SIRIUS ASTRONOMER

www.ocastronomers.org

The Newsletter of the Orange County Astronomers

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This image of the Crab Nebula was taken by OCA member Bill Patterson from our Anza observing site on November 27, 2005 using an RCOS 12.5" telescope on an AP 1200 mount with an STL11000 camera. Don't know what all this means? Want to learn? The AstroImagers SIG wants to hear from you! (details, page 5)

OCA CLUB MEETING

The free and open club meeting will be held Friday, February 10th at 7:30 PM in the Irvine Lecture Hall of the Hashinger Science Center at Chapman University in Orange. The featured speaker this month is Dr. Larry Adkins, adjunct professor of astronomy and physics at Cerritos College on a topic to be announced. More details are forthcoming at www.ocastronomers.org

NEXT GENERAL MEETING:

March 10th

STAR PARTIES

The Anza site will be open this month on February 25th. The Black Star Canyon site will be open this month on February 18th. Members are encouraged to check the website calendar, for the latest updates on star parties and other events.

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

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

COMING UP

The next session of the Beginners Class will be held on Friday, February 3rd at the Centennial Heritage Museum at 3101 West Harvard Street in Santa Ana.
GOTO SIG: Feb. 6th
Astrophysics SIG: Feb. 17th, Mar. 17th
Astro-Imagers SIG: TBA (contact coordinator for details)
EOA SIG: Feb. 27th, Mar. 27th
Dark Sky SIG: TBA (contact coordinator for details)

AROUND OCA
By Barbara Toy

Well, the New Year's Eve star party at Anza didn't happen, after all – too bad, as it would have been a great way to kick off 2006. But weather intervened, and pretty intense weather at that, as shown by the fact that the wind blew the moving roof off Dave Kodama's observatory (fortunately, not much more than the roof itself was damaged). On the brighter side, we had a really good turnout of both people who needed help and of volunteers to help them at the "How to Use Your Telescope" class on January 6, which was a great way to kick off our outreach activities for the new year.

I hope all of you had really great holiday seasons, and that 2006 has gotten off to a good start for all of you!

2006 Board Election –
The election for the 2006 Board is now behind us, along with a very entertaining (and informative) Astronomy Jeopardy game at our January meeting, thanks to the efforts of Craig Bobchin and Matt Ota. Hopefully you've all seen a formal announcement of the new Board by now, but, just in case you missed the election results, the 2006 Board is:

President:	Barbara Toy
Vice President:	Craig Bobchin
Secretary:	Bob Buchheim
Treasurer:	Charlie Oostdyk
Trustees:	Gary Schones
	Steve Short
	Tom Kucharski
	Matt Ota
	Alan Smallbone
	Leon Aslan
	Steve Condrey

It's always a pleasure to welcome new people to the Board, and having new people join the Board every year is healthy for both the Board and the club. However, this also means that we have to say goodbye to some of our past members each year, and that's always sad. This year, the members of the 2005 Board who won't be returning in 2006 are Tony Obra, Bill Hepner, Paul Brewer, and, of course, Dave Radosevich. I've had the pleasure of knowing them all for several years, and I'd like to take this opportunity to say a few words of appreciation about them.

Tony Obra
Tony has been an OCA Trustee for many years, and I first met him when I joined the Board in 2001. Among his many activities at the time was working with one of the teachers in the LAUSD who regularly brought his classes out to Anza for astronomy field trips. My first attempt to go to our Anza site was to join Tony, this teacher (whose name, interestingly enough for OCA long-timers, was Wayne Johnson), and several others for one of these field trips – it took a lot longer to get there than I'd expected, and I got thoroughly confused on the dirt roads, so I never did make it to the site on that trip, to my lasting regret. I did make it to one of Mr. Johnson's later field trips, and found the students to be an impressive bunch – and Tony's pleasure at working with them helped make the event memorable.

In the days before the needs of his family and work pressures seriously limited the time he had available for astronomy, Tony was involved in a lot of outreach activities, and also had pretty strong ties to Mt. Wilson. As one result of his Mt. Wilson activities, he was able to get us the observatory building that now houses the Mocat telescope near Anza House when it was decommissioned at Mt. Wilson. On the more local level, even when he hasn't been able to stay and do any observing himself as a reward for his hard work, Tony has regularly shown up with a large truck to help out on Anza clean-up days. The truck and Tony have both been a lot less available this last year than before, which, for anyone who might have doubted it, proved just how helpful they have been in years past.

One of the things that I appreciated about Tony when we served together on the Board was his ability to take in information from the general discussion of a particular issue, then ask what often seemed to be a simple question that went to the true heart of the matter. In particular, in the period after the Kuhn's drive system burned out a few years ago, John Hoot found the burned-out circuit board for the control system and determined that the damage was too extensive to attempt repair, and we were all discussing what should be done to get the Kuhn back into operation. After taking in a lot of discussion without comment, Tony asked a very basic question that we discovered we didn't have the information at the time to answer fully – which was what actually caused the circuit board to burn out. Dave Radosevich finally provided the answer to that question after he evaluated the telescope as a whole, and his answer went to the heart of the repairs – basically, "delayed maintenance"had

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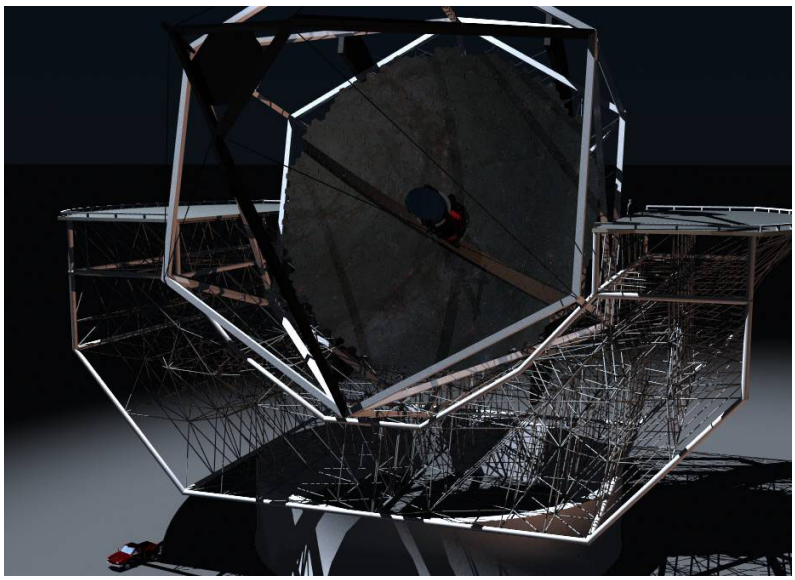
The Thirty Meter Telescope: A Sharper View of Cosmic History by Walt Glowski

This article provides a summary of a recent lecture given by Professor Ellis, Director of Caltech Optical Observatories. It concerns future plans for large ground-based optical telescopes. Any elegance contained herein belongs to Professor Ellis. I myself will have to accept the responsibility for any mistakes.

