery has two sections, segregating day sleepers from night sleepers. Our meals were taken in the little "Galley" located between the 60-inch and 100-inch domes. The story that I heard was that Dr. Hale enforced an absolute prohibition on eating in the observatories, on the theory that if people were allowed to eat, then pretty soon they would bring in hot-plates, and that would create an unacceptable fire hazard. This was apparently a well-founded fear: the original Monastery burned down due to a kitchen fire less than 10 years after it was built.

If you know a college student who is interested in astronomy – say, a junior or senior majoring in physics, math, or engineering – then you should let them know about this program. It is a unique opportunity for "hands-on" experience at real research, which is quite a bit different than the "canned for success" laboratory experiments that they have at school. Details are at http://www.curea.org/info.html.

By the way, when you do go up to the Mt. Wilson Observatory, you may be wise to select your older car. As I was entering the gate (immediately below all of those high power radio and TV transmission antennas) I stopped to assist a fellow whose brand new BMW had inexplicably died. I tracked down one of the observatory technicians, who chuckled and said that this was not a rare occurrence – the radio interference can mess with the electronic systems in the new cars (e.g. neither his ignition nor the door locks would function). The cure is to tow the vehicle a few miles down the mountain, away from the antennas, where it will spontaneously spring back to life.

Discount tickets for Pacific Astronomy & Telescope Show

The Pacific Astronomy & Telescope Show is one of the premier annual conventions of amateur astronomers. This year's gathering, September 17-18 at the Pasadena Convention Center, will include lectures by interesting speakers, product displays of all types of astronomical equipment, and plenty of opportunity for you to meet and network with other amateur astronomers and organizations. For details, see http://www.rtmcastronomyexpo.org/PATS.htm. Admission is $20 at the door, but you can get discount tickets ($10/person/day) from OCA. Contact Bob Buchheim (OCA Secretary) via e-mail at oca_bob@yahoo.com, or in person at the September General Meeting to purchase your tickets.

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