Professor Ellis began discussions with an overview on the history of Large Ground Based Telescopes. In particular he noted how each new large telescope was instrumental in defining future programs in astronomical research. Time restrictions limited his discussion to the following three telescopes:

- Hooker 100" (2.5 M) ~ This Mt Wilson based telescope drastically expanded the scale of our universe as it established that galaxies are indeed external systems, beyond our own Milky Way. Later Hubble used this telescope to establish the expansion of our universe, one of the great scientific findings of the 20th century.
- Hale 200" (5 M) Telescope at Mt Palomar ~ The Hale Telescope was originally motivated by the need for further understanding of the expansion of our universe and its ultimate fate. However during its first 20 years of operation it provided unforeseen results as it:
    - Discovered and studied the structure of Quasars
    - Studied the structure and chemistry of nebulous clouds in intragalactic space. This provided the basis for our current understanding on the synthesis of the elements in the universe
    - Provided first direct evidence of individual stars in distant galactic systems
    - Provided a lower limit on the age of the universe based on the oldest stars observed
- Twin Keck 400" (10 M) Segmented Multi-Mirrored Telescopes in Mauna Kea, Hawaii ~ Professor Ellis noted that since first light (1992 and 1997) the Keck Telescopes have:
    - Discovered and performed extensive studies on distant galaxies with a red-shift beyond Z=2
    - Located and provided further understanding on the afterglow of Gamma Ray Bursters (GRB)
    - Used distant supernova to determine that the cosmic expansion is accelerating
    - Detected many extra-solar planets

It was noted that none of these were foreseen when Keck was being planned back in 1985! If the past history of Large Ground Based Telescopes holds true, the most exciting and important discoveries awaiting the next generation of telescopes could well be in new and unanticipated areas which might eventually revolutionize our basic perception of the universe, just as Galileo's telescope once did.



Artist's conception of Thirty Meter Telescope (Caltech)

In addition to larger mirrors great strides have been made in recent years with improved instrumentation and with Adaptive Optics systems. This is what has kept the 55 year old Hale Telescope at the cutting edge of astronomical research.

Professor Ellis noted the synergy between Large Ground Based Telescopes and Space Based Telescopes, such as the 100" Hubble, the Spitzer IR telescope, and the Chandra X-Ray telescope. For example ground-based deep-spectroscopy can be performed on objects first seen by the HST. This cannot be accomplished on space-based telescopes. It is anticipated that this synergy with large ground-based telescopes will remain as future space-based telescopes are launched, such as the Herschel, Constellation X, and the James Webb Space Telescopes. This includes special purpose telescopes such as the Supernova/ Acceleration Probe (SNAP) designed to better evaluate distant Type Ia supernovae for an improved understanding of what is driving the runaway expansion of the universe and to investigate the properties of dark energy.

The Thirty Meter Telescope (TMT) had its beginnings as the California Extremely Large Telescope (CELT). Thirty meters was chosen as it would increase existing capabilities by about an order of magnitude. For example it would have nine times the light gathering power of the 10-M Keck and would provide an order of magnitude improvement in resolving power (using Adaptive Optics). Yet costs would remain reasonable and the concept wouldn't push existing technology too much. CELT consisted of a

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partnership between Cal Tech and the University of California. Later on the Associated Universities for Research in Astronomy brought in their Giant Segmented Mirror Telescope (GSMT) and the Association of Canadian Universities for Research in Astronomy brought forth their Very Large Optical Telescope (VLOT). With the addition of these new partners the integrated concept was renamed the Thirty Meter Telescope (TMT).

Currently the conceptual design is being finalized with tradeoffs in risk, costs, and scientific performance driving some of the major design decisions. For example it wouldn't make much sense to design an ideal observatory that nobody could afford. The current baseline design has 738 mirrors with a diameter of 1.2 meters each (versus Keck which has 36 mirrors at 1.8 meters each). Each mirror element is 0.045 meter thick. After considering re-aluminization requirements it was decided to go to 10 different mirror segment design configurations, including all of the off-axis elements. The f/1 primary mirror will provide about f/15 at final focus for a 20 arc minute field of view. It was also decided that a fully steerable telescope was desired because of its added flexibility over a fixed telescope. Currently site selection activities are on-going with five sites being considered: three in Chile, one on the summit of Mauna Kea, and one at a site in Baja.

The TMT is 1.4 years into its four year design phase. Construction is planned for 2008 to 2014 with science operations beginning in 2015. Of course all of this depends on the project obtaining adequate funding. Additional technical challenges also need to be met, including advanced instrumentation and Adaptive Optics capabilities.

The TMT will use Adaptive Optics (AO) to obtain diffraction limited capabilities and thereby exceed the on-orbit capabilities of the HST. This includes an adaptive mirror made up of many tessellated segments, a wave-front sensor, and a laser to provide for an artificial reference star. This type of system as currently used on the Keck can get 49.7 milli-arc-sec of resolution on a good evening. With this system motions of stars around the center of the Milky Way have been observed and the resulting velocity profiles have identified that there is indeed a black hole within the center of our galaxy. This same system has also been used to observe the methane clouds and ring structure around Uranus. In addition to correcting for turbulent activity in the upper atmosphere the TMT AO system will also be configured to correct for ground layer turbulence above the observatory dome. This new concept is called Multi-Conjugate Adaptive Optics. For turbulence within the dome itself control will be provided by assuring a uniform constant temperature flow over the primary mirror.

Some of the science that is hoped to be accomplished with the TMT includes:

- Connect the first nano-seconds after the Big Bang to the origin of life
- Understand the density fluctuations following recombination and how they impact on the large scale structure of the universe
- Understand the evolution of the first stars and the first galaxies
- Understand the nature of planetary systems and of life and its precursors. The TMT will be critical to resolving extra-solar planets and for securing their spectroscopy
- Study the dynamics of galaxies including their formation and rotational curves
- Understand the cosmic web of gas, how it is enriched with chemical elements, and how these elements are processed during planetary formation
- Sub-stellar system studies, including Brown Dwarfs and fainter extra-solar planets
- Look for forming planets and the associated gravitational gaps in evolving extra-solar planetary systems

A couple of other large ground based concepts are also currently being studied: The Giant Magellan Telescope (GMT) and the Overwhelmingly Large Telescope (OWL). The GMT is a concept of a consortium headed by the Carnegie Institution. Its 25.2 meter primary mirror consists of 7 monolithic mirrors arranged in a floral pattern. It is based on the 8.4 meter mirrors being developed for the Large Binocular Telescope (LBT) in Arizona. The problem is that the off-axis mirrors on the GMT will require new techniques in both casting and polishing. Professor Ellis feels that the TMT will have the advantage if there ever is a shoot-out between it and the GMT due to funding limitations. First there are the greater technology issues associated with the development of the GMT. Secondly the GMT's large monolithic mirrors are not scalable to the larger sized telescopes of the future. It won't provide the needed data required for the next generation 100-meter telescope. On the other hand the small multi-mirror segments of the TMT would be fully scalable to a much larger telescope. In addition to doing great science the TMT will provide an ideal technology test-bed for future generations of giant ground based telescopes.

The OWL is a concept being evaluated by the European Southern Observatory (ESO). They are looking at a giant 100-meter telescope, the Overwhelmingly Large Telescope (OWL) for doing overwhelming science! Their position is that most of the Extremely Large Telescope concepts being investigated today are basically up-scaled versions of the segmented Ritchey-Chretien concept successfully pioneered in the early 90s with the twin 10 meter Keck telescopes. The ESO is of the opinion that

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a paradigm change is required. For the OWL they have done just that, with the following major shifts incorporated into their design:

- The telescope will be built with modular building blocks, as pioneered by Gustave Eiffel in 1899 for his famous tower
- The primary mirror will consist of multiple "spherical segmented" mirrors

Professor Ellis feels that this large of a telescope is a bit before its time. Both technical challenges and costs enter into this position. The 100-meter telescope might be a better idea in 30 to 40 years. However he feels that this concept will be such "big science" that it will require international support. It was noted that the TMT itself has already received inquiries from Japan, the United Kingdom, and Australia. The TMT may well be the last big observatory where the US has the leading control.

The need for a Giant Segmented Mirror Telescope (GSMT) was identified in the 2001 decadal report of the National Academy of Science as the highest-priority new ground-based facility for the next decade. The TMT appears at this time to be the most viable response to this item. It would both provide for a lot of new science and act as a technology test-bed for the next generation of giant telescopes. Perhaps most important of all it will most likely define new fields of investigation, ones not even dreamt of at this time. Professor Ellis ended his talk with a quote from his mentor Fred Hoyle from a time when they both worked on the 4-meter Anglo-Australian Telescope, "A large telescope is a good example of the things which our civilization does well". Perhaps the TMT represents civilization's next thrust into this exciting realm!

TECHNICAL ASSISTANCE NEEDED FOR OUR WEBSITE

We need someone to handle the technical side of the OCA website. Hassi Norlen is our Website Editor, and deals with content and a lot of the day-to-day maintenance, but we need someone who can deal with the "down-and-dirty programming" aspects of the website. If you have knowledge of VBScript, JScript, Javascript, Access Databases, Microsoft IIS (Internet Information Server) and ASP (Active Server Pages), as well as HTML, and understand and are able to code dynamic web sites running under Microsoft IIS developed using ASP and Microsoft Access databases, you have the necessary skills for this, and we could really use your help.

If you can help us out with this, please contact Hassi Norlen (hassi@norlens.net or 714/710-9444) or Barbara Toy (btoy@cox.net or 714/606-1825).

AstroImaging 'Boot Camp'

Bill Patterson

The AstroImaging Special Interest Group is gauging club and public interest in holding an "Astro-Imaging for Beginners Workshop" with the following characteristics:

- 4 to 6 meetings of 60 to 90 minutes each covering imaging fundamentals
- Workshops to begin in February or March (location TBD)
- Focus on entry level equipment and techniques
- At least one hands-on workshop in town "under the skies" doing actual setup and imaging
- At least one hands-on workshop at the OCA Anza Dark Sky Site "under the skies" doing actual setup and imaging

There would be no charge for the workshop and we would expect absolute beginners as well as people familiar with visual observing that want to explore imaging.

To gauge interest, there will be a poll on the OCA Yahoo NewsGroup. If you're not connected there, please e-mail Bill Patterson at bill@laastro.com indicating that you would like to participate and your preference for date and time of meetings.

"Are you still trying to hook up that CCD, boy? Then you need to get to this workshop pronto!!!!!"

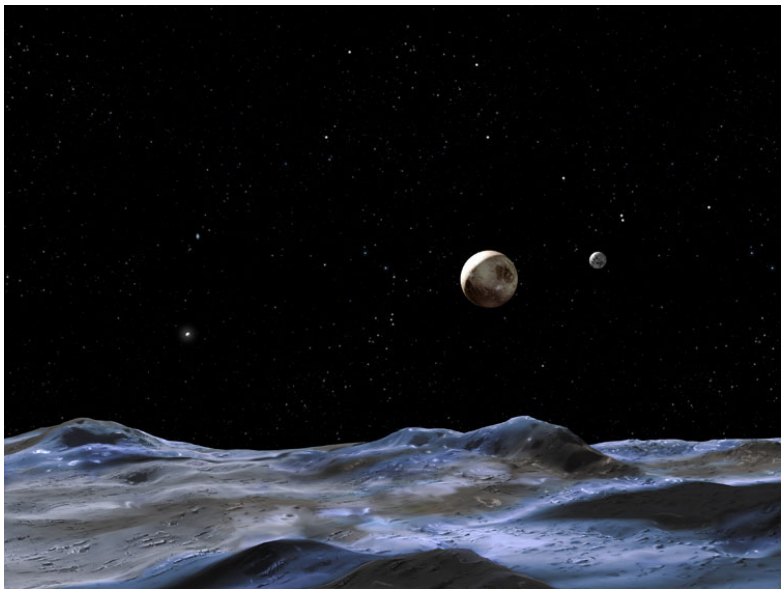
HANDY TELESCOPE MAINTENANCE TIPS

Bill Hepner

Rules of Life
1. If it moves and should not - use duct tape
2. If it does not move and should - use WD40

Snowstorm on Pluto

by Dr. Tony Phillips



This artist's rendering shows how Pluto and two of its possible three moons might look from the surface of the third moon. Credit: NASA/ ESA and G. Bacon (STSci)

There's a nip in the air. Outside it's beginning to snow, the first fall of winter. A few delicate flakes tumble from the sky, innocently enough, but this is no mere flurry.

Soon the air is choked with snow, falling so fast and hard it seems to pull the sky down with it. Indeed, that's what happens. Weeks later when the storm finally ends the entire atmosphere is gone. Every molecule of air on your planet has frozen and fallen to the ground.

That was a snowstorm—on Pluto.

Once every year on Pluto (1 Pluto-year = 248 Earth-years), around the beginning of winter, it gets so cold that the atmosphere freezes. Air on Pluto is made mainly of nitrogen with a smattering of methane and other compounds. When the temperature dips to about 32 K (-240 C), these molecules crystallize and the atmosphere comes down.

"The collapse can happen quite suddenly," says Alan Stern of the Southwest Research Institute. "Snow begins to fall, the surface reflects more sunlight, forcing quicker cooling, accelerating the snowfall. It can all be over in a few weeks or months."

Researchers believe this will happen sometime during the next 10 to 20 years. Pluto is receding from the warmth of the Sun, carried outward by its 25% elliptical orbit. Winter is coming.

So is New Horizons. Stern is lead scientist for the robotic probe, which left Earth in January bound for Pluto. In 2015 New Horizons will become the first spacecraft to visit that distant planet. The question is, will it arrive before the snowstorm?

"We hope so," says Stern. The spacecraft is bristling with instruments designed to study Pluto's atmosphere and surface. "But we can't study the atmosphere if it's not there." Furthermore, a layer of snow on the ground ("probably a few centimeters deep," estimates Stern) could hide the underlying surface from New Horizon's remote sensors.

Stern isn't too concerned: "Pluto's atmosphere was discovered in 1988 when astronomers watched the planet pass in front of a distant star—a stellar occultation." The star, instead of vanishing abruptly at Pluto's solid edge, faded slowly. Pluto was "fuzzy;" it had air. "Similar occultations observed since then (most recently in 2002) reveal no sign of [impending] collapse," says Stern. On the contrary, the atmosphere appears to be expanding, puffed up by lingering heat from Pluto's waning summer. Nevertheless, it's a good thing New Horizons is fast, hurtling toward Pluto at 30,000 mph. Winter. New Horizons. Only one can be first. The race is on….

Find out more about the New Horizons mission at http://pluto.jhuapl.edu . Kids can learn amazing facts about Pluto at spaceplace.nasa.gov/en/kids/pluto.

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

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caught up with us, and a combination of worn gears, dirt in the gears, improper balance, and similar issues ultimately made it so hard to drive the Kuhn that it was only a matter of time before it failed. Tony's simple question and the discussion that followed redirected our focus, and helped us realize that the scope had deeper problems than just a failed circuit board, so we were better prepared when Dave brought us his findings and recommendations for a complete overhaul of the telescope.

Tony's been increasingly tied up with responsibilities in other parts of his life over the last few years, and hopefully having a period without Board responsibilities will free up some of his time so he can indulge in other aspects of our hobby – though we'll miss him on the Board.

Bill Hepner

Although I had seen him at outreaches before, I first got to know Bill when we were part of a group that stuck around to chat after an outreach at a school in Trabucco Canyon (where it was incredibly dark for Orange County). That was the first of many interesting conversations I've had with Bill over the last four or five years – he's been actively involved in different aspects of astronomy for over thirty years, and has done many different types of public education in astronomy over the years he's been involved in the hobby, so he has a lot of knowledge to draw on and experiences to share. I'm one of many who have learned a lot from him – and I have him to thank for showing me how to convert my original ETX90 to a "goto" scope, and for making that transformation possible.

I didn't have the pleasure of serving on the Board with Bill, but I know that he approached his position as Trustee this last year with as much dedication as he gives his ongoing outreach activities and his other club activities. Among other things, he has had a particular interest in making at least some of our facilities out at Anza more accessible to people with physical impairments, which is one of my own goals. Even though he won't be on the Board as a Trustee in 2006, I hope to draw on his knowledge and insight in that area to continue to improve access to our facilities for all of our members.

Paul Brewer

Paul is one of those quiet people who don't advertise their capabilities, so you find out about them almost by accident. In talking to him at various outreaches and at Anza, I've become aware that he's an active astroimager (though he hasn't posted many of his images on the website Image Album) and woodworker, he knows a lot about astronomy and has a good way of conveying that information to schoolkids and other members of the general public, he's a loving uncle who's been doing his best to inspire a love of astronomy in his nieces and nephews, and he also does well with a camera in daylight conditions – among other capabilities. Back after the fire we had at Anza, he kindly provided me with copies of pictures he took when he was out there shortly afterward to view the damage, and he also generously gave me a copy of the set of pictures he took at RTMC a couple years ago when I needed some shots for a related activity – I was very grateful for the help, and appreciative of his skill. I've generally seen Paul most when his camera and telescope are doing their thing on star party nights and don't need his active supervision, so he decides to drop in at the club observatory to see what's going on, maybe view a few objects through the Kuhn, and share information and conversation with whoever is there, which is always a pleasure.

As with Bill Hepner, I didn't have the pleasure of serving on the Board with Paul, but I'm sure he was as serious about doing a good job as Trustee as he is about his other activities. He's been around the club a long time and has a lot of insights and information that could be valuable to the Board – and I hope we'll continue to benefit from his knowledge even though he won't be a Trustee this coming year.

Dave Radosevich

They say that an article should end on a strong note – so I'll take the liberty of ending this column with Dave, who is certainly one of OCA's most colorful members and one of the most active people I've ever met. He's a man of many talents, interests and capabilities – the nuts and bolts of astronomy, of course, but also telescope building and refurbishing, including classical telescopes, building of telescope mounts, woodworking as a fine art, collecting meteors, astroimaging and so on, and so on. Along the way, he's built a business buying and selling high quality wood, he's bought and sold a lot of different astronomy-related equipment and parts, he's built telescopes for other people – all this (and more), and he still manages to work full time, get out to his house at Anza a couple times a month, and spend some time with his wife and kids. And he's also somehow been able to continue doing all of these types of things during the time he's been on the Board. Those, like me, who operate at a much less intense level can only marvel at his energy and his boundless enthusiasm.

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ASTROSPACE UPDATE

February 2006

Gathered by Don Lynn from NASA and other sources

To find out more on these topics, or those of past months' columns, through the World Wide Web, send your Web browser to our OCA Web site (http://www.ocastronomers.org), select Space Update Online, and the topics are there to click on.

Mars water (or lack thereof) – A new analysis of data from the Mars rover Opportunity has led a group of scientists to declare that the rock formations formerly attributed to being formed by the action of a salty lake were instead formed by steamy sulfuric volcanic action. They stated the rocks were formed in an environment more like the Hawaiian volcanoes than like the Great Salt Lake. First they showed that the rocks on Mars were similar to those formed on Earth under certain volcanic conditions, and then they showed that the Martian rocks lacked sufficient levels of certain elements, like iron, calcium and magnesium, that should have been present if they were formed by a salty lake.

Short gamma-ray burst – A team of astronomers analyzing observations of a short gamma-ray burst have concluded that it was caused by a neutron star falling into a black hole. Smaller bursts were seen by the Swift gamma-ray satellite about 200-300 seconds after the first, and various other telescopes found afterglows later. The pattern and energy observed fit what is expected for a neutron star falling into a black hole, not other combinations. Theory says that such a collision would break off pieces of the neutron star from tidal forces. Some piece would then fall in minutes after then main body, producing the weaker bursts, and some would take longer, resulting in the afterglow. Other recent evidence indicates that short gamma-ray bursts (less than 2 seconds long) are caused by collisions of either neutron stars or black holes. This is the first strong evidence that it is one of each colliding.

Supernova light echoes – Comparing old and new images from a survey to find dark matter has revealed the light echoes from 3 old supernovas in the Large Magellanic Cloud, a neighboring galaxy. When a supernova explodes, a sphere of light expands from it, and wherever that sphere hits dust clouds, we see an arc of light later than we see the explosion directly. These arcs are called light echoes. Although light echoes have been seen around recent supernovas, such as 1987a, these are the first light echoes seen around supernovas that were visible hundreds of years ago. Each of the 3 echoes was shown to surround a known supernova remnant, a cloud of nebulosity left from the explosion. By measuring the size of the arc and calculating the geometry of the light path, the time since the supernova exploded can be determined. This is more precise than the method previously used to date supernovas, that of measuring the expansion rate and size of the remnant nebula. Light echoes could also be used to map locations of dust clouds, since they are otherwise too dark to see unless they happen to occur next to a star bright enough to illuminate them.

Constants of Physics – A team of astronomers has used the Byrd Green Bank radiotelescope to precisely measure the frequencies of 4 different spectral lines emitted by hydroxyl molecules in a galaxy so far that it has taken the (radio) light 6 billion years to reach us. Although traditionally physicists have assumed that the constants of physics are indeed constant, some recent theories to explain dark energy require that some of these constants change over the life of the Universe. Two of these constants, are the mass of the proton expressed as a multiple of the mass of the electron, and the fine structure constant, which depends in turn on the electron charge, the speed of light and the Planck constant. The 4 frequencies emitted by hydroxyl molecules depend on these two constants, but in different ways, so if the constants have changed in the last 6 billion years, this observation should show relative shifts in these frequencies. No shifts were found so far, and work continues to make even more precise measurements.

Dark matter – Two separate studies using the 8-meter Japanese Subaru Telescope in Hawaii have found evidence that galaxies form where clumps of dark matter exist, supporting that theory of galaxy formation, and that several galaxies can form in one clump of dark matter, supporting certain theories of galaxy cluster formation. The studies were made of young (newly formed) galaxies, which are difficult to find. Most galaxies formed early in the history of the Universe, so to find many young galaxies requires that we look at extremely distant ones, where the light left there so long ago that we are seeing them as they were early in the history of the Universe. The studies took very long exposures with very sensitive instruments, resulting respectively in images of 17,000 and 5,000 galaxies whose light has taken over 12 billion years to reach us. Dark matter cannot be seen, except indirectly by its gravitational influence on visible objects. Various observations over the last few decades have shown that there is far more dark matter than visible matter, and that most of it is composed of exotic particles (not protons, neutrons and electrons, like ordinary matter). The theories of what those particles are can be divided into two classes: cold particles and hot particles. Most recent evidence, including these 2 studies, supports cold particles.

Medium black hole – Scientists using the Rossi X-ray spacecraft have observed what appears to be a red giant star orbiting a medium sized black hole. Essentially all black holes known are either small (the mass of a large star) or huge (the mass of millions of stars), so astronomers have expended a great deal of effort to find a medium-sized black hole. The mass of this new discovery will be measured soon to verify that it is indeed the rarity believed. The period of orbiting is known to be 62 days, and now either the size or velocity of the orbit is needed to calculate the black hole mass. These observations may be difficult because it is located in a dust-obscured region. A star nearing the end of its life may swell up into a red giant, as this star apparently has. This puts much material in the red giant at risk of falling into the black hole that it is orbiting, and that material falling in is causing the X-rays observed by Rossi. The object is located in a massive compact star cluster where theoretically medium-sized black holes should form from star collisions.

Integral (European gamma-ray spacecraft) has measured the density of a rare isotope of aluminum over a large volume near the center of our Milky Way galaxy, and from this it was calculated the rate of supernovas that must occur to supply this isotope. The result is on average one supernova every 50 years somewhere in our galaxy. This is roughly the same as other methods of measuring the supernova rate, all of which depend on applying data from other galaxies to ours, but is a little more frequent than some of those measures.

Perseus Arm – Using the Very Long Baseline Array of radiotelescopes, a team of astronomers made the most accurate measurement of the distance to clouds of gas in the Perseus

Arm of our Milky Way galaxy, and it was found closer than previously believed. Other methods of measuring this had disagreed by a factor of 2. The new measurement used the parallax method. Since this array has much finer resolution than optical telescopes, it can use parallax to about 100 times greater distance. Our solar system lies in the Orion spur, a small galaxy arm that juts inward from the Perseus Arm. Much about the exact shape of the arms of the Milky Way remains to be determined, since it is so difficult to map the galaxy from the inside.

Companion galaxy – Scientists have discovered in Virgo a companion galaxy to our Milky Way that appears so large and spread out that it had been overlooked before. Some stars in it have been observed for hundreds of years. It was found in the Sloan Digital Sky Survey, which is imaging a very large portion of the sky, and determining rough distances to every star. Knowing the distances of the stars allowed separating this galaxy from the foreground Milky Way stars. The distance comes by measuring each star's color, classifying what type of star it is, looking up what that type's absolute brightness should be, and comparing that to its actual brightness, as affected by its distance. The galaxy is only 30,000 light years away, and is likely the remnant of a small galaxy that was captured and disrupted by the Milky Way.

Charon (Pluto's moon) – Astronomers observed Charon passing in front of (occulting) a star and were able to measure the moon's diameter to unprecedented accuracy (753 miles, plus or minus 5), and also that it has no substantial atmosphere. They would have been able to detect as little as 1 millionth the atmospheric pressure that we have on Earth, but none was detected. It was fortunate that the path from which the occultation could be seen passed over several large telescopes in Chile. Combining the newly determined size with the known mass produced the most precise value for Charon's density (1.72 times that of water), which confirms that it is composed of a rock-ice mixture. Theorists claim that if Charon had formed by condensing of the original solar nebula, it would now have a thin atmosphere, so the new observation supports that the moon was formed by a collision instead. This is also indicated by the fact that Charon's newly determined density is lower than Pluto's, but they should theoretically be the same if formed at the same place from condensing nebula. Diffraction fringes were observed also as the star was covered by Charon. It is hoped to use the occultation technique on the larger objects in the Kuiper Belt to obtain results for their sizes, atmospheres, and sometimes densities.

Pluto – Temperature measurements have been made that for the first time separate Pluto from its moon Charon, using the Submillimeter Array telescopes in Hawaii. They appear too close together to have allowed this before. As suspected, the presence of a thin atmosphere about the planet, but not its moon, causes the planet to be colder, even though they get the same amount of sunlight. Pluto is -382 degrees F., while Charon is -364. Some of the sunlight hitting Pluto evaporates frozen nitrogen into the atmosphere instead of raising the ground temperature.

Cassini (Saturn mission) took spectra of particles emitted by geyser action from the moon Enceladus, and comparison with observations of the particles of the E-ring show that this action is definitely the source of the E-ring. It is the broadest and faintest of the known rings of Saturn. Much of the material thrown out falls back onto Enceladus, but some escapes. The escaped particles are pushed by light pressure and magnetic forces into the ring.

Hubble Space Telescope (HST) has imaged 2 rings and 2 small moons orbiting Uranus that were not previously known. One of the moons orbits in one of the rings. Material knocked off the surface of the moon by meteor impacts probably supplies the material of which the ring is made. A moon to supply material for the other new ring has not been found, although one could simply be too small to see. Once the location of the new rings was known, they were found very faintly on earlier HST and Voyager images. In 2007 all of the rings of Uranus will turn edge-on to Earth. Edge-on views of rings often reveal new features, so considerable study of the rings will be made then. The current positions of the known moons in the new HST images were compared to that predicted from old HST and Voyager observations, and there was considerable error in many predictions. This indicates that the inner moons are perturbing each others orbits in chaotic ways rather than predictable ways. The amount of this perturbing indicates that every few million years inner moons of Uranus statistically should collide.

HST has also observed **Polaris**, the North Star, and for the first time managed to separate the closer companion star (of 2), which lies only 1/5 arc second away. Next astronomers will try to measure the movement over time of the companion, which will allow calculation of the mass of the primary star. Since Polaris is a Cepheid variable, getting an accurate mass would confirm our theoretical understanding of Cepheids.

A study of over 4500 galaxies found in the HST Ultra Deep Field image has resulted in statistical evidence that the **supermassive black holes** at the centers of galaxies grow at the same time as the galaxy is being assembled by merging of smaller galaxies. This has long been suspected, but evidence is difficult to come by because black hole growth activity is often shrouded in dust, and because galaxy formation happened in the early history of the Universe. We are able to see these early events only when we look at galaxies so distant that their light took billions of years to reach us. The teams making the study believe they are seeing 2 distinct phases of galaxy formation: the first shows tadpole shapes caused by tidal forces during galaxy merging strips stars away into tadpole-like tails, and the second after the merged system has stabilized. Galaxies in the first phase generally hid the black hole growth activity by dust clouds, while the activity could be seen in the second phase.

Milky Way warp – It has long been known that the Milky Way disk is warped, with one end drooping and the other lifted, but determining the cause conclusively has eluded scientists until now. An accurate map of the location of hydrogen clouds throughout the galaxy was made, and then the exact dimensions of the warp were measured from this. Then computer models of the motions of the Milky Way and its companion galaxies attempted to reproduce this warp. This was not successful until the effects of the cloud of dark matter surrounding the Milky Way were added to the computer model. It was then found that the orbiting of the Magellanic Clouds sets up oscillations in the dark matter, which makes our galaxy vibrate in 3 directions, one of which is the flapping of the galaxy ends that are seen as the most obvious part of the known warp. The period of the flapping is 1.5 billion years, the same as the orbital period of the Magellanic Clouds. This is bad news for the theorists attempting to explain the behavior of the Universe without huge amounts of dark matter, using such alternate gravity theories, such as MOND. If any theory without the huge amount of dark matter

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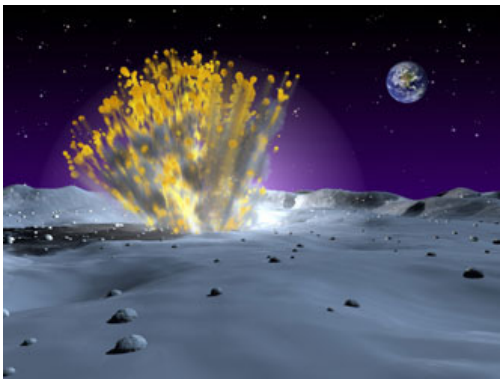
holds, then the computer model does not predict that the Milky Way would warp as it does.

Chandra (X-ray space telescope) has imaged 56 elliptical galaxies to study their X-ray properties. Astronomers found that massive clouds of hot (multimillion degree) gas have been stirred up, apparently by explosive activity occurring when matter falls into the supermassive black holes at the centers of the galaxies. It had been expected that in most such galaxies, activity around the central black hole had mostly stopped long ago, and that the hot gas would have settled into equilibrium by now, but these observations showed otherwise. Periodic infalls of gas to central black holes resulting in explosive activity was known to occur in galaxies in clusters, but this study found it must happen in isolated (non-cluster) elliptical galaxies also.

Spitzer (infrared space telescope) has observed what appears to be comet dust surrounding a white dwarf star. A white dwarf is the compact remnant of a star that has run out of fuel and is slowly cooling. This star ended its active life about 500 million years ago. This is the first observational evidence that comets can outlive their star. The white dwarf went through a red giant stage as it ran out of fuel, which probably engulfed any inner planets that might have existed. But there is a possibility of outer planets that may still orbit there. The dust resembles that created when a comet strays near its star and is pulled apart by tidal forces, although some other explanations exist. Further observation may shed light on the method of creation of the dust and the possibility of planets.

Lunar meteor strikes – Following up from several amateur astronomers' observations during meteor showers of flashes on the dark part of the Moon caused by meteoroids striking, NASA has begun a long-term program of observations for such events, using a small (10-inch) telescope and video equipment. On the first night of test observations, a strike was recorded. From the brightness of the flash, it is estimated that it left a 10-foot crater on the Moon. The software has not been developed yet to search for the flashes. That will be necessary before the program really gets into operation, since the video produces mostly uneventful images. This study is expected to determine the frequency of lunar meteor strikes of various sizes. This is a statistic that planners of future missions to the Moon would like to know.



Artist's conception of small lunar impact similar to Nov. 7th event (NASA)

Exoplanet search - A new method has been developed to find exoplanets (planets orbiting other stars), and it has found its first planet. It works the same as the common method of detecting the wobble of the star due to the gravity of the orbiting planet, but it uses an interferometer to detect the wobble rather than a spectrograph. It appears to be more sensitive than the spectrograph method, and uses far less light, so can be used on much smaller telescopes. This new planet was found with a 36-inch telescope. It orbits a star in Virgo in under 5 days. It is hoped this method can search far more stars for planets, since there is much more time available on smaller telescopes.

GRACE (Earth gravity mission) has measured the melting rate of the Greenland ice sheet more precisely than previous methods, and has found it is faster than any previous measurement. The rate is sufficient to raise all the Earth's oceans by 1.6 inches per century. GRACE also measured the seasonal changes in the Antarctic Circumpolar Current for the first time, and the amount of Earth movement during the December 2004 Sumatra earthquake.

TOPEX/Poseidon (sea surface radar mission) has ceased operations due to a reaction wheel failure, ending 13 years of observation. A follow on oceanography mission called Jason has been operating for 4 years, and the Ocean Surface Topography mission is scheduled for launch in 2008. Major achievements of TOPEX/Poseidon include: first decade-long global descriptions of seasonal and yearly ocean current changes, refined estimates of rising sea level, new understanding of how tides act in mixing the deep ocean, most accurate ever global tides models, first global data set to test ocean circulation models, and first proof that a spacecraft could use the GPS system for extremely accurate position work. TOPEX was the name applied to the US portion, and Poseidon to the French portion, of this joint spacecraft.

Instant AstroSpace Updates:

Astronomers using the Byrd Green Bank radiotelescope have measured the magnetic field in space in a region of Orion and showed that it is a coiled **helical field** that is squeezing a huge gas cloud into a filamentary shape. The observations used the Zeeman effect, which splits spectral lines when a magnetic field is present.

New stellar nursery - A glowing gas cloud has been found in Cassiopeia that has just begun to shine with newborn stars. It should appear much like the Orion Nebula in about 100,000 years, just about the time the Orion Nebula fades from view.

Astronomers have discovered that the nearby **pulsar** Geminga is leaving a comet-like **trail** of material behind, along its path of motion. It is believed composed of electrons that escaped from the pulsar's magnetic field.

New Horizons (Pluto mission) launch has been delayed until January 17, but that is still well within the launch window necessary to reach Pluto. So by the time you read this, the spacecraft should be on its way to arrival in 2015.

Beagle 2 (Mars lander) – New images from the Mars Global Surveyor show a few dots at the limit of resolution that appear to be the Beagle 2 and its airbag system, which were lost from contact during landing 2 years ago. Previous candidates in images were found not to be the lander.

Stardust, the spacecraft that collected dust near a comet, successfully landed in the Utah desert early the morning of January 15. It was launched in February 1999, flew within 150 miles of comet Wild 2 in January 2004, collecting cometary material, and also collected interstellar dust entering our solar system.

My first experience with Dave's enthusiasm and energy was with the refurbishing of the Kuhn telescope. As I mentioned above, Dave gave the Board a good analysis of the overall physical problems that had built up with the Kuhn, ultimately causing the drive system to fail, and he came up with an affordable plan for refurbishing it that included cleaning, properly aligning and reworking the gears, and installing a new drive system; Dave dealt with the equipment end of the project and John Hoot handled software and other find-tuning issues once the telescope was physically back in operation. Dave was so filled with enthusiasm for this project that he actually finished the bulk of the work within a matter of weeks, though he'd originally estimated that it would take him several months because of other commitments. Although it took a lot longer to work out some of the remaining bugs, this initial burst of work by Dave gave us a functional telescope that was generally a pleasure to run and that could be used for star parties and other visual work, even if it wasn't yet optimal for imaging. As Observatory Custodian, I have particular reason to be grateful to him for his extraordinary efforts during that period, and I continue to benefit from his advice and assistance in maintaining the Kuhn and working to optimize its performance.

Filling the position of president of this club has its pleasures as well as challenges, and I hope that Dave found pleasure in the position while he held it. He certainly didn't shy away from taking on challenges over the last year – one particularly important challenge was implementing the new rules regarding brush clearance that the Board adopted after the fire. I hope that we'll be able to build on the groundwork he laid, so that we won't ever again go into a fire season with the Anza property as overgrown as it was the year of the fire. As another challenge, we finally got the County's approval of the overall plan for development of the Anza site this last year – we now have to figure out how best to implement it, and Dave has done a lot to get that planning process under way. That's an ongoing process, and a lot of hard work remains to be done before we move any dirt or construct anymore pads or observatories on the Anza site, but we are much further along than we were a year ago. And we still need to replace the moving roof on the club observatory and complete the perimeter fence for the Anza site – those and other projects will undoubtedly keep us all very busy this coming year!

Dave started a couple of practices as president that I hope will become club traditions. One is having all Board members who are present come down to the front to take part in presenting awards – it's a good way to show how much the club really honors those recipients, and also helps people get more familiar with who is on the Board. The other is having the members of the new Board introduce themselves and talk a bit about their background at the start of the first meeting of the new board. Dave tried that last January, and I thought it got that first meeting and the entire year off to a good start. I plan to continue with these practices, and I hope future presidents will, as well.

In Closing…

Every year presents its own challenges to the Board, and the 2005 Board is to be commended for seeing us through the last year so well. Thank you all for entrusting me with the presidency again for the coming year, and I look forward to working with the 2006 Board, both new and returning members – with their help and the help of all of you club members, I hope we will be able to see even more of our long-standing projects completed in the coming year.

FOR SALE Desert Oasis with an eye on the sky—Custom Santa Fe and Observatory. Hill top location on 5 acres, 5000' under roof, 3 bedrms, 4 baths, spacious kitchen, family rm, great rm, formal dining, hobby & work rms; Ceilings 8' to 14', large covered flagstone patio and garden entryways, Private courtyard off master bedrm, 3 fireplaces. Detached 288 ft^2 observatory (12' x 12' lab with computer controls; 12' x 12' observation deck; and 12' x 12' storage area under observation deck), 10' steel ASHDOME, CELESTRON C14 (hand picked mirror) white OTA, PARAMOUNT GT-1100S, MERIDIAN SYSTEMS dome control hardware & software. See attached website & links for more details, photo gallery, virtual tours, etc. Contact Ernie Bigsby (623-826-8051); Dave Bigsby (623-826-8053) or ebigsby.mywindermere.com (MLS# 2428445).

FOR SALE Celestron 14 complete - includes optical tube, corrector cover plate, finder, 2-inch diagonal, drive-control box, counterweights, fork, wedge, tripod, few eyepieces. Early orange-tube model, but in good condition. Unused for several years because of bad back. No reasonable offer will be refused. Offers accepted until April 25, 2006. Call Carroll Slemaker at (949) 586-5673 to arrange appointment to inspect equipment.

FOR SALE

1. Unitron 3" Photo-Equitorial with all the original 1970's accessories and wood boxes. Unihex ep holder (in fitted box) with 7 Unitron oculars (in fitted box), finderscope, 4 x 5 camera with plate holders (in fitted box), solar projection screens, and slow-motion controls for the EQ mount (no motors). The objective is damaged with a 3/8" flake on the edge of one element. Price: $2000 o/b/o

2. Alt-Az mount: Light Speed Telescopes Mark 2.5 Wagon superduty mount with manual slow-motions and 8000 step encoders. Easily carries 35 lb load - ultimate giant binocular or RFT mount. Scope or binocular mounts on heavy duty sliding dovetail for front to back balance, and the 10" wide cradle adjusts up and down. Comes with Quick Release tripod mount, and everything is clear anodized. New condition. Price: $3000 o/b/o

Contact Cort Schuyler at 760-724-0373 or cschuyler@cox.net for more details.

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CLUB OFFICERS			
President	Barbara Toy	btoy@cox.net	714-606-1825
Vice-President	Craig Bobchin	ETX_Astro_Boy@sbcglobal.net	714-721-3273
Treasurer	Charlie Oostdyk	charlie@cccd.edu	714-751-5381
Secretary	Bob Buchheim	rbuchheim@earthlink.net	949-459-7622
Trustee	Gary Schones	gary378@pacbell.net	714-556-8729
Trustee	Tom Kucharski	TomRigel@aol.com	949-348-0230
Trustee	Matthew Ota	matthewota@yahoo.com	714-392-6751
Trustee	Steve Short	steves@inductors.com	714-771-2624
Trustee	Alan Smallbone	asmallbone@earthlink.net	818-237-6293
Trustee	Leon Aslan	leon@socalastro.com	562-305-6455
Trustee	Steve Condrey	SiriusAstronomer@OCAstronomers.org	951-471-0153
COMMITTEES, SUBGROUPS, AND OTHER CLUB VOLUNTEERS			
Press Contact	Russell Sipe	russell@sipe.com	714-281-0651
Sirius Astronomer Editor	Steve Condrey	SiriusAstronomer@OCAstronomers.org	951-471-0153
Web Management Team	Hassi Norlen	hassi@norlens.net	714-710-9444
	Hari Dudani	hdudani@cox.net	949-495-9129
Beginner's Astronomy Class	David Pearson	astrodwp@dslextreme.com	949-492-5342
Observatory Custodian/Trainer/ Member Liaison/Dark Sky SIG	Barbara Toy	btoy@cox.net	714-606-1825
Astrophysics SIG	Chris Buchen	buchen@cox.net	949-854-3089
AstroImagers SIG	Bill Patterson	bill@laastro.com	714-578-2419
GoTo SIG	Mike Bertin	MCB1@aol.com	949-786-9450
EOA Liaison	Del Christiansen	DelmarChris@earthlink.net	714-895-2215
Anza Site Maintenance	Don Lynn	donald.lynn@office.xerox.com	714-775-7238
Librarian	Karen Schnabel	karen@schnabel.net	949-887-9517
Membership, Pad Coordinator	Charlie Oostdyk	charlie@cccd.edu	714-751-5381
Explore the Stars OCA Contact	Richard Cranston	rcransto@ix.netcom.com	714-893-8659
Black Star Canyon Star Parties	Steve Short	steves@inductors.com	714-771-2624
OCA Outreach Coordinator	Jim Benet	jimbenet@pacbell.net	714-693-1639
Telescope Loaner Program	Mike Myers	loanerscopes@twow.com	714-240-8458
Anza House Coordinator	Timothy Hunt	Hunt_Timothy@msn.com	562-587-1340
WAA Representative	Tim Hogle	Tim.Hogle@jpl.nasa.gov	626-357-7